

MIAMI-DADE COUNTY

MIAMI-DADE PUBLIC LIBRARY SYSTEM



VOLUME II PROJECT MANUAL

SPECIFICATIONS BOOK
DIVISIONS 01 THRU 28
APPENDIX

South Dade Regional Library Interior Renovations

10750 SW 211 ST, Cutler Bay, Florida 33189

C23-MDPLS-01-ESP

10-18-2024

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SOUTH DADE REGIONAL LIBRARY
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VOLUME II
PROJECT MANUAL
DIVISION 01-GENERAL REQUIREMENTS

South Dade Regional Library Interior Renovations

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**SECTION 012000
PRICE AND PAYMENT PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Procedures for preparation and submittal of application for final payment.

1.02 SCHEDULE OF VALUES

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.
- F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- G. Revise schedule to list approved Change Orders, with each Application For Payment.

1.03 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.



- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Submit one electronic and three hard-copies of each Application for Payment.
- J. Include the following with the application:
 - 1. Transmittal letter as specified for submittals in Section 013000.
 - 2. Construction progress schedule, revised and current as specified in Section 013000.
 - 3. Current construction photographs specified in Section 013000.
 - 4. Partial release of liens from major subcontractors and vendors.
 - 5. Project record documents as specified in Section 017800, for review by Owner which will be returned to the Contractor.
 - 6. Affidavits attesting to off-site stored products.
- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.04 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within ____ days.
- E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 016000.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.



1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 3. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- G. Substantiation of Costs: Provide full information required for evaluation.
1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- K. Promptly enter changes in Project Record Documents.

1.05 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
 1. All closeout procedures specified in Section 017000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION



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**SECTION 012500
SUBSTITUTION PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. A Substitution Request for specified installer constitutes a representation that the submitter:
 - 1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.
- D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response. See 012510 Section Substitution Request Form



1. Forms included in the Project Manual are required for this purpose, and must be used.
- E. Limit each request to a single proposed substitution item.
 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Submittal Form:
 1. Submit substitution requests by completing the form attached to this section. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Owner will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form:
 1. Submit substitution requests by completing the form attached to this section. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Architect will consider requests for substitutions only within 15 days after date of Agreement.
- C. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- D. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 3. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
 - b. Other construction by Owner.
 - c. Other unanticipated project considerations.
- E. Substitutions will not be considered under one or more of the following circumstances:
 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 2. Without a separate written request.
 3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION



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- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.
 - 1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

3.06 CLOSEOUT ACTIVITIES

- A. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

3.07 ATTACHMENTS

- A. A facsimile of the Substitution Request Form required to be used on the Project is included after this section.

END OF SECTION



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SECTION 012515
SUBSTITUTION REQUEST FORM

PART 1 GENERAL

PROJECT: _____ SUBSTITUTION REQUEST NUMBER. _____

FROM: _____

TO: _____ DATE: _____

A/E PROJECT NO. _____

RE: _____ CONTRACT FOR: _____

=====

SPECIFICATION TITLE: _____ DESCRIPTION: _____

SECTION: _____ PAGE: _____ ARTICLE/PARAGRAPH: _____

PROPOSED
SUBSTITUTION: _____

MANUFACTURER: _____ ADDRESS: _____
PHONE: _____

TRADE NAME: _____
MODEL NO.: _____

INSTALLER: _____ ADDRESS: _____
PHONE: _____

HISTORY: _____ []
NEW PRODUCT [] 2-5 YEARS OLD [] 5-10 YRS OLD [] MORE THAN 10 YEARS OLD

=====

REASON FOR NOT PROVIDING SPECIFIED ITEM:

SIMILAR INSTALLATION:
PROJECT: _____ ARCHITECT: _____
ADDRESS: _____ OWNER: _____
DATE INSTALLED: _____

PROPOSED SUBSTITUTION AFFECTS OTHER PARTS OF WORK: [] NO [] YES;
EXPLAIN:



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=====
=
SAVINGS TO OWNER FOR ACCEPTING SUBSTITUTION: \$ _____
PROPOSED SUBSTITUTION CHANGES CONTRACT TIME: [] NO [] YES [ADD]
[DEDUCT] _____ DAYS
=====

=====
=
POINT-BY-POINT COMPARATIVE DATA ATTACHED - REQUIRED FOR CONSIDERATION BY ARCHITECT
SUPPORTING DATA ATTACHED: [] DRAWINGS [] PRODUCT DATA [] SAMPLES []
TESTS [] REPORTS [] _____
SUBSTITUTION REQUEST
=====

=====
=
THE UNDERSIGNED CERTIFIES:
PROPOSED SUBSTITUTION HAS BEEN FULLY INVESTIGATED AND DETERMINED TO BE EQUAL OR SUPERIOR IN ALL RESPECTS TO SPECIFIED PRODUCT
SAME WARRANTY WILL BE FURNISHED FOR PROPOSED SUBSTITUTION AS FOR SPECIFIED PRODUCT.
SAME MAINTENANCE SERVICE AND SOURCE OF REPLACEMENT PARTS; AS APPLICABLE, IS AVAILABLE.
PROPOSED SUBSTITUTION WILL HAVE NO ADVERSE EFFECT ON OTHER TRADES AND WILL NOT AFFECT OR DELAY PROGRESS SCHEDULE.
COST DATA AS STATED ABOVE IS COMPLETE. CLAIMS FOR ADDITIONAL COSTS RELATED TO ACCEPTED SUBSTITUTION WHICH MAY SUBSEQUENTLY BECOME APPARENT ARE TO BE WAIVED.
PROPOSED SUBSTITUTION DOES NOT AFFECT DIMENSIONS AND FUNCTIONAL CLEARANCES.
PAYMENT WILL BE MADE FOR CHANGES TO BUILDING DESIGN, INCLUDING A/E DESIGN, DETAILING, AND CONSTRUCTION COSTS CAUSED BY THE SUBSTITUTION.
COORDINATION, INSTALLATION, AND CHANGES IN THE WORK AS NECESSARY FOR ACCEPTED SUBSTITUTION WILL BE COMPLETE IN ALL RESPECTS.
=====

=====
=
SUBMITTED BY:



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SIGNED BY:

FIRM: _____

ADDRESS: _____

TELEPHONE: _____

ATTACHMENTS: _____

=====

=

ARCHITET'S REVIEW AND ACTION

SUBSTITUTION APPROVED - MAKE SUBMITTALS IN ACCORDANCE WITH SPECIFICATION SECTION 01330.

SUBSTITUTION APPROVED AS NOTED - MAKE SUBMITTALS IN ACCORDANCE WITH SPECIFICATION SECTION 01330.

SUBSTITUTION REJECTED - USE SPECIFIED MATERIALS.

SUBSTITUTION REQUEST RECEIVED TOO LATE - USE SPECIFIED MATERIALS.

SUBSTITUTION REJECTED - INSUFFICIENT OR INCOMPLETE MATERIAL SUBMITTED

SIGNED BY:

DATE: _____

=====

=

ADDITIONAL COMMENTS: CONTRACTOR SUBCONTRACTOR SUPPLIER MANUFACTURER A/E _____

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION



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SECTION 013000 ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Construction progress schedule.
- G. Progress photographs.
- H. Coordination drawings.
- I. Submittals for review, information, and project closeout.
- J. Number of copies of submittals.
- K. Requests for Interpretation (RFI) procedures.
- L. Submittal procedures.

1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an



Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.

1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 2. Contractor and Architect are required to use this service.
 3. It is Contractor's responsibility to submit documents in allowable format.
 4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.
- C. Submittal Service: Use one of the following:
1. Submittal Exchange (tel: 1-800-714-0024): www.submittalexchange.com/#sle.
 2. EADOC LLC (tel: 1-877-305-3844): www.eadocsoftware.com/#sle.
 3. Newforma ConstructEx: www.newforma.com/products/constructex/#sle.
- D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
- E. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

- A. Schedule meeting after Notice of Award.
- B. Attendance Required:
 1. Owner.
 2. Architect.
 3. Contractor.
- C. Agenda:
 1. Execution of Owner-Contractor Agreement.
 2. Submission of executed bonds and insurance certificates.
 3. Distribution of Contract Documents.



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4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 5. Designation of personnel representing the parties to Contract.
 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 7. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

- A. Schedule meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
1. Contractor.
 2. Owner.
 3. Architect.
 4. Contractor's superintendent.
 5. Major subcontractors.
- C. Agenda:
1. Use of premises by Owner and Contractor.
 2. Owner's requirements.
 3. Construction facilities and controls provided by Owner.
 4. Temporary utilities provided by Owner.
 5. Survey and building layout.
 6. Security and housekeeping procedures.
 7. Schedules.
 8. Application for payment procedures.
 9. Procedures for testing.
 10. Procedures for maintaining record documents.
 11. Requirements for start-up of equipment.
 12. Inspection and acceptance of equipment put into service during construction period.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
1. Contractor.
 2. Owner.
 3. Architect.



4. Special consultants.
5. Contractor's superintendent.
6. Major subcontractors.

D. Agenda:

1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Coordination of projected progress.
12. Maintenance of quality and work standards.
13. Effect of proposed changes on progress schedule and coordination.
14. Other business relating to work.

- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 013216

- A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

3.06 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.
- C. Photography Type: Digital; electronic files.
- D. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.
- E. In addition to periodic, recurring views, take photographs of each of the following events:



1. Completion of site clearing.
2. Excavations in progress.
3. Foundations in progress and upon completion.
4. Structural framing in progress and upon completion.
5. Enclosure of building, upon completion.

F. Views:

1. Provide aerial photographs from four cardinal views at each specified time, until structure is enclosed.
2. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
3. Consult with Architect for instructions on views required.
4. Provide factual presentation.
5. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
6. Point of View Sketch: Provide sketch identifying point of view of each photograph.

G. Digital Photographs: 24 bit color, minimum resolution of 1600 by 1200 ("2 megapixel"), in JPG format; provide files unaltered by photo editing software.

1. Delivery Medium: Via email.
2. File Naming: Include project identification, date and time of view, and view identification.
3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
5. Photo CD(s): Provide 1 copy including all photos cumulative to date and PDF file(s), with files organized in separate folders by submittal date.
6. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

3.07 COORDINATION DRAWINGS

- A. Provide information required by Project Coordinator for preparation of coordination drawings.
- B. Review drawings prior to submission to Architect.

3.08 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for



- claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 2. Prepare in a format and with content acceptable to Owner.
 - a. Use AIA G716 - Request for Information .
 3. Prepare using software provided by the Electronic Document Submittal Service.
 4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 016000 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
 - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 2. Owner's, Architect's, and Contractor's names.
 3. Discrete and consecutive RFI number, and descriptive subject/title.
 4. Issue date, and requested reply date.
 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.



7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 2. Note dates of when each request is made, and when a response is received.
 3. Highlight items requiring priority or expedited response.
 4. Highlight items for which a timely response has not been received to date.
 5. Identify and include improper or frivolous RFIs.
- H. Review Time: Architect will respond and return RFIs to Contractor within 15 calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
 4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.09 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
 1. Submit at the same time as the preliminary schedule specified in Section - 013216 - Construction Progress Schedule.
 2. Coordinate with Contractor's construction schedule and schedule of values.
 3. Format schedule to allow tracking of status of submittals throughout duration of construction.
 4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work



- covered, and role and name of subcontractor.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
 - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.10 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.11 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.12 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Final Property Survey.



- E. Submit for Owner's benefit during and after project completion.

3.13 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Extra Copies at Project Closeout: See Section 017800.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.14 SUBMITTAL PROCEDURES (SEE SECTION 013300 SUBMITTAL PROCEDURES)

- A. General Requirements:
 - 1. Use a separate transmittal for each item.
 - 2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 - 3. Transmit using approved form.
 - a. Use Form AIA G810.
 - b. Use Contractor's form, subject to prior approval by Architect.
 - 4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 - 5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 - 7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Upload submittals in electronic form to Electronic Document Submittal Service website.
 - 8. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
 - 9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 - 10. Provide space for Contractor and Architect review stamps.



11. When revised for resubmission, identify all changes made since previous submission.
 12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 14. Submittals not requested will not be recognized or processed.
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Submit concurrently with related shop drawing submittal.
 4. Do not submit (Material) Safety Data Sheets for materials or products.
 5. Submit sustainable design reporting submittals under separate cover.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 2. Do not reproduce Contract Documents to create shop drawings.
 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
 3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.15 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Approved", or language with same legal meaning.
 - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.



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- 1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
 - 2) Non-responsive resubmittals may be rejected.
 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
 - 2) Non-responsive resubmittals may be rejected.
 - b. "Rejected".
 - 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
 1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
 2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

END OF SECTION



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SECTION 013216 CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, with network analysis diagrams and reports.

1.02 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Submit in PDF format.
- G. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.
- H. Submit one reproducible transparency and one opaque reproduction.
- I. Submit under transmittal letter form specified in Section 013000 - Administrative Requirements.

1.03 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.
- B. Contractor's Administrative Personnel: 3 years minimum experience in using and monitoring CPM schedules on comparable projects.

1.04 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 22 x 17 inches.
- C. Sheet Size: Multiples of 8-1/2 x 11 inches.
- D. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION



3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Provide sub-schedules for each stage of Work.
- E. Provide sub-schedules to define critical portions of the entire schedule.
- F. Include conferences and meetings in schedule.
- G. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- H. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- I. Indicate delivery dates for owner-furnished products.
- J. Coordinate content with schedule of values specified in Section 012000 - Price and Payment Procedures.
- K. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 NETWORK ANALYSIS

- A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.
- B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.
- C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
 - 1. Preceding and following event numbers.
 - 2. Activity description.
 - 3. Estimated duration of activity, in maximum 15 day intervals.
 - 4. Earliest start date.
 - 5. Earliest finish date.
 - 6. Actual start date.
 - 7. Actual finish date.



8. Latest start date.
 9. Latest finish date.
 10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
 11. Monetary value of activity, keyed to Schedule of Values.
 12. Percentage of activity completed.
 13. Responsibility.
- D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.
- E. Required Reports: List activities in sorts or groups:
1. By preceding work item or event number from lowest to highest.
 2. By amount of float, then in order of early start.
 3. By responsibility in order of earliest possible start date.
 4. In order of latest allowable start dates.
 5. In order of latest allowable finish dates.
 6. Contractor's periodic payment request sorted by Schedule of Values listings.
 7. Listing of basic input data that generates the report.
 8. Listing of activities on the critical path.

3.05 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.06 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.
- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.07 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION



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SECTION 013300 SUBMITTALS

1.1 TYPES OF SUBMITTALS

- A. Submittals in this Section: After Contractor's check, coordination and approval, submit (as each of the following is required) with a signed copy of the attached Submittals form.
 - 1. Submittals: Product data (including installation and maintenance instructions), shop drawings, selection samples, and record samples. Also notices of worksite mockups and sample walls when they are ready for approval by A/E and M-DPLS.
 - 2. Samples (as a record of type and quality).
 - 3. Mockups and sample walls: Give notice of readiness for inspection by A/E and M-DPLS.
 - 4. Information Submittals, requiring no response from A/E, such as:
 - a. Certifications.
 - b. Test or laboratory reports.
 - c. Source quality control reports.
 - d. Producer's instructions.
 - e. Sustainable design submittals.
 - f. Producer site observations.
 - g. Material Safety Data Sheets (MSDS).
 - h. Recycling certificates.
 - i. Installation meeting reports.
 - j. Inspection reports and Installation quality control reports.
- B. Submissions not specified in this Section.
 - 1. Closeout deliverables: As specified in "Closeout of the Work".

1.2 PROCEDURES FOR ALL SUBMITTALS

- A. Schedule scope and time: Designate in the CPM construction schedule the dates for submittal to A/E and the review completion dates needed for each submittal's A/E review, to maintain the required Contract Time.
- B. Attach filled-out Submittal form: After checking each submittal for compliance with the Construction Documents and coordination with the rest of the Work, attach a filled-out and signed copy of the Submittal form that is attached to this section to each submittal.
- C. Identify the data: Identify submitted product data, shop drawings, and samples by referring to sheets, details, schedules, or room numbers as shown on Drawings.
- D. Cover or include, in all submittals:
 - 1. Field measurements and worksite conditions.
 - 2. Catalog numbers, ASTM standards and other quality assurance data.
 - 3. Performance criteria, capacities and limits, ingredients, detailed finish data, etc.
 - 4. Dimensions that ensure clearances, fit, and expected movement in use.
 - 5. Key each product to its location in the Work using room numbers, Drawing sheet and detail numbers, marks, etc.
 - 6. Coordination with other parts of the Work, including needed work by others.
 - 7. Wiring, control, piping, connection diagrams and schematic diagrams.
 - 8. Compliance with Construction Documents.
 - 9. Installation, cleaning and maintenance instructions.



10. Draft of each special warranty where specified.
 11. Contractor shall bear the cost of all submittals such as printing, samples, calculations, engineering services, mock-ups, and delivery.
- E. Unify submittals: Submit product data, shop drawings, test data, color charts / selection samples and special warranty at the same time for each product, using one (1) Submittal form.
- F. Maintain and up-to-date spreadsheet record of all submittal activity. Record spreadsheet shall include, at a minimum, the submittal number; description of the product(s) covered in the submittal; the manufacturer(s) of the product(s); the subcontractor, materials or equipment supplier of fabricator who prepared the submittal; the number of copies received from the subcontractor, materials or equipment supplier or fabricator; date the submittal was received from the subcontractor, materials or equipment supplier or fabricator; the date the submittal was sent to the A/E for review; the date the submittal was returned by the A/E with their review; the number of copies returned by the A/E; the A/E's review finding; the date the reviewed submittal was returned to the subcontractor, materials or equipment supplier or fabricator; and the number of copies returned to the subcontractor, materials or equipment supplier or fabricator. Record spreadsheet shall include all initial submittals and follow-up submittals. Copies of record spreadsheet shall be made available to A/E and M-DPLS as needed to facilitate their administration of the submittal process. The record spreadsheet shall be coordinated with, and may be based on or incorporated into the "Submittal Schedule" specified in article 1.5 A. of this section.
- G. Review: Check each submittal for conformity to the Construction Documents, coordination with other work, dimensions, needed clearances and fit, fastenings and support, power and piping connections, finishes, needed prior work and accessory products.
1. Excessive errors, omissions, and/or incompleteness in a submittal, and/or gross lack of coordination with the requirements of the project or the conditions of the installation, or other evidence of a lack of understanding of the applicable project requirements by the entity responsible for the submittal will be cause for the A/E's rejection of the submittal.
 2. Contractor's failure, prior to transmitting submittal to A/E, to check submittal and affix Contractor's review approval stamp with Contractor's signature and date will be cause for A/E's rejection of the submittal.
- H. Deviations: Notify the A/E, in writing, at time of submission, of deviations from the requirements of the Construction Documents in what is being submitted.
1. Deviations shall be prominently displayed, and identified as deviations, so that the A/E will not miss them in reviewing.
 2. Minor deviations, if not marked or listed, will be cause for A/E to return the submittal. A major deviation, noted or not, will be considered an attempt at unauthorized substitution and will be cause for A/E to reject the submittal.
 3. The A/E shall be the judges of when a change qualifies, not as a substitution, but as a minor deviation not affecting function, performance or appearance.
 4. Submittal of products deemed to be of lower quality than that specified will be cause for A/E's rejection of the submittal.
- I. Accept: Both Contractor, and then A/E, shall review and approve (or take other appropriate action for) each submittal for conformance to Contract.
1. Terms equivalent to "approve" may be used by Contractor or A/E, as long as the term used ensures that professional attention has been given in analyzing that each submittal maintains the design intent as expressed in the Construction Documents.
- J. Resubmitting: When a resubmittal is required by the A/E's finding in the preceding review, identify the resubmittals with the initial submittal number, followed by a hyphen (-) and a letter A, B, etc. to show the resubmittal sequence.



- K. Fabricating and Shipping: Do not ship products from stock or fabricate products until submittals have been reviewed, accepted and returned by A/E:
 - 1. Unless a submittal is unusually lengthy or complex, allow / limit review time to:
 - a. Two (2) weeks for architectural submittals.
 - b. Three (3) weeks for engineering submittals.
 - c. Plus an additional one (1) week if M-DPLS needs to advise on the acceptability of a submitted product.
 - d. For samples for color selection, and for submittals for products that require color selection, allow the complete timeframe for review and color selection that is provided for in the approved CPM schedule for the project (see Sections 01321 and/or 01322).
- L. Field file: Always maintain and have available for reference a field copy of approved shop drawings, catalog cuts, and installation instructions at the worksite.
- M. Closeout deliverables: While processing submittals, assemble, as one file, one (1) copy of all approved submittals (in the case of samples, the signed and approved Submittal form only) for delivery to A/E and M-DPLS at time of closeout of the Work.

1.3 CONTRACTOR APPROVAL PROCEDURE

- A. Generally limit each submittal to one (1) product, except as follows:
 - 1. For each system or assembly where a number of components or equipment interacts, a coordinated booklet of data sheets shall be compiled for ease of review by A/E.
 - 2. For comprehensive lists of products similar in function (such as roof assembly, firestopping, sealants, access panels, hardware, paints, toilet accessories, kitchen equipment, plumbing fixtures, wiring devices, lighting fixtures, and playground equipment) a booklet of data sheets may be compiled for coordinated review by A/E.
- B. No substitutions or other significant deviations from the Construction Documents shall appear or be requested in any submittal:
 - 1. To request a substitution, follow the General Conditions of the Contract for Construction with its time limit for such a request. In addition comply with all the requirements noted under the "Products" section of these Specifications, using the "Substitution Request Form" contained therein.
- C. Stamp, approve, and sign each submittal before transmitting to A/E. If not so checked and certified, submittals will be returned to the Contractor without being reviewed by the A/E.
- D. Provide a blank space approximately 6 inches x 4 inches in the lower right corner of each sheet in the shop drawing set:
 - 1. In the space the A/E's will place their shop drawing stamp. Include the Contractor's approval, initialed by the reviewing person who signs the accompanying Submittal form.
 - 2. Alternatively, a separate Contractor's approval stamp may be added, initialed by the reviewing person who signs the accompanying Submittal form.

1.4 PRODUCT DATA SUBMITTALS

- A. Manufacturer's catalog cuts and other product data: Submit 8 copies of each catalog cut or eight (8) edited catalogs:
 - 1. Product data shall contain detailed information as to the materials, physical properties, coats and thicknesses, compatibility, finish, available colors, method of installing, jointing, terminations or trim, operating, energy characteristics and consumption, cleaning, and maintenance as appropriate to each product.
- B. Submittal of Color Charts or Color Chips for Selection and Coordination. Unless otherwise specified:
 - 1. Submit three (3) copies of all product color charts or boxes of color chips within sixty



- (60) days after start of construction to allow for selection, color coordination, and final approval by A/E. Submit producer's full range of colors and patterns, including but not limited to the standard and premium ranges of colors and patterns, unless specified otherwise.
2. For architectural pre-cast concrete, cast-in-place architectural concrete, and cast stone, submit at least four (4) – 8 inch x 8 inch samples of color and texture.
 3. For exposed unpainted block (CMU), submit at least two (2) sets of 4x4 in. samples in producer's full color and texture range.
 4. For shingles, roof tiles, and siding, submit at least two (2) sets of samples in producer's full range of colors and textures.
- C. Producers' stock publications, including such items as printed product data, catalog cuts, illustrations, tables, charts, details, schematic drawings, and diagrams:
1. Mark pages by crossing out information not applicable to the Work.
 2. Circle or highlight selections made or that identify items to be provided for this Work.
 3. Supplement standard information to provide information applicable to this Work.
 4. Failure to indicate products selected will be cause for A/E's rejection of the submittal.
 5. Make sure reproduced or faxed copies of submittal information are legible. Illegibility of submittal information will be cause for A/E's rejected of the submittal.
- D. Disclosure: Approval will not be given to producers who withhold information deemed essential to A/E's analysis for acceptance. In submitting product data, make full disclosure of the design and composition of the product, including such information as physical and chemical composition and characteristics, weights and thicknesses, design of components, connections/fastenings, control diagrams, wiring diagrams, and the availability of maintenance and repair service by authorized and trained mechanics.
- E. Selection samples: No individual color selections from color/texture/pattern samples will be approved before receipt of all samples, including paint, to ensure overall coordination.
1. Submit all exterior color selection samples at one time.
 2. Submit all interior color samples, for floor, wall, and ceiling finish products at one time.
- 1.5 SHOP DRAWING SUBMITTALS
- A. A proposed "Submittal Schedule" shall be submitted to the A/E as required by General Conditions of the Contract for Construction.
- B. Shop Drawings: Submit 2 or more prints, together with a sepia or electronic "original", for each required shop drawing.
1. The number of prints shall be as agreed to by Contractor and A/E after examining project size and complexity, as well as how many tiers of subcontracts, at the initial construction meeting. Advise in writing entities providing submittals of the number of copies required.
 2. At the earliest possible construction meeting, agree, with A/E and various trades, on the most effective medium for making copies of the "original" and the precise number of prints for various submittals.
 3. Submittal of shop drawings that require M-DCPS review and approval (such as door finish hardware / M-DCPS Lock-shop, roofing systems / M-DCPS Roofing Dept., EMS / M-DCPS Energy Management, etc.) shall be coordinated with the M-DCPS Project Manager to ensure prompt and proper handling of these submittals.
- C. Identify each shop drawing with at least the following information placed on each sheet:
1. Name of the facility and M-DPLS's project number.
 2. Name of firm preparing the shop drawing and name of Contractor.
 3. Date of drawing and any revision dates.
 4. Identification referring to exactly which Drawing and detail in the Construction Documents the



shop drawing or shop drawing detail refers to. A/E may decline to review shop drawings without precise references to the Drawings.

1.6 SAMPLE SUBMITTALS

- A. Submit samples of sufficient size and quantity to clearly illustrate the functional characteristics of product, its component parts, attachment devices, and operation. Submit in A/E's selection of color, texture, and pattern if known.
- B. Record samples: After selections have been made, submit record samples for each product, if and as required by A/E.

1.7 FIELD SAMPLE AND MOCK-UP SUBMITTALS

- A. Erect at worksite, at a location facing southerly (southeast to southwest) with at least 40 ft of frontal viewing room, or otherwise as approved by A/E:
 - 1. Size and area: As shown on Construction Documents.
 - 2. Incorporate reinforcing, accessories, and how head, jambs, sill and stools are coordinated with doors / windows / louvers and sealed against wind & water intrusion.
 - 3. Place on concrete foundation, elevate against mud splash, brace against overturning.
 - 4. Remove samples and mockups at completion of Work, as directed by the A/E.

1.8 ATTACHED AS PART OF THIS SECTION

- A. Submittal form:
 - 1. Contractor to provide attached form. This form may be reproduced, the footer deleted, and stock information (such as project name and numbers, and names and addresses of the parties) replaced with project-specific information. **Items under contractor's certification SHALL BE INCLUDED IN ALL SUBMITTALS.**

END OF SECTION



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SECTION 014000 QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. Testing and inspection agencies and services.
- D. Contractor's construction-related professional design services.
- E. Contractor's design-related professional design services.
- F. Control of installation.
- G. Mock-ups.
- H. Tolerances.
- I. Manufacturers' field services.
- J. Defect Assessment.

1.02 DEFINITIONS

- A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.
- B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
 - 1. Design Services Types Required:
 - a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor's sole responsibilities for construction means, methods, techniques, sequences, and procedures.
 - b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.
- C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.03 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
 - 1. Temporary sheeting, shoring, or supports.



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2. Temporary scaffolding.
3. Temporary bracing.
4. Temporary stairs or steps required for construction access only.
5. Temporary hoist(s) and rigging.
6. Investigation of soil conditions to support construction equipment.

1.04 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
 1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.
- C. Scope of Contractor's Professional Design Services: Provide for the items of work indicated in individual sections.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
 - a. Full name.
 - b. Professional licensure information.
 - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
 2. Include required product data and shop drawings.
 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.



- f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
- 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
- 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
- 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
 - 2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
- 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.
- B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a



Professional Engineer experienced in design of this type of work and licensed in Florida.

C. Contractor's Quality Control (CQC) Plan:

1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
 - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
 - 1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
 - b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
 - 1) Management and control of documents and records relating to quality.
 - 2) Communications.
 - 3) Coordination procedures.
 - 4) Resource management.
 - 5) Process control.
 - 6) Inspection and testing procedures and scheduling.
 - 7) Control of noncomplying work.
 - 8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
 - 9) Control of testing and measuring equipment.
 - 10) Project materials certification.
 - 11) Managerial continuity and flexibility.
 - c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
 - d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.
- D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.07 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.



- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.08 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
 - 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
 - 2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
 - 3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
 - 4. Laboratory: Authorized to operate in Florida.
 - 5. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 - 6. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.



3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.
- E. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- F. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- G. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- H. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- I. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
 - 1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
 - 2. Make corrections as necessary until Architect's approval is issued.
- J. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- K. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.



- B. Testing Agency Duties:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Attend preconstruction meetings and progress meetings.
 - 8. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.



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- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
 - 1. Observer subject to approval of Architect.
 - 2. Observer subject to approval of Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION



**SECTION 015000
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices.

1.02 TEMPORARY UTILITIES

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Existing facilities may not be used.
- C. New permanent facilities may not be used.
- D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Telephone Land and Mobile Lines: One line, each minimum; one handset per line.
 - 3. Internet Connections: Minimum of one; DSL modem or faster.
 - 4. Email: Account/address reserved for project use.
 - 5. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.
 - 6. Project web site.

1.04 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.
- C. At end of construction, return facilities to same or better condition as originally found.



1.05 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 FENCING

- A. Construction: Contractor's option.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.09 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.

1.10 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.



- F. Provide one parking space for Owner use.
- G. Provide one parking space for Architect use.

1.11 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers.<>
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Erect on site at location established by Architect.
- C. No other signs are allowed without Owner permission except those required by law.

1.13 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION



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**SECTION 016000
PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 15 days after date of Agreement.
 - 2. For products specified only by reference standards, list applicable reference standards.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.03 QUALITY ASSURANCE

- A. Bio-Based Content: Of vegetable or animal origin, not including products made by killing the animal.
 - 1. Determine percentage of bio-based content in accordance with ASTM D6866.
 - 2. Bio-based content must be sourced from a Sustainable Agriculture Network certified farm.
- B. CAL (CDPH SM) v1.1: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.1–2010, for the emissions testing and requirements of products and materials.
- C. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.
 - 1. Good: Product-specific; compliant with ISO 14044.



2. Better: Industry-wide, generic; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
 3. Best: Commercial-product-specific; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
 4. Where demonstration of impact reduction below industry average is required, submit both industry-wide and commercial-product-specific declarations; or submit at least 5 declarations for products of the same type by other manufacturers in the same industry.
- D. GreenScreen Chemical Hazard Analysis: Ingredients of 100 parts-per-million or greater evaluated using GreenScreen (METH).
1. Good: GreenScreen (LIST) evaluation to identify Benchmark 1 hazards; a Health Product Declaration includes this information.
 2. Better: GreenScreen Full Assessment.
 3. Best: GreenScreen Full Assessment by GreenScreen Licensed Profiler.
 4. Acceptable Evidence: GreenScreen report.
- E. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. See Section 014000 - Quality Requirements, for additional source quality control requirements.
- C. Use of products having any of the following characteristics is not permitted:
 1. Made outside the United States, its territories, Canada, or Mexico.
 2. Made using or containing CFC's or HCFC's.
 3. Made of wood from newly cut old growth timber.
 4. Containing lead, cadmium, or asbestos.
- D. Where other criteria are met, Contractor shall give preference to products that:
 1. Are made of recycled materials.
 2. Have a published Environmental Product Declaration (EPD).
 3. Have a published Health Product Declaration (HPD).
 4. Have a published GreenScreen Chemical Hazard Analysis.
 5. Have a published Manufacturer's Inventory of Chemical Content.
- E. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
- F. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.02 PRODUCT OPTIONS



- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 012500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
 - 1. Review Owner reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.



- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.
 - 1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.
- H. Provide off-site storage and protection when site does not permit on-site storage or protection.
 - 1. Execute a formal supplemental agreement between Owner and Contractor allowing off-site storage, for each occurrence.
- I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- J. Comply with manufacturer's warranty conditions, if any.
- K. Do not store products directly on the ground.
- L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- N. Prevent contact with material that may cause corrosion, discoloration, or staining.
- O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- P. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION



SECTION 016116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.
- C. Requirement for installer certification that they did not use any non-compliant products.

1.02 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
 - 3. Flooring.
 - 4. Products making up wall and ceiling assemblies.
 - 5. Thermal and acoustical insulation.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
 - 1. Concrete.
 - 2. Metals that are plated, anodized, or powder-coated.
 - 3. Glass.
 - 4. Ceramics.
 - 5. Solid wood flooring that is unfinished and untreated.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1)



no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.04 QUALITY ASSURANCE

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 - 1. Wet-Applied Products: State amount applied in mass per surface area.
 - 2. Paints and Coatings: Test tinted products, not just tinting bases.
 - 3. Evidence of Compliance: Acceptable types of evidence are the following;
 - a. Current UL (GGG) certification.
 - b. Current SCS (CPD) Floorscore certification.
 - c. Current SCS (CPD) Indoor Advantage Gold certification.
 - d. Current listing in CHPS (HPPD) as a low-emitting product.
 - e. Current CRI (GLP) certification.
 - f. Test report showing compliance and stating exposure scenario used.
 - 4. Product data submittal showing VOC content is NOT acceptable evidence.
 - 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
 - b. Published product data showing compliance with requirements.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
 - 2. Aerosol Adhesives: GreenSeal GS-36.
 - 3. Joint Sealants: SCAQMD 1168 Rule.
 - 4. Paints and Coatings: Each color; most stringent of the following:
 - a. 40 CFR 59, Subpart D.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).

PART 3 EXECUTION



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3.01 FIELD QUALITY CONTROL

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION



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**SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, <>.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- J. General requirements for maintenance service.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 2. Submit surveys and survey logs for the project record.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
- D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.03 QUALIFICATIONS



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- A. For demolition work, employ a firm specializing in the type of work required.
 - 1. Minimum of 5 years of documented experience.
- B. For surveying work, employ a land surveyor registered in Florida and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
- C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Florida. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.
- D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Florida.

1.04 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Perform dewatering activities, as required, for the duration of the project.
- E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
 - 2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
 - 2. Indoors: Limit conduct of especially noisy interior work to 8 am to 5 pm.
- I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.



1.05 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.



- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect 7 days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Control datum for survey is that indicated on drawings.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- H. Utilize recognized engineering survey practices.
- I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.



- J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
 - 4. Controlling lines and levels required for mechanical and electrical trades.
- K. Periodically verify layouts by same means.
- L. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings.
 - 2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.



1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 2. Remove items indicated on drawings.
 3. Relocate items indicated on drawings.
 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 4. Verify that abandoned services serve only abandoned facilities.
 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
 2. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
 3. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.



- H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- I. Refinish existing surfaces as indicated:
 - 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 - 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.
- M. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Restore work with new products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.
- H. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.



2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.



- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

- A. See Section 017900 - Demonstration and Training.

3.12 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
 - 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Accompany Contractor's Superintendent on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.



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- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Accompany Contractor's Superintendent on Contractor's preliminary final inspection.
- H. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- I. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION



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**SECTION 017419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Owner may decide to pay for additional recycling, salvage, and/or reuse based on Landfill Alternatives Proposal specified below.
- E. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood.
 - 5. Land clearing debris, including brush, branches, logs, and stumps; see Section 311000 - Site Clearing for use options.
 - 6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - 7. Glass.
 - 8. Gypsum drywall and plaster.
 - 9. Plastic buckets.
 - 10. Paint.
 - 11. Plastic sheeting.
 - 12. Rigid foam insulation.
 - 13. Plumbing fixtures.
 - 14. Mechanical and electrical equipment.
- F. The following recycling incentive programs are mandatory for this project; Contractor is responsible for implementation:
 - 1. <>: Revenue or savings shall accrue equally to Owner and Contractor.
 - 2. <>: Rebates and credits must be applied for by Owner and shall accrue to Owner.
- G. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- H. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.



- I. The following sources may be useful in developing the Waste Management Plan:
- J. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
 - 5. Incineration, either on- or off-site.
- K. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.



- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Landfill Alternatives Proposal: Within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner, submit a projection of trash/waste that will require disposal and alternatives to landfilling, with net costs.
 - 1. Submit to Architect for Owner's review and approval.
 - 2. If Owner wishes to implement any cost alternatives, the Contract Price will be adjusted as specified elsewhere.
 - 3. Include an analysis of trash/waste to be generated and landfill options as specified for Waste Management Plan described below.
 - 4. Describe as many alternatives to landfilling as possible:
 - a. List each material proposed to be salvaged, reused, or recycled.
 - b. List the proposed local market for each material.
 - c. State the estimated net cost resulting from each alternative, after subtracting revenue from sale of recycled or salvaged materials and landfill tipping fees saved due to diversion of materials from the landfill.
- C. Once Owner has determined which of the landfill alternatives addressed in the Proposal above are acceptable, prepare and submit Waste Management Plan; submit within 10 calendar days after notification by Architect.
- D. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 - 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 - 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
 - 7. Recycling Incentives: Describe procedures required to obtain credits, rebates, or similar incentives.



- E. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 2. Submit Report on a form acceptable to Owner.
 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 4. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
 5. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards.
 - c. Include weight tickets as evidence of quantity.
 6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.
- F. Recycling Incentive Programs:
1. Where revenue accrues to Contractor, submit copies of documentation required to qualify for incentive.
 2. Where revenue accrues to Owner, submit any additional documentation required by Owner in addition to information provided in periodic Waste Disposal Report.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. See Section 016000 - Product Requirements for substitution submission procedures.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 016000:
 1. Relative amount of waste produced, compared to specified product.



2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
3. Proposed disposal method for waste product.
4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 013000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 015000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 016000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 017000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 1. Prebid meeting.
 2. Preconstruction meeting.
 3. Regular job-site meetings.
 4. Job safety meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 1. As a minimum, provide:
 - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
 - b. Separate dumpsters for each category of recyclable.
 - c. Recycling bins at worker lunch area.
 2. Provide containers as required.
 3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
 4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if



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- possible.
- 5. Locate enclosures out of the way of construction traffic.
- 6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
- 7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
- 8. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION



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SECTION 017800 CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

1.02 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.



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- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and



maintenance of the specific products.

- F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - 1. Include HVAC outdoor and exhaust air damper calibration strategy.
 - a. Include provisions which ensure that full closure of dampers can be achieved.
 - 2. Include Carbon Dioxide Monitoring Protocol.
 - 3. Include Carbon Monoxide Monitoring Protocol.
 - 4. Include Frost Mitigation Strategy for ventilation heat-recovery system.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.



P. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- D. Prepare data in the form of an instructional manual.
- E. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- L. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Photocopies of warranties and bonds.
 - 4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.
- M. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.



- N. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
- O. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.
- P. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION



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SECTION 017900 DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
 - 2. Finishes, including flooring, wall finishes, ceiling finishes.
 - 3. Fixtures and fittings.
 - 4. Items specified in individual product Sections.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Architect for transmittal to Owner.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
- D. Training Reports:
 - 1. Identification of each training session, date, time, and duration.
 - 2. Sign-in sheet showing names and job titles of attendees.
 - 3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
- E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.

1.03 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.



- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Provide training in minimum two hour segments.
- C. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- D. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 - 3. Typical uses of the O&M manuals.
- E. Product- and System-Specific Training:
 - 1. Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 - 6. Discuss common troubleshooting problems and solutions.
 - 7. Discuss any peculiarities of equipment installation or operation.
 - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 - 10. Review spare parts and tools required to be furnished by Contractor.
 - 11. Review spare parts suppliers and sources and procurement procedures.
- F. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.



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**SECTION 019113
GENERAL COMMISSIONING REQUIREMENTS**

PART 1 GENERAL

1.01 SUMMARY

- A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
 - 1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
 - 2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
 - 3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
 - 4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.
- B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Functional Completion.
- C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.
- D. The Commissioning Authority is employed by Contractor on behalf of Owner.

1.02 SCOPE OF COMMISSIONING

- A. The following are to be commissioned:
- B. Building envelope:
 - 1. Thermal and moisture integrity.
 - 2. Air tightness.
- C. Elevating and conveying systems.
- D. Fire Protection Systems.
- E. Plumbing Systems:
 - 1. Water heaters.
 - 2. Landscape irrigation.
- F. HVAC System, including:
 - 1. Major and minor equipment items.
 - 2. Piping systems and equipment.
 - 3. Ductwork and accessories.
 - 4. Terminal units.



5. Control system.
 6. Sound control devices.
 7. Vibration control devices.
 8. Variable frequency drives.
- G. Electrical Systems:
1. Power quality.
 2. Emergency power systems.
 3. Uninterruptible power systems.
 4. Lighting controls other than manual switches.
- H. Electronic Safety and Security:
1. Security system, including doors and hardware.
 2. Fire and smoke alarms.
- I. Communications:
1. Voice and data systems.
 2. Public address/paging.
- J. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
- K. Sound Transmission Class-rated interior partitions.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.
 2. Submit one copy to the Commissioning Authority, not to be returned.
 3. Make commissioning submittals on time schedule specified by Commissioning Authority.
 4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.
 5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.
- B. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
1. Manufacturer's product data, cut sheets, and shop drawings.
 2. Manufacturer's installation instructions.
 3. Startup, operating, and troubleshooting procedures.
 4. Fan and pump curves.
 5. Factory test reports.
 6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.



- C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.
- D. Startup Plans and Reports.
- E. Completed Prefunctional Checklists.
- F. Commissioning Issues Log:

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Provide all standard testing equipment required to perform building envelope air tightness testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- C. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
 - 1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
 - 2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
 - 3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.
- D. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.
- E. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
 - 1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

- A. Commissioning Authority has prepared the Commissioning Plan.



1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.
- B. Contractor is responsible for compliance with the Commissioning Plan.
- C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.
- D. Commissioning Schedule:
 1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
 2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
 3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
 4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 DOCUMENTATION IDENTIFICATION SYSTEM

- A. Give each submitted form or report a unique identification; use the following scheme.
- B. Type of Document: Use the following prefixes:
 1. Startup Plan: SP-
 2. Startup Report: SR-
 3. Prefunctional Checklist: PC-
 4. Functional Test Procedure: FTP-
 5. Functional Test Report: FTR-
- C. System Type: Use the first 4 digits from CSI/CSC MF (Master Format), that are applicable to the system; for example:
 1. 2300: HVAC system as a whole.
 2. 2320: HVAC Piping and Pumps.
 3. 2330: HVAC Air Distribution.
- D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.
- E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.
- F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

3.03 STARTUP PLANS AND REPORTS

- A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.



- B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.
- C. Submit directly to the Commissioning Authority.

3.04 PREFUNCTIONAL CHECKLISTS

- A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
 - 1. No sampling of identical or near-identical items is allowed.
 - 2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
 - 3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
 - a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
 - b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
 - c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
 - d. Serial number of installed unit.
 - e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.
 - f. Sensor and actuator calibration information.
 - 4. All preliminary Prefunctional Checklists are included in Contract Documents; the Commissioning Authority has the authority to modify these and will furnish final versions as applicable.
- B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
 - 1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
 - 2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
 - 3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
 - 4. If any Checklist line item is not relevant, record reasons on the form.



5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
 6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
 7. Submit completed Checklists to Commissioning Authority within two days of completion.
- C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
 2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
 3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
 4. When asked to review the proposed Checklists, do so in a timely manner.
- D. Commissioning Authority Witnessing: Required for:
1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
 2. A sampling of non-primary equipment, as allowed by the commissioning plan.
- E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.05 FUNCTIONAL TESTS

- A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.
- B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.
- C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.
- D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
 1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
 2. Use the standard form provided with copies submitted to Owner and Contractor.
 3. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the



- Commissioning Authority will reschedule the test and the Contractor shall re-test.
4. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
 5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
 6. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.
- E. Functional Test Procedures:
1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
 2. Examples of Functional Testing:
 - a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
 - b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
 - c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
 - d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.
- F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.
- G. Factory Tests: Commissioning Authority and Contractor are responsible for coordinating testing of equipment at the factory by factory personnel, to ensure compliance with commissioning requirements.
- H. Field Tests By Others: Where Functional Tests are indicated as to be performed by others not subject to Contract Documents, those tests are not subject to these commissioning requirements.

3.06 SENSOR AND ACTUATOR CALIBRATION



- A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
- B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.
- C. All Sensors:
 - 1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
 - 2. Verify that sensors with shielded cable are grounded only at one end.
 - 3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
 - 4. Tolerances for critical applications may be tighter.
- D. Sensors Without Transmitters - Standard Application:
 - 1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
 - 2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
 - 3. If not, install offset, calibrate or replace sensor.
- E. Sensors With Transmitters - Standard Application.
 - 1. Disconnect sensor.
 - 2. Connect a signal generator in place of sensor.
 - 3. Connect ammeter in series between transmitter and building automation system control panel.
 - 4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
 - 5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
 - 6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
 - 7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
 - 8. Reconnect sensor.
 - 9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
 - 10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
 - 11. If not, replace sensor and repeat.
 - 12. For pressure sensors, perform a similar process with a suitable signal generator.



- F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
 - 1. Watthour, Voltage, Amperage: 1 percent of design.
 - 2. Pressure, Air, Water, Gas: 3 percent of design.
 - 3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
 - 4. Relative Humidity: 4 percent of design.
 - 5. Barometric Pressure: 0.1 inch of Hg.
 - 6. Flow Rate, Air: 10 percent of design.
 - 7. Flow Rate, Water: 4 percent of design.
 - 8. AHU Wet Bulb and Dew Point: 2.0 degrees F.
 - 9. Hot Water Coil and Boiler Water Temperature: 1.5 degrees F.
 - 10. Cooling Coil, Chilled and Condenser Water Temperatures: 0.4 degrees F.
 - 11. Natural Gas and Oil Flow Rate: 1 percent of design.
- G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.
- H. Valve/Damper Stroke Setup and Check:
 - 1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
 - 2. Set pump/fan to normal operating mode.
 - 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
 - 4. Command valve/damper to open; verify position is full open and adjust output signal as required.
 - 5. Command valve/damper to a few intermediate positions.
 - 6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
 - 1. With full pressure in the system, command valve closed.
 - 2. Use an ultra-sonic flow meter to detect flow or leakage.

3.07 TEST PROCEDURES - GENERAL

- A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
- B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.
- C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
 - 1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.



2. Sampling is not allowed for:
 - a. Major equipment.
 - b. Life-safety-critical equipment.
 - c. Prefunctional Checklist execution.
 3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
 4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
 5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
 6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
 7. If YY percent of the units in the second sample fail, test all remaining identical units.
 8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.
- D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
- E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.
- F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.
- G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.
- H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.
- I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
 2. Other points will be monitored by the Commissioning Authority using dataloggers.
 3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
 4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.



5. Graphical output is desirable and is required for all output if the system can produce it.
6. Monitoring may be used to augment manual testing.

3.08 BUILDING ENVELOPE COMMISSIONING

- A. General: Comply with the following procedural requirements:
 1. NEBB S110 Whole Building Technical Commissioning of New Construction.
 2. ASTM E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
 3. ASTM E1827 Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door.
 4. ANSI/RESNET/ICC 301 Standard for the Calculation and Labeling of the Energy Performance of Low-Rise Residential Buildings using an Energy Rating Index.
 5. ANSI/RESNET/ICC 380 Standard for Testing Airtightness of Building Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems.
- B. Verify that the building envelope has been sufficiently completed for testing to commence.
- C. Conduct ongoing inspections as construction progresses to document satisfactory installation conditions related to thermal and moisture integrity of the building envelope that become concealed upon completion of construction.
- D. Submit a detailed narrative of proposed pressure test procedures prior to the test. Include a plan view showing proposed installation locations (personnel doors or other similar openings) for blower doors (or flexible ducts for trailer-mounted fans, if used).
- E. Avoid testing on days forecast to experience high winds, or rain.
- F. Test the completed building and demonstrate that the air leakage rate of the building envelope does not exceed the specified requirements.
- G. Determine location and nature of undesirable air leakage pathways using methods specified in ASTM E1186-17 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
- H. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
 1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.09 FIELD TESTING AND COMMISSIONING OF PARTITIONS FOR NOISE ISOLATION

- A. Conduct testing of partitions requiring a specific STC class indicated on drawings and/or in various specifications sections. Comply with ASTM E336 for testing methods, including requirements of Annex A1 for reduction of flanking sound transmission.
- B. Confirm that the FSTC values are not less than 67 percent of design STC values.
- C. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.



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1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.
2. Sealants for remedying flanking sound transmission deficiencies evidenced as excessive air leakage are specified in Section 079200.

3.10 OPERATION AND MAINTENANCE MANUALS

- A. See Section 017800 - Closeout Submittals for additional requirements.
- B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.
- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION

MIAMI-DADE PUBLIC LIBRARY SYSTEM
VOLUME II
PROJECT MANUAL
DIVISION 02-EXISTING CONDITIONS

South Dade Regional Library Interior Renovations

C23-MDPLS-01-ESP



024000 Demolition



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SECTION 024100 DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with the work of this Section, meeting current building codes and complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Identify the Demolition Contractor to be used and that they are from the City approved list.
- C. Prior to bidding the demolition work, you are requested to review copy of the Asbestos Report. If Lead Paint Reports, or Noise and Vibration Reports are required, they will be responsibility of Contractor. Copy of the Asbestos Report will be provided. Contractor to certify that report has been reviewed and Contractor will comply to the requirements.
- D. Provide documentation to the City Engineering Department a list of proposed types of demolition equipment that meets the required sound level and vibration ratings meeting the minimum standards.
- E. Submit to the City and secure approval of a proposed haul route from the site to the destination.
- F. Submit to the City the proposed destination recycling and diversion center from the City's list of approved locations.
- G. Designate areas for the field office, proposed Fire Dept. access driving lanes, staging area of waste and recycled materials. Submit the plan to the City and Fire Dept. and obtain stamped approval.
- H. Provide the Architect and the Owner a copy of all City stamped approvals prior to commencing any site demolition work.
- I. Site Plan: Showing:
 - 1. Vegetation to be protected.
 - 2. Areas for temporary construction and field offices.
 - 3. Areas for temporary and permanent placement of removed materials.
- J. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
- K. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.



1.03 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
 - 1. Minimum of 5 years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

PART 3 EXECUTION

3.01 SCOPE

- A. Remove portions of existing building as indicated.
- B. Remove other items indicated, for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with other requirements specified in Section 017000.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.
 - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 8. Do not close or obstruct roadways or sidewalks without permit.
 - 9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Do not begin removal until built elements to be salvaged or relocated have been removed.
- E. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.
- F. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.



- G. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- H. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.
- I. Perform demolition in a manner that maximizes salvage and recycling of materials.
 - 1. Comply with requirements of Section 017419 - Waste Management.
 - 2. Dismantle existing construction and separate materials.
 - 3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.



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1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 2. Remove items indicated on drawings.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 3. Verify that abandoned services serve only abandoned facilities before removal.
 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 3. Repair adjacent construction and finishes damaged during removal work.
 4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; do not burn or bury.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

MIAMI-DADE PUBLIC LIBRARY SYSTEM
VOLUME II PROJECT
MANUAL DIVISION 03-
CONCRETE

South Dade Regional Library Interior Renovations

C23-MDPLS-01-ESP



031000	Concrete Formwork
032000	Concrete Reinforcing
033000	Cast-In-Place Concrete
033543	Polished Concrete



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**SECTION 031000
CONCRETE FORMING AND ACCESSORIES**

(SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on void form materials and installation requirements.
- C. Designer's Qualification Statement.
- D. Design Data: As required by authorities having jurisdiction.

1.03 QUALITY ASSURANCE

- A. Designer Qualifications: Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in Florida.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.
- C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

2.02 WOOD FORM MATERIALS

- A. Form Materials: At the discretion of the Contractor.

2.03 REMOVABLE PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gauge, 0.0598 inch thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.



2.04 FORMWORK ACCESSORIES

- A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.
- B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
 - 1. Do not use materials containing diesel oil or petroleum-based compounds.
- C. Waterstops: Rubber, complying with COE CRD-C 513, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.
 - 1. Configuration: As indicated on drawings.
 - 2. Size: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

- A. Earth forms are not permitted.

3.03 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Install stay in place mesh steel formwork in accordance with manufacturer's recommendations.
- D. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- E. Align joints and make watertight. Keep form joints to a minimum.
- F. Obtain approval before framing openings in structural members that are not indicated on drawings.
- G. Coordinate this section with other sections of work that require attachment of components to formwork.

3.04 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.



3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.07 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

3.08 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.09 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION



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**SECTION 032000
CONCRETE REINFORCING**

(SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
 - 1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in Florida.
- C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.
- D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- E. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.03 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301.
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.4/D1.4M and no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.01 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Plain billet-steel bars.
 - 2. Galvanized in accordance with ASTM A767/A767M, Class I.

2.02 RE-BAR SPLICING:

- A. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing full steel reinforcing design strength in tension and compression.
- B. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

2.03 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.



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- B. Welding of reinforcement is not permitted.
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Comply with applicable code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Section 014000 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

END OF SECTION



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**SECTION 033000
CAST-IN-PLACE CONCRETE**

(SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
 - 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
 - 2. For chemical-resistant waterstops, provide data on ASTM D471 test results.
- C. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
 - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
 - 3. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.
 - 4. Indicate proposed mix design complies with admixture manufacturer's written recommendations.
 - 5. Indicate proposed mix design complies with expansive component manufacturer's written recommendations.
- D. Samples: Submit samples of underslab vapor retarder to be used.
- E. Test Reports: Submit report for each test or series of tests specified.
- F. Test Reports: Submit termite-resistant sheet manufacturer's summary of independent laboratory and field testing for effectiveness in subterranean termite exclusion.
- G. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE



- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Comply with requirements of Section 031000.

2.02 REINFORCEMENT MATERIALS

- A. Comply with requirements of Section 032000.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
 - 1. Acquire cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
- C. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.
- D. Structural Fiber Reinforcement: ASTM C1116/C1116M.
 - 1. Fiber Length: 2 inch, nominal.
 - 2. Fiber Type: Alkali-resistant synthetic.
 - 3. Products:
 - a. Euclid Chemical Company: www.euclidchemical.com/#sle.
 - b. Fibermesh: www.fibermesh.com/#sle.
 - c. Forta Corporation: www.forta-ferro.com/#sle.
 - d. GCP Applied Technologies: www.gcpat.com/#sle.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
- D. Shrinkage Reducing Admixture:

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder:
 - 1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
 - 2. Products:
 - a. Henry Company; Moistop Ultra 15: www.henry.com/#sle.
 - b. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
 - c. Stego Industries, LLC; 15 MIL: www.stegoindustries.com/#sle.
 - d. Tex-Trude, LP; Xtreme Vapor Barrier (15-mil): www.tex-trude.com/#sle.
 - e. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.



2.06 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Acetate Bonding Agent: Non-redispersable polyvinyl acetate.
 - 1. Products:
 - a. Larsen Products Corp; Weldcrete: www.larsenproducts.com/#sle.
- C. Waterstops: Synthetic rubber; swells to 1000 percent of original size in clean water.
 - 1. Configuration: As indicated on drawings.
 - 2. Size: As indicated on drawings.
- D. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
- E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.

2.07 CURING MATERIALS

- A. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
 - 1. Vehicle: Water-based.
 - 2. Solids by Mass: 25 percent, minimum.
 - 3. VOC Content: OTC compliant.
 - 4. Products:
 - a. Clemons Concrete Coatings: www.clemonsconcretecoatings.com/#sle.
 - b. Concrete Sealers USA: www.concretesealersusa.com/#sle.
 - c. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
 - d. Euclid Chemical Company; www.euclidchemical.com/#sle.
 - e. W. R. Meadows, Inc; CS-309-25 OTC: www.wrmeadows.com/#sle.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.
- E. Normal Weight Concrete:
 - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch.



2. Water-Cement Ratio: Maximum 40 percent by weight.
3. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
4. Maximum Slump: 3 inches.
5. Maximum Aggregate Size: 5/8 inch.

2.09 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 1. Use latex bonding agent only for non-load-bearing applications.
- E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify Architect not less than 24 hours prior to commencement of placement operations.



- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.
- E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.06 SEPARATE FLOOR TOPPINGS

- A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.
- B. Apply bonding agent to substrate in accordance with manufacturer's instructions.
- C. Screed toppings level, maintaining surface flatness of maximum 1:1000.

3.07 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. An independent testing agency, as specified in Section 014000, will inspect finished slabs for compliance with specified tolerances.
- B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
 - 1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.
 - 2. Under Thick-Bed Tile: F(F) of 20; F(L) of 15, on-grade only.
 - 3. Under Carpeting: F(F) of 25; F(L) of 20, on-grade only.
 - 4. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.
 - 5. Under epoxy flooring: F(F) of 35; F(L) of 25
- C. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.
- D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.



- E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.08 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than seven days.
- C. Surfaces Not in Contact with Forms:
 - 1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 - 2. Final Curing: Begin after initial curing but before surface is dry.

3.09 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.
- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- H. Permeability Test: Test concrete with waterproofing admixture according to COE CRD-C 48.

3.10 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.



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3.11 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION



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SECTION 033543 POLISHED CONCRETE -

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate work of this section with concrete floor placement and concrete floor curing.
- B. Preinstallation Meeting: Conduct a preinstallation meeting 10 days prior to start of work of this section.
 1. Items for Review:
 - a. Physical requirements of completed concrete slab and slab finish.
 - b. Location and timing of test areas.
 - c. Protection of surfaces not scheduled for finish application.
 - d. Surface preparation.
 - e. Application procedure and quality control.
 - f. Cleaning and protection of finish.
 - g. Coordination with other work.
 2. Require attendance of parties directly affecting work of this section, including:
 - a. Concrete installer.
 - b. Finish installer.
 - c. Contractor's representative.
 - d. Architect.
 - e. Owner's representative.
 3. Notify parties one week in advance of date and time of meeting.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Product Data: Manufacturer's published data and installation instructions for concrete polishing system and finishing products, including manufacturer's installation instructions, information on compatibility of different products, and limitations.
- D. Product Data: Submit certification that products comply with regulations controlling use of volatile organic compounds.
- E. Maintenance Data: Provide data on maintenance and renewal of applied finishes.
- F. Installer's qualification statement.



- G. Executed warranty.
- H. Floor protection plan.

1.04 QUALITY ASSURANCE

- A. Comply with national, state, and local VOC regulations.
- B. Installer Qualifications:
 - 1. Company specializing in installing products specified in this section, having completed minimum of five projects of similar size and complexity.
 - 2. Company is listed applicator of concrete finishes, having completed manufacturer's training program.

1.05 MOCK-UP

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- C. Mock-Up Size: 50 sq ft.
- D. Locate on site where directed.
- E. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.
- F. Mock-up may remain as part of work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.
- B. Store materials per manufacturer's product data sheets:
 - 1. Store containers upright in cool, dry, well-ventilated place, out of the sun, at temperature between 40 degrees F and 100 degrees F.
 - 2. Store away from other chemicals and potential sources of contamination.
 - 3. Keep lights, fire, sparks, and heat away from container.
 - 4. Do not drop containers or slide across sharp objects.
 - 5. Do not stack pallets more than three high.
 - 6. Keep containers tightly closed when not in use.

1.07 FIELD CONDITIONS

- A. Ambient Conditions:
 - 1. Apply treatments and coatings when surface and air temperature is between 40 degrees F and 95 degrees F.
 - 2. Apply treatments and coatings when surface and air temperature is expected to remain above 40 degrees F for a minimum of eight hours after application.
 - 3. Maintain ambient temperature of 50 degrees F minimum.
 - 4. Apply treatments and coatings during calm wind conditions; provide adequate ventilation of enclosed or confined area.



5. Apply treatments and coatings minimum 24 hours after rain exposure; suspend application when rain is anticipated within 8 hours of application.
6. Do not apply to frozen substrate.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a two-year period commencing on the mm-dd-yyyy.
- C. Installer Warranty: Provide two-year manufacturer warranty for finish commencing on the mm-dd-yyyy; ensure that warranty forms have been completed in Owner's name and registered with manufacturer.

PART 2 PRODUCTS

2.01 POLISHED CONCRETE SYSTEM

- A. Polished Concrete System: Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.

2.02 SURFACE TREATMENTS

- A. Cutting Aid: Clear, water-based blended surfactant treatment spray-applied to wet concrete.
 1. VOC Content: 0.5 g/L or less.
- B. Repair Material: Low-odor, liquid fill material.
 1. VOC Content: 100 g/L or less.
- C. Cleaner: Pre-densifier concrete cleaner for existing slab surfaces.

2.03 DENSIFIERS AND HARDENERS

- A. Liquid Densifier and Hardener: Penetrating chemical compound, reacts with concrete, filling pores, hardening, and dustproofing.
 1. Composition: Lithium silicate.
 2. VOC Content: 50 g/L or less.
 3. Abrasion Resistance: Greater than 50 percent improvement compared to untreated sample in accordance with ASTM C1353/C1353M.
 4. Treated Material Slip Resistance: High traction range when tested according to ANSI/NFSI B101.1 and ANSI/NFSI B101.3.
 5. Adhesion: Greater than 10 percent increase in pull-off strength compared to untreated sample when tested according to ASTM D4541.
 6. Water Vapor Transmission: Zero perms compared to untreated sample when tested according to ASTM E96/E96M Method B.
 7. UV Stability: No degradation or yellowing when tested in accordance with ASTM G154.
 8. Product: PROSOCO, Inc; Consolideck LS: www.prosoco.com/consolideck/#sle.

2.04 COATINGS

- A. Coatings, General:
 1. Treated Material Slip Resistance: High traction range when tested according to ANSI/NFSI B101.1 and ANSI/NFSI B101.3.
 2. Stain Resistance: No adverse effect when tested according to ASTM D1308.



3. UV Stability: No degradation or yellowing when tested according to ASTM G154.
- B. Colored coating to match adjacent LVT, as acceptable to Architect.:
 1. Medium Gloss: Film forming protective treatment.
 - a. Composition: Lithium silicate.
 - b. Adhesion: Greater than 10 percent increase in pull off strength compared to untreated sample when tested according to ASTM D4541.
 - c. Product: PROSOCO, Inc; Consolideck LSGuard:
www.prosoco.com/consolideck/#sle.
 - C. Penetrating Sealer:
 1. Low Gloss: Solvent-based penetrating clear protective treatment.
 - a. VOC Content: 100 g/L or less.
 - b. Product: PROSOCO, Inc; Consolideck Concrete Protector SB:
www.prosoco.com/consolideck/#sle.

PART 3 EXECUTION

3.01 INSTALLERS

- A. Execute using manufacturer-approved installer:

3.02 EXAMINATION

- A. Verify that floor surfaces are clean and free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes and allow complete curing before application of concrete hardener and densifier. .

3.03 GENERAL

- A. Apply materials in accordance with manufacturer's instructions.

3.04 PREPARATION

- A. Protect adjacent non-coated areas from drips, overflow, and overspray; avoid contact with metal, glass, and painted surfaces; immediately remove excess material.
- B. Correct variations in slab texture and color prior to application of hardener-densifier.

3.05 CONCRETE POLISHING

- A. Grind and polish in multiple passes with each full pass in direction perpendicular to previous pass.
- B. Fill gaps, voids, and pop-outs during grinding operation.
- C. Apply densifier and hardener at specified rates and intervals.
- D. Final Polished Concrete Aggregate Exposure: Not to exceed CPC Class A - Cement Fines; cement fines, 85 to 95 percent; fine aggregates, 5 to 15 percent based on visual observation of overall area of polished floor versus Polished Concrete Aggregate Exposure Chart.



- E. Final Polished Concrete Appearance: CPC Level 4 - Highly Polished, image clarity value 70 to 100 percent with haze index less than 10.

3.06 PROTECTIVE TREATMENT

- A. Apply coatings in accordance with manufacturer's instructions. Match approved mock-ups for color, texture, sealing, and workmanship.
- B. Apply manufacturer's recommended protective treatment material to clean, dry slab after mechanically polishing.
 - 1. Low gloss protective treatment:
 - a. Allow to dry tack-free before burnishing slab surface in accordance with manufacturer's recommendations.
 - b. Repeat treatment up to two coats.
 - c. For reduced haze, allow final coat to dry before burnishing slab surface in accordance with manufacturer's recommendations.
- C. Clean spills on slab surfaces immediately, with manufacturer's recommended chemicals and absorptive materials.
- D. No haze, white residue, streaking, or burnish marks permitted.

3.07 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Defective Concrete: Repair or replace concrete not complying with required lines, details, dimensions, tolerances, or specified requirements at no additional cost to Owner.
- C. Final Polished Concrete Appearance: Test image clarity value and haze index prior to application of sealer at a rate of three tests per 1000 sq ft of polished concrete.
 - 1. Image clarity: Test with Image Clarity Meter in accordance with ASTM D5767.
 - 2. Haze index: Test with Glossmeter in accordance with ASTM D4039.
 - 3. Match approved mock-ups for texture, appearance, and workmanship.

3.08 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.
- B. Protect finished surface as required and as recommended by manufacturer of polishing system.

END OF SECTION



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055000 Metal Fabrications
055213 Pipe and Tube Railings



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**SECTION 055000
METAL FABRICATIONS**

(SEE CONTRACT STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
 - a. Include the following, as applicable:
 - 1) Design criteria.
 - 2) Engineering analysis depicting stresses and deflections.
 - 3) Member sizes and gauges.
 - 4) Details of connections.
 - 5) Support reactions.
 - 6) Bracing requirements.
- C. Designer's Qualification Statement.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.03 QUALITY ASSURANCE

- A. Design <> under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Florida.
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.
- C. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL



- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.
- D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.
- E. Bolts, Nuts, and Washers: Stainless steel.
- F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by intermittent welds and plastic filler.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

- A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.
- B. Lintels: As detailed; prime paint finish.
- C. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; prime paint finish.



- D. Corner Guards
 - 1. Brushed stainless steel, 0.0030 " thick, 1" x 1" wings, plain back or peel & stick (no screw mounting)
- E. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.
- F. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.05 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be imbedded in masonry.
 - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.06 FINISHES - ALUMINUM

- A. Exterior Aluminum Surfaces: Class I natural anodized.
- B. Interior Aluminum Surfaces: Class I natural anodized.
- C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
- D. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.07 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION



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- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION



**SECTION 055213
PIPE AND TUBE RAILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
- C. Samples: Submit two, 12 inch long samples of handrail. Submit two samples of elbow, wall bracket, and end stop.
- D. Designer's Qualification Statement.
- E. Fabricator's Qualification Statement.

1.03 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Florida, or personnel under direct supervision of such an engineer.
- B. Fabricator Qualifications:
 - 1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.
 - 2. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Handrails and Railings:
 - 1. Alumi-Guard; <>: www.alumi-guard.com/#sle.
 - 2. Avcon Railing Systems: www.avcon.com/#sle.
 - 3. Greco Aluminum Railings: www.grecoaluminumlrailings.com/#sle.
 - 4. ATR Technologies Inc: <http://www.atr-technologies.com/#sle>.
 - 5. Superior Aluminum Products, Inc: www.superioraluminum.com/#sle.
 - 6. Ultra Aluminum Manufacturing, Inc: www.ultrafence.com/#sle.

2.02 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.



- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E 935.
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 - 1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
 - 2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
 - 3. For anchorage to stud walls, provide backing plates, for bolting anchors.
- G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A 53/A 53M Grade B Schedule 40, black finish.
- C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- D. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.
- E. Straight Splice Connectors: Steel concealed spigots.
- F. Galvanizing: In accordance with requirements of ASTM A123/A123M.
 - 1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.04 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

PART 3 EXECUTION



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3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or placed in partitions with setting templates, for installation as work of other sections.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.
- F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION



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061000	Rough Carpentry
062000	Finish Carpentry
064100	Architectural Casework
066401	Plastic Fabrications



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**SECTION 061000
ROUGH CARPENTRY**

(SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

1.04 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a two-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Douglas Fir-Larch, unless otherwise indicated.
 - 2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.



- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- B. Other Applications:
 - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 - 3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 - 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.



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- B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.03 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.

3.04 CLEANING

- A. Waste Disposal: See Section 017419 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION



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SECTION 062000 FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
 - 2. Provide data on fire retardant treatment materials and application instructions.
 - 3. Provide instructions for attachment hardware and finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
 - 2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 - 3. Include certification program label.
- D. Samples: Submit two samples of wood trim 12 inch long.
- E. Sustainable Design Submittal: Documentation for sustainably harvested wood-based components.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Manufacturer's Instructions: Provide manufacturer's installation instructions for factory-fabricated units.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.



2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
 3. Single Source Responsibility: Provide and install this work from single fabricator.
- B. Quality Certification:
1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
 2. Provide labels or certificates indicating that work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 3. Provide designated labels on shop drawings as required by certification program.
 4. Provide designated labels on installed products as required by certification program.
 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.05 MOCK-UPS

- A. Provide mock-up, full size, illustrating finish and construction.
- B. See Section 014000 - Quality Requirements for additional requirements.
- C. Locate where directed.
- D. Approved mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.
- B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- C. Protect from moisture damage.
- D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.
- C. Interior Woodwork Items:
 1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.

2.02 LUMBER MATERIALS

- A. Softwood Lumber: <> Pine species, <> rift sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
- B. Hardwood Lumber: <> Birch species, <> rift sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.



2.03 SHEET MATERIALS

- A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
- B. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
- C. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1 Front Face Grade AA Back Face Grade 1, glue type as recommended for application.

2.04 PLASTIC LAMINATE MATERIALS

- A. Plastic Laminate: NEMA LD 3, HGS; color as selected by Architect; textured, low gloss finish.
 - 1. Products:
 - a. Arborite; <>: www.arborite.com/#sle.
 - b. Panolam Industries International, Inc: www.panolam.com/#sle.
- B. Laminate Backing Sheet: NEMA LD 3, BKL; undecorated plastic laminate.
- C. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.05 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Fasteners: Of size and type to suit application; any finish in concealed locations and match adjacent materials finish in exposed locations.
- C. Fasteners for Exterior Applications: Stainless steel; length required to penetrate wood substrate 1-1/2 inch minimum.
- D. Concealed Joint Fasteners: Threaded steel.

2.06 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Trim: Extruded convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness; color as selected.
- C. Primer: Alkyd primer sealer.
- D. Wood Filler: Solvent base, tinted to match surface finish color.

2.07 HARDWARE

- A. Hardware: Comply with BHMA A156.9.

2.08 WOOD TREATMENT

- A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.



- B. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
- C. Provide identification on fire retardant treated material.
- D. Redry wood after pressure treatment to maximum 12 percent moisture content.

2.09 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. Fit exposed sheet material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.
- C. Cap exposed plastic laminate finish edges with plastic trim.
- D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- E. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- F. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

2.10 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.
- D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 12, Polyurethane, Water-based.
 - b. Stain: As selected by Architect.
 - c. Sheen: Flat.
 - 2. Opaque:
 - a. System - 12, Polyurethane, Water-based.
 - b. Color: As selected by Architect.
 - c. Sheen: Flat.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION



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- A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- D. Install components with nails at 8 inch on center.
- E. Install hardware in accordance with manufacturer's written instructions.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION



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SECTION 064100 ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
 - 2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 - 3. Include certification program label.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Sustainable Design Submittal: Documentation for sustainably harvested wood-based components.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
 - 2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.



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2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
6. Replace, repair, or rework all work for which certification is refused.

1.05 MOCK-UPS

- A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware and finishes.
- B. See Section 014000 - Quality Requirements for additional requirements.
- C. Locate where directed.
- D. Approved mock-ups may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS (SEE FINISH SCHEDULE FOR MATERIAL SELECTIONS)

2.01 CABINETS

- A. All parts of the cabinet are made of solid wood or non-formaldehyde emitting materials such as metal or glass
- B. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- C. Plastic Laminate Faced Cabinets: Custom grade.
- D. Cabinets:
 1. Finish - Exposed Exterior Surfaces: Decorative laminate, as scheduled.
 2. Finish - Exposed Interior Surfaces: Decorative laminate, as scheduled.
 3. Finish - Concealed Surfaces: Manufacturer's option.
 4. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
 5. Door and Drawer Front Retention Profiles: Fixed panel.
 6. Casework Construction Type: Type A - Frameless.
 7. Interface Style for Cabinet and Door: Style 1 - Overlay; .
 8. Cabinet Design Series: As indicated on drawings.
 9. Adjustable Shelf Loading: 40 psf.
 - a. Deflection: L/144.
 10. Cabinet Style: Flush overlay.



11. Cabinet Doors and Drawer Fronts: Flush style.
12. Drawer Side Construction: Multiple-dovetailed.
13. Drawer Construction Technique: Dovetail joints.

2.02 PANEL CORE MATERIALS

- A. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.
 1. Grade: 115; moisture resistance: MR10.
 2. Panel Thickness: 1 inch.

2.03 LAMINATE MATERIALS

- A. Manufacturers:
 1. Arborite: www.arborite.com/#sle.
 2. Formica Corporation: www.formica.com/#sle.
 3. Panolam Industries International, Inc; Nevamar: www.nevamar.com/#sle.
 4. Wilsonart LLC: www.wilsonart.com/#sle.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Provide specific types as indicated.
 1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, color as selected, finish as indicated.
 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, color as selected, finish as indicated.
 3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, color as selected, finish as indicated.
 4. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, color as selected, finish as indicated.
 5. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.04 COUNTERTOPS

- A. Countertops: See Section 123600.

2.05 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 1. Color: As selected by Architect from manufacturer's full range.
 2. Use at all exposed plywood edges.
 3. Use at all exposed shelf edges.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in



exposed locations.

- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Standard painted metal or rubber grommets for cut-outs, in color to match adjacent surface.

2.06 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using surface mounted metal shelf standards or multiple holes for pin supports and coordinated self rests, #4, brushed satin finish, for nominal 1 inch spacing adjustments.
- C. Countertop Brackets: Fixed, concealed vertical leg, side-of-stud mounting.
 - 1. Materials: Steel L-shapes.
 - a. Finish: Manufacturer's standard, factory-applied, powder coat.
 - b. Color: As selected by Architect.
 - c. Vertical Leg: 18 inches.
 - d. Support Member Depth: 1 inch.
 - e. Support Member Width: 1 inch
 - f. Support Member Length: 18 inches.
 - 2. Products:
 - a. Basis of Design: Rakks/Rangine Corporation; Inside Wall Flush Mount Brackets: www.rakks.com/#sl
 - b. A&M Hardware, Inc; Concealed Brackets: www.aandmhardware.com/#sle.
- D. Drawer and Door Pulls: "U" shaped wire pull, aluminum with satin finish, 4 inch centers.
- E. Sliding Door Pulls: Elongated shape for recessed installation, aluminum with satin finish.
- F. Keyed Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.
- G. Cabinet Catches and Latches:
 - 1. Type: Push latch.
 - 2. Manufacturers:
 - a. Knappe & Vogt Manufacturing Company: www.knappeandvogt.com/#sle.
 - b. Sugatsune America, Inc: www.sugatsune.com/#sle.
 - c. Titus Cabinet Hardware: www.titusplus.com/us/en/#sle.
- H. Drawer Slides:
 - 1. Type: Extension types as indicated.
 - 2. Static Load Capacity: Commercial grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Features: Provide self closing/stay closed type.
 - 6. Manufacturers:
 - a. Accuride International, Inc; Heavy-Duty Drawer Slides: www accuride.com/#sle.
 - b. Blum, Inc: www.blum.com/#sle.
 - c. Grass America Inc: www.grassusa.com/#sle.



- d. Hettich America, LP: www.hettich.com/#sle.
 - e. Knappe & Vogt Manufacturing Company; Heavy-Duty Drawer Slides: www.knappeandvogt.com/#sle.
 - f. Sugatsune America, Inc: www.sugatsune.com/#sle.
- I. Hinges: European style concealed self-closing type, steel with nickel-plated finish.
- 1. Manufacturers:
 - a. Blum, Inc: www.blum.com/#sle.
 - b. Grass America Inc; <>: www.grassusa.com/#sle.
 - c. Hardware Resources: www.hardwareresources.com/#sle.
 - d. Hettich America, LP: www.hettich.com/#sle.
 - e. Sugatsune America, Inc: www.sugatsune.com/#sle.
 - f. Titus Cabinet Hardware: www.titusplus.com/us/en/#sle.

2.07 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.
- F. Provide cutouts for plumbing fixtures, inserts, and outlet boxes. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.
- G. Shop glaze glass materials using Interior Dry method; see Section 088000.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.



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- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION



**SECTION 066401
PLASTIC FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: For each panel and trim type.
- C. Shop Drawings:
 - 1. For each fabricated panel layout, indicate:
 - a. Elevations: Dimensioned locations of panels and penetrations. Include field measurements indicating extents of paneling.
 - b. Drawing Scale: 1/4 inch to 1 foot, minimum.
- D. Samples: For each <> panel type, two samples, 6 inches by 6 inches in size, indicating specified color and texture.
- E. Samples: For each trim type, two samples, 4 inches in length, indicating specified color and texture.
- F. Manufacturer's Instructions: For each panel type and associated trim, provide installation instructions.
- G. Installer's qualification statement.
- H. Maintenance Data: Panel maintenance and cleaning recommendations.
- I. Executed warranty.
- J. Specimen warranty.
- K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
 - 1. See Section 016000 - Product Requirements for additional provisions.
 - 2. Extra Stock Materials: 6 extra panels <> <>.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.04 MOCK-UPS

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Construct 1 mock-up, indicating panels, trim, and joints.
- C. Locate where directed.



- D. Approved mock-up may remain as part of work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver products to site in manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.
- C. Store products in clean, dry, interior areas in accordance with manufacturer's instructions.
- D. Store plastic panels and trim flat.

1.06 FIELD CONDITIONS

- A. Ambient Field-Cutting Conditions: Before field-cutting panels in temperatures below 40 degrees F, warm space to 60 degrees F minimum. Maintain temperature for 24 hours before, during, and after field-cutting.
- B. Ambient Conditions for Installation: When ambient temperatures are below 40 degrees F, warm space to 60 degrees F minimum. Maintain temperature for 24 hours before, during, and after installation.
- C. Ambient Conditions for Installation: When ambient temperatures are above 70 degrees F, cool space to 60 degrees F. Maintain temperature for 24 hours before, during, and after installation.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 10-year manufacturer warranty for products free from manufacturing defects. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 PLASTIC PANELING

- A. Material: 100 percent virgin PVC (polyvinyl chloride), exterior grade.
- B. Surface Burning Requirements, Interior Use: Flame spread index of 25 or less and smoke-development index of 450 or less; Class A classification when tested in accordance with ASTM E84.
- C. Fungi Resistance: No visible growth, when tested in accordance with ASTM G21.

2.02 PLASTIC LINER PANEL ASSEMBLIES

- A. Description: DoCurved panels and shown
 1. Panel Thickness: 1/2 inch.
 2. Panel Color: As scheduled.
 3. Trim: Extruded PVC, same color as liner panels, sized to fit liner panel thickness; types:

2.03 ACCESSORIES

- A. Plastic Spacers: Rigid nylon spacers, same thickness as panel.
- B. Sound-Absorbtion Filler



1. Basis Of Design: Nordgrona; "Reinder Moss Pixel; www.noedgona.com
 - a. Manufactured from all natural, hand-picked Scandinavian Reindeer Moss and Recycled PET felt base.
 - b. Preserved in a natural salt solution and colored with water-based dyes with no chemicals, additives, and is glycerin free.
 - c. Guarantee materials and constructions for three (3) years from the date of delivery.
- C. Adhesives: Type recommended by panel manufacturer for application; not containing formaldehyde or volatile organic compounds.
 1. Where visible in finished work, tint adhesive to match exposed panel surface.
- D. Joint Sealants: Type recommended by paneling manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify field measurements are as indicated on shop drawings.
- B. Verify substrates are prepared to receive plastic paneling.
- C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Verify mechanical, electrical, and other building components affecting work of this section are placed and ready to receive work of this section.

3.02 PREPARATION

- A. Surface Preparation: Clean substrate surfaces prior to installing paneling.

3.03 INSTALLATION - GENERAL

- A. Maintain manufacturer recommended gap tolerances between panels and adjacent abutments.
- B. Field-cut panels in accordance with manufacturer's written instructions. Make straight and square cuts; do not damage panels.

3.04 INSTALLATION - PLASTIC <> PANELS

- A. Install panels and trim in accordance with manufacturer's written instructions and approved shop drawings.
- B. Vertically Installed Liner Panel: Install panels plumb within specified tolerances.
- C. Horizontally Installed Liner Panels: Install panels level within specified tolerances.
- D. Install threaded fasteners into panels without overtightening in accordance with manufacturer recommendations.
- E. Adhesive Attachment to Concrete Walls: Apply adhesive in accordance with panel manufacturer's written instructions.
- F. Apply sealant between panels and trim in accordance with panel manufacturer's written instructions.

3.05 TOLERANCES

- A. Maximum Variation from True Position: 1/4 inch.



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- B. Maximum Variation from Plumb: 1/4 inch in 10 feet.
- C. Maximum Variation from Level: 1/4 inch in 10 feet.

3.06 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Clean exposed surfaces of panels and trim in accordance with manufacturer's instructions.

3.07 PROTECTION

- A. Protect installed plastic paneling from subsequent construction operations.

END OF SECTION

MIAMI-DADE PUBLIC LIBRARY SYSTEM
VOLUME II
PROJECT MANUAL
DIVISION 07- THERMAL AND MOISTURE PROTECTION

South Dade Regional Library Interior Renovations

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072100	Thermal Insulation
078123	Intumescent Fire Protection
078400	Firestopping
079200	Joint Sealants



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SECTION 072100 THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on project site during and after installation. Present on-site documentation upon request.
- H. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.03 QUALITY ASSURANCE

- A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
 - 1. Installer Qualification: Use accredited contractors, certified installers, evaluated materials, and third-party field quality control audit.
 - 2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.04 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS (WALLS R=19, ROOF R=30)

2.01 MINERAL FIBER BLANKET INSULATION MATERIALS



- A. Insulation emissions are in accordance with emission levels of CDPH/EHLB Standard Method v1.1.
- B. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 4. Formaldehyde Content: Zero.
 - 5. Products:
 - a. CertainTeed Corporation: www.certainteed.com.
 - b. Johns Manville: www.jm.com.
 - c. Owens Corning Corp: www.owenscorning.com.
- C. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
 - 1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 2. Products:
 - a. Johns Manville: www.jm.com/sle.
 - b. Knauf Insulation; EcoBatt Insulation: www.knaufinsulation.com/#sle.
 - c. Thermafiber, Inc; <>: www.thermafiber.com.
 - d. ROXUL, Inc; <>: www.roxul.com/sle.
 - e. ROCKWOOL; AFB: www.rockwool.com/#sle.

2.02 ACCESSORIES

- A. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
- B. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- C. Wire Mesh: Galvanized steel, hexagonal wire mesh.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

3.02 BATT INSTALLATION

- A. Install insulation, where indicated, in accordance with manufacturer's instructions.
- B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- C. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- D. Staple or nail facing flanges in place at maximum 6 inches on center.



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- E. Tape insulation batts in place.
- F. Retain insulation batts in place with spindle fasteners at 12 inches on center.
- G. Retain insulation batts in place with wire mesh secured to framing members.
- H. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Coordination of Air Barrier Association of America (ABAA) Tests and Inspections:
 - 1. Provide testing and inspection required by ABAA Quality Assurance Program (QAP).
 - 2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
 - 3. Cooperate with ABAA testing agency.

3.04 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION



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SECTION 078123 INTUMESCENT FIRE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Performance characteristics and test results.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Selection Samples: For decorative top coat, color chips representing manufacturer's full range of available colors and sheens.
- D. Verification Samples: For each thickness, color, sheen, and finish required, submit samples not less than 4 inches square on designated substrate illustrating finished appearance.
- E. Certificates: Certify that intumescent fireproofing provided for this project meets or exceeds specified requirements in all respects.
- F. Test Reports: Published fire resistive designs for structural elements of the types required for the project, indicating hourly ratings of each assembly.
- G. Field Quality Control Submittals: Submit field test report.
- H. Manufacturer's qualification statement.
- I. Installer's qualification statement.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company that specializes in manufacturing the type of products specified, with minimum of ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.04 MOCK-UPS

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Provide a mock-up for evaluation of surface preparation techniques and application workmanship; approved mock-up will serve as a standard of comparison for subsequent work of this section.



- C. Finish at least 100 sq ft of surface in areas as designated by Architect.
- D. Evaluate mock-up for compliance with specified requirements, including thickness and finish texture.
- E. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
- F. Refinish mock-up area as required to produce acceptable work.
- G. Approved mock-up may remain as part of the project.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver materials in manufacturer's original, unopened containers with identification labels and testing agency markings intact and legible.
- C. Store products in manufacturer's unopened packaging until ready for installation.
 - 1. Store at temperatures not less than 50 degrees F in dry, protected area.
 - 2. Protect from freezing, and do not store in direct sunlight.
 - 3. Dispose of any materials that have come into contact with contaminants of any kind prior to application.
- D. Dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

- A. Protect areas of application from windblown dust and rain.
- B. Maintain ambient field conditions, such as temperature, humidity, and ventilation, within limits recommended by manufacturer for optimum results. Do not install products under ambient conditions outside manufacturer's absolute limits.
 - 1. Provide temporary enclosures as required to control ambient conditions.
 - 2. Do not apply intumescent fireproofing when ambient temperatures are below 50 degrees F without specific approval from manufacturer.
 - 3. Ensure that relative humidity is between 40 and 60 percent in areas of application.
 - 4. Provide ventilation in enclosed spaces during application and for not less than 72 hours afterward.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Intumescent Fire Protection Top Coating for Gypsum Board:
 - 1. FlameOFF Coatings, Inc; FlameOFF Fire Barrier Paint: www.flameoffcoatings.com/#sle.

2.02 SYSTEM REQUIREMENTS

- A. Fireproofing: Provide intumescent thin-film fire protection systems tested by an independent testing agency in accordance with ASTM E119 and acceptable to authorities having jurisdiction (AHJ).



1. Provide assemblies listed by FM (AG) or UL (FRD) and bearing listing agency label or mark.

2.03 MATERIALS

- A. Fire Resistive Coating System: Thin-film intumescent fire protection system for gypsum board.
 1. Surface Burning Characteristics: Class A, flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
 2. For Interior Use:
 - a. Use only water-based products.
 - b. VOC Content: Less than 500 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24).
 - c. Direct Impact Resistance: 40 in-lb.
 - d. Abrasion Resistance: 0.005 ounce/1000 cycles, maximum.
 - e. Bond Strength: 631 psi, minimum.
 - f. Durometer Hardness, Type D: 65, minimum, in accordance with ASTM D2240.
- B. Sealers and Primer: As required by tested and listed assemblies, and recommended by fireproofing manufacturer to suit specific substrate conditions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates to determine if they are in satisfactory condition to receive intumescent fire protection; verify that substrates are clean and free of oil, grease, incompatible primers, or other foreign substances capable of impairing bond to fireproofing system.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Thoroughly clean surfaces to receive fireproofing.
- B. Repair substrates to remove surface imperfections that could effect uniformity of texture and thickness of fireproofing system, and remove minor projections and fill voids that could telegraph through finished work.
- C. Cover or otherwise protect other work that might be damaged by fallout or overspray of fireproofing system, and provide temporary enclosures as necessary to confine operations and maintain required ambient field conditions.

3.03 APPLICATION

- A. Comply with manufacturer's instructions for each particular intumescent fire protection system installation application as indicated.
- B. Apply manufacturer's recommended primer to required coating thickness.
- C. Apply fireproofing to full thickness over entire area of each substrate to be protected.



- D. Apply coats at manufacturer's recommended rate to achieve dry film thickness (DFT) as required for fire resistance ratings designated for each condition.
- E. Apply intumescent fire protection by spraying to maximum extent possible, and as necessary complete coverage by roller application or other method acceptable to manufacturer.
- F. Achieve uniform finished appearance complying with approved mock-up.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 014000 - Quality Requirements.
 - 1. Arrange for testing of installed intumescent fire protection by an independent testing laboratory using magnetic pull-off dry film thickness gauge in accordance with SSPC-PA 2, and ensure it meets requirements of authorities having jurisdiction (AHJ).
 - 2. Submit field test reports promptly to Contractor and Architect.
- B. Repair or replace intumescent fire protection at locations where test results indicate fireproofing does not meet specified requirements.

3.05 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Immediately after installation of fireproofing in each area, remove overspray and fallout from other surfaces and clean soiled areas.

3.06 PROTECTION

- A. Protect installed intumescent fire protection from damage due to subsequent construction activities, so fireproofing is without damage or deterioration before Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION



SECTION 078400 FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.
- E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Certificate from authority having jurisdiction indicating approval of materials used.
- H. Manufacturer's qualification statement.
- I. Installer's qualification statement.

1.03 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Trained by manufacturer.
 - 2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
 - 3. Verification of minimum three years documented experience installing work of this type.
 - 4. Verification of at least five satisfactorily completed projects of comparable size and type.



5. Licensed by local authorities having jurisdiction (AHJ).

1.04 MOCK-UP

- A. Install one firestopping assembly representative of each fire rating design required on project.
 1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
 2. Where firestopping is intended to fill a linear opening, install minimum of 1 linear ft.
- B. Obtain approval of authorities having jurisdiction (AHJ) before proceeding.
- C. If accepted, mock-up will represent minimum standard for this work.
- D. If accepted, mock-up may remain as part of this work. Remove and replace mock-ups not accepted.

1.05 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
 2. A/D Fire Protection Systems Inc: www.adfire.com/#sle.
 3. Everkem Diversified Products, Inc: www.everkemproducts.com/#sle.
 4. Hilti, Inc: www.us.hilti.com/#sle.
 5. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
 6. Specified Technologies Inc: www.stifirestop.com/#sle.
 7. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

2.02 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
- C. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- E. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.



1. Movement: Provide systems that have been tested to show movement capability as indicated.
 2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
 3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.
- B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
1. Movement: Provide systems that have been tested to show movement capability as indicated.
- C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
1. Movement: Provide systems that have been tested to show movement capability as indicated.
 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.04 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.



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- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION



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SECTION 079200 JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Substrates for which laboratory adhesion and/or compatibility testing is required.
 - 7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 - 8. Sample product warranty.
 - 9. Certification by manufacturer indicating that product complies with specification requirements.
 - 10. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- F. Sustainable Design Documentation: For sealants and primers, submit VOC content and emissions documentation as specified in Section 016116.
- G. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- H. Installation Plan: Submit at least four weeks prior to start of installation.



- I. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
- J. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- K. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.
- L. Installation Log: Submit filled out log for each length or instance of sealant installed.
- M. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
 - 1. Adhesion Testing: In accordance with ASTM C794.
 - 2. Compatibility Testing: In accordance with ASTM C1087.
 - 3. Stain Testing: In accordance with ASTM C1248; required only for stone substrates.
 - 4. Allow sufficient time for testing to avoid delaying the work.
 - 5. Deliver to manufacturer sufficient samples for testing.
 - 6. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
 - 7. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.
- E. Installation Plan: Include schedule of sealed joints, including the following.
 - 1. Joint width indicated in Contract Documents.
 - 2. Joint depth indicated in Contract Documents; to face of backing material at centerline of joint.
 - 3. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgement that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.
 - 4. Approximate date of installation, for evaluation of thermal movement influence.
 - 5. Installation Log Form: Include the following data fields, with known information filled out.
 - a. Unique identification of each length or instance of sealant installed.
 - b. Location on project.
 - c. Substrates.
 - d. Sealant used.



- e. Stated movement capability of sealant.
 - f. Primer to be used, or indicate as "No primer" used.
 - g. Size and actual backing material used.
 - h. Date of installation.
 - i. Name of installer.
 - j. Actual joint width; provide space to indicate maximum and minimum width.
 - k. Actual joint depth to face of backing material at centerline of joint.
 - l. Air temperature.
- F. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
- 1. Identification of testing agency.
 - 2. Name(s) of sealant manufacturers' field representatives who will be observing
 - 3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
 - a. Substrate; if more than one type of substrate is involved in a single joint, provide two entries on form, for testing each sealant substrate side separately.
 - b. Test date.
 - c. Location on project.
 - d. Sealant used.
 - e. Stated movement capability of sealant.
 - f. Test method used.
 - g. Date of installation of field sample to be tested.
 - h. Date of test.
 - i. Copy of test method documents.
 - j. Age of sealant upon date of testing.
 - k. Test results, modeled after the sample form in the test method document.
 - l. Indicate use of photographic record of test.
- G. Owner will employ an independent testing agency to perform the field quality control inspection and testing as referenced in PART 3 of this section and as follows, to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.
- 1. Contractor shall cooperate with testing agency and repair failures discovered and destructive test location damage.
- H. Field Quality Control Plan:
- 1. Visual inspection of entire length of sealant joints.
 - 2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
 - a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 24 inches thereafter.
 - b. If any failures occur in the first 10 linear feet, continue testing at 12 inches intervals at no extra cost to Owner.



3. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.
- I. Field Adhesion Test Procedures:
 1. Allow sealants to fully cure as recommended by manufacturer before testing.
 2. Have a copy of the test method document available during tests.
 3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
 4. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.
- J. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
 1. Record results on Field Quality Control Log.
 2. Repair failed portions of joints.
- K. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

1.04 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 1. Adhesives Technology Corporation: www.atcepoxy.com/sle.
 2. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 3. Bostik Inc: www.bostik-us.com.
 4. Dow Corning Corporation: www.dowcorning.com/construction/sle.
 5. Fortifiber Building Systems Group: www.fortifiber.com/sle.
 6. Franklin International, Inc: www.titebond.com/sle.
 7. Hilti, Inc: www.us.hilti.com/#sle.
 8. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
 9. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/#sle.
 10. Pecora Corporation: www.pecora.com.
 11. The QUIKRETE Companies: www.quikrete.com.
 12. Sherwin-Williams Company: www.sherwin-williams.com.
 13. Sika Corporation: www.usa-sika.com.



14. Specified Technologies Inc: www.stifirestop.com/#sle.
 15. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 16. W.R. Meadows, Inc: www.wrmeadows.com/sle.
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
1. Adhesives Technology Corporation: www.atcepoxy.com/sle.
 2. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 3. Bostik Inc: www.bostik-us.com.
 4. Dayton Superior Corporation: www.daytonsuperior.com.
 5. Dow Corning Corporation: www.dowcorning.com/construction/sle.
 6. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
 7. Pecora Corporation: www.pecora.com.
 8. The QUIKRETE Companies: www.quikrete.com.
 9. Sherwin-Williams Company: www.sherwin-williams.com.
 10. Sika Corporation: www.usa-sika.com.
 11. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 12. W.R. Meadows, Inc: www.wrmeadows.com/sle.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - c. Other joints indicated below.
 3. Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.



- B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 - 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
 - 2. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; clear.
 - 3. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
- D. Interior Wet Areas: Bathrooms and restrooms; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- B. Colors: As as selected by Architect from manufacturer's full range.

2.04 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
 - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 - 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 - 5. Color: To be selected by Architect from manufacturer's full range.
 - 6. Cure Type: Single-component, neutral moisture curing.
 - 7. Service Temperature Range: Minus 20 to 180 degrees F.
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: Clear.
- C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: To be selected by Architect from manufacturer's full range.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F.
- D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
 - 1. Color: To be selected by Architect from manufacturer's full range.
 - 2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).

2.05 SELF-LEVELING SEALANTS



- A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
 - 1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
 - 2. Hardness Range: 0 to 15, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: To be selected by Architect from manufacturer's full range.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F.

2.06 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
 - 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
 - 3. Open Cell: 40 to 50 percent larger in diameter than joint width.
 - 4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
 - 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
 - 2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
 - 3. Arrange for sealant manufacturer's technical representative to be present during tests.
 - 4. Record each test on Preinstallation Adhesion Test Log as indicated.
 - 5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.



6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
 1. Width/depth ratio of 2:1.
 2. Neck dimension no greater than 1/3 of the joint width.
 3. Surface bond area on each side not less than 75 percent of joint width.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

- A. Owner will employ an independent testing agency to perform field quality control inspection and testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

3.05 POST-OCCUPANCY



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- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION



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MIAMI-DADE PUBLIC LIBRARY SYSTEM
VOLUME II
PROJECT MANUAL
DIVISION 08- OPENINGS

South Dade Regional Library Interior Renovations

C23-MDPLS-01-ESP



081116	Aluminum Door Frames
081416	Flush Wood Doors
083100	Access Doors and Panels
087100	Door Hardware
087110	Hardware Sets
088000	Glazing



**SECTION 081116
ALUMINUM DOOR FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for each type of door; include information on fabrication methods.
- C. Shop Drawings: Include elevations of each opening type.
 - 1. Verify dimensions by field measurements before fabrication and indicate on shop drawings.
- D. Selection Samples: Complete set of color and finish options, using actual materials, for Architect's selection.
- E. Verification Samples: Two actual pieces of products in each finish specified, not less than 6 inches square or 6 inches long for linear components. For finishes subject to color variation, include not less than two samples illustrating extreme range to be anticipated.
- F. Test Report: Certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- J. Specimen warranty.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver aluminum components in manufacturer's standard protective packaging, palletted, crated, or banded together.
- B. Inspect delivered components for damage and replace. Repaired components will not be accepted.



- C. Store components in clean, dry, indoor area, under cover in manufacturer's packaging until installation.
- D. Protect materials and finish from damage during handling and installation.

1.05 FIELD CONDITIONS

- A. Do not begin installation of interior aluminum components until space has been enclosed and ambient thermal conditions are being maintained at levels consistent with final project requirements.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Manufacturer Warranty: Provide 10-year manufacturer warranty for defects in workmanship and materials. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Aluminum Frames:
 - 1. Arcadia, Inc: www.arcadiainc.com/#sle.
 - 2. Cline Aluminum Doors, Inc: www.clinedoors.com/#sle.
 - 3. Western Integrated Materials: www.western-integrated.com
 - 4. Wilson Partitions: www.wilsonpart.com/#sle.

2.02 DOOR FRAMES

- A. Accessibility: Comply with ICC A117.1 and ADA Standards.
- B. Aluminum Frames for Doors, Sidelights, or Transoms: Extruded aluminum, non-thermally broken hollow or C-shaped sections; no steel components.
 - 1. Frame Depth: To fit wall thicknesses as indicated on drawings.
 - 2. Frames for Fire-Rated Doors Specified Elsewhere: Tested in accordance with NFPA 252, listed and labeled by UL (DIR), ITS (DIR), or testing agency acceptable to authorities having jurisdiction.
 - 3. Finish: Class I - Natural anodized.
 - 4. Sidelight/Transom Glazing: Sealed insulating glass units, 1 inch overall thickness, with two panes of clear 1/4 inch thick fully tempered glass.
- C. Dimensions and Shapes: As indicated on drawings; dimensions indicated are nominal.
 - 1. Provide vision lites as indicated on drawings.
 - 2. Provide the following clearances:
 - a. Hinge and Lock Stiles: 1/8 inch.
 - b. Between Meeting Stiles: 1/4 inch.
 - c. At Top Rail and Bottom Rail: 1/8 inch.

2.03 COMPONENTS



- A. Frames: Extruded aluminum shapes, not less than 0.062 inch thick, reinforced at hinge and strike locations.
 - 1. Corner Brackets: Extruded aluminum, fastened with stainless steel screws.
 - 2. Trim: Extruded aluminum, not less than 0.062 inch thick, removable snap-in type without exposed fasteners.
- B. Vision Lites: Extruded aluminum framed, gasket glazed.
 - 1. Glazing: Clear, single pane of 1/4 inch thick fully tempered glass.

2.04 PERFORMANCE REQUIREMENTS

- A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.
- B. Air Leakage: Maximum of 0.1 cu ft/min/sq ft at 6.27 psf differential pressure, when tested in accordance with ASTM E283/E283M.
- C. Acoustical Performance: Sound Transmission Class (STC) of 25, minimum, when tested in accordance with ASTM E90.

2.05 MATERIALS

- A. Aluminum Sheet: ASTM B209/B209M, alloy 5005, temper H14, stretcher leveled.
- B. Extruded Aluminum: ASTM B221 (ASTM B221M), alloy 6063, temper T5, or alloy 6463, temper T5.

2.06 FINISHES

- A. Class I Natural Anodized Finish: Clear anodic coating; AAMA 611 AA-M12C22A41, minimum dry film thickness (DFT) of 0.7 mils, 0.0007 inch.
- B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.07 ACCESSORIES

- A. Fasteners: Aluminum, non-magnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components.
- B. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, non-magnetic stainless steel or steel hot-dip galvanized in compliance with ASTM A123/A123M.
- C. Bituminous Coating: Cold-applied asphaltic mastic, compounded for 30-mil thickness per coat.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces and openings are ready to receive frames and are within tolerances specified in manufacturer's instructions.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION



- A. Perform cutting, fitting, forming, drilling, and grinding of frames as required for project conditions.
- B. Replace components with damage to exposed finishes.
- C. Separate dissimilar metals to prevent electrolytic action between metals.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and approved shop drawings.
- B. Set frames plumb, square, level, and aligned to receive doors. Anchor frames to adjacent construction in strict accordance with manufacturer's recommendations and within specified tolerances.
- C. Where aluminum surfaces contact metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by painting dissimilar metal with heavy coating of bituminous paint.
- D. Hang doors and adjust hardware to achieve specified clearances and proper door operation.
- E. Install door hardware. See Section 087100.
- F. Install glazing; set glazing stops and glazing gaskets flush with face of door or frame.
- G. Comply with glazing installation requirements. See Section 088000.

3.04 FIELD QUALITY CONTROL

- A. Provide services of aluminum door manufacturer's field representative to observe for proper installation of system and submit report.
- B. See Section 014000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

3.05 CLEANING

- A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance with AAMA 609 & 610.
- B. Do not use abrasive, caustic, or acid cleaning agents.

3.06 PROTECTION

- A. Protect products of this section from damage caused by subsequent construction until Date of Substantial Completion.
- B. Replace damaged or defective components that cannot be repaired to a condition indistinguishable from undamaged components.

END OF SECTION



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SECTION 081416 FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - 1. Provide information as required by AWI/AWMA/WI (AWS) or AWMA/WI (NAAWS).
 - 2. Include certification program label.
- D. Samples: Submit two samples of door construction, 10 x 10 inch in size cut from top corner of door.
- E. Samples: Submit two samples of door veneer, 10 x 10 inch in size illustrating wood grain, stain color, and sheen.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Manufacturer's Installation Instructions: Indicate special installation instructions.
- H. Manufacturer's qualification statement.
- I. Installer's qualification statement.
- J. Specimen warranty.
- K. Warranty, executed in Owner's name.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
 - 1. Company with at least one project within past five years with value of woodwork within at least 20 percent of cost of woodwork for this project.
 - 2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.



- C. Woodwork Quality Assurance Program:
 - 1. Provide labels indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 2. Provide designated labels on shop drawings as required by quality assurance program.
 - 3. Provide designated labels on installed products as required by quality assurance program.
 - 4. Submit documentation upon completion of installation that verifies this work is in compliance with specified requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
 - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. High Pressure Decorative Laminate (HPDL) Faced Doors:
 - 1. Ampco Products, Inc: www.ampco.com/#sle.
 - 2. Oregon Door: www.oregondoor.com/#sle.
 - 3. Masonite Architectural: www.architectural.masonite.com/#sle.
 - 4. Poncraft Door Co: www.poncraft.com/#sle.
 - 5. VT Industries, Inc: www.vtindustries.com/#sle.

2.02 DOORS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 - 3. High pressure decorative laminate (HPDL) finish as indicated on drawings.
 - 4. Hardboard facing with factory opaque finish as indicated on drawings.

2.03 DOOR AND PANEL CORES



- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. High Pressure Decorative Laminate (HPDL) Facing for Fire Doors: NEMA LD 3, SGF; color as selected; textured, low gloss finish.
- B. High Pressure Decorative Laminate (HPDL) Facing for Non-Fire-Rated Doors: NEMA LD 3, HGS; color as selected; textured, low gloss finish.
- C. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- G. Provide edge clearances in accordance with the quality standard specified.

2.06 ACCESSORIES

- A. Metal Louvers:
 - 1. Material and Finish: Roll formed steel; pre-painted finish to color as selected.
 - 2. Louver Blade: Inverted V blade, sight proof, light proof.
 - 3. Louver Free Area: 50 percent.
 - 4. Frame: Flush style with tamper proof fasteners.
 - 5. Material and Finish: Roll formed steel; pre-painted finish to color as selected.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.



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- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Use machine tools to cut or drill for hardware.
- C. Coordinate installation of doors with installation of frames and hardware.
- D. Install door louvers plumb and level.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

3.05 SCHEDULE

- A. Refer to Door and Frame Schedule on drawings.

END OF SECTION



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SECTION 083100 ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Samples: Submit two access units, 10 X 10 inch in size illustrating frame configuration.
- E. Manufacturer's Installation Instructions: Indicate installation requirements.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Project Record Documents: Record actual locations of each access unit.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units with Return Air Grille:
 - 1. Location: As indicated on drawings or required.
 - 2. Panel Material: Aluminum extrusions with gypsum board inlay.
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
 - 5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
- B. Wall-Mounted Units in Wet Areas:
 - 1. Location: As indicated on drawings or required.
 - 2. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.



3. Size: 6 inch by 6 inch, unless otherwise indicated or required.
 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
 6. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
- C. Fire-Rated Wall-Mounted Units:
1. Location: As indicated on drawings or required.
 2. Wall Fire-Rating: As indicated on drawings.
 3. Panel Material: Steel.
 4. Size: 12 inch by 12 inch, unless otherwise indicated or required.
 5. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.
- D. Ceiling-Mounted Units with Return Air Grille:
1. Type: Stealth
 2. Location: As indicated on drawings or required.
 3. Material: Glass Fiber Reinforced Gypsum (GFRG) .
 4. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
 5. Size: 12 inch by 12 inch, unless otherwise indicated or required..
 6. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
- E. Exterior Access Panels
1. Material:
 - a. Frame: Steel, 16 gage, galvanized.
 - b. Door: Door/Panel: 2 inch thick, 0.040 aluminum with continuous stainless steel hinge, Insulated double-surface panel[<>], R-5.7.
 - c. Handel: (H2) Non-locking, plastic with chrome finish.
 2. Size: 36 inch by 36 inch, unless otherwise indicated or required.
 3. Gaskets: Adhesive backed EPDM foam and silicone rubber seals on door and frame.
 4. Manufacturer: Access Doors & Panels: Model XPA R=5.7; www.accessdoordandpanels.com

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION



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- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION



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**SECTION 087100
DOOR HARDWARE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
 - 1. Architect.
 - 2.
 - 3. Hardware Installer.
 - 4. Owner's Security Consultant.
- D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- E. Keying Requirements Meeting:
 - 1. Schedule meeting at project site prior to Contractor occupancy.
 - 2. Attendance Required:
 - a. Contractor.
 - b. Owner.
 - c. Installer's Architectural Hardware Consultant (AHC).
 - d. Hardware Installer.
 - 3. Agenda:
 - a. Establish keying requirements.
 - b. Verify locksets and locking hardware are functionally correct for project requirements.
 - c. Verify that keying and programming complies with project requirements.
 - d. Establish keying submittal schedule and update requirements.
 - 4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
 - a. Access control requirements.
 - b. Key control system requirements.
 - c. Schematic diagram of preliminary key system.
 - d. Flow of traffic and extent of security required.



5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
6. Deliver established keying requirements to manufacturers.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
 1. Prepared by or under supervision of CONSULTANTural Hardware Consultant (AHC).
 2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
 3. List groups and suffixes in proper sequence.
 4. Provide complete description for each door listed.
 5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
 6. Include account of abbreviations and symbols used in schedule.
- D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
 1. Prepared by or under supervision of CONSULTANTural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
 2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
 3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- E. Samples for Verification:
 1. Submit minimum size of 2 by 4 inch for sheet samples, and minimum length of 4 inch for other products.
 2. Submit one (1) sample of hinge, latchset, lockset, and closer illustrating style, color, and finish.
 3. Return full-size samples to Contractor.
 4. Submit product description with samples.
- F. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 1. Submit manufacturer's parts lists and templates.
 2. Bitting List: List of combinations as furnished.
- G. Keying Schedule:



1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- H. Manufacturer's qualification statement.
- I. Specimen warranty.
- J. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- K. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
 1. See Section 016000 - Product Requirements, for additional provisions.
 2. Lock Cylinders: Ten for each master keyed group.
 3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.04 QUALITY ASSURANCE

- A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
 1. Closers: Five years, minimum.
 2. Exit Devices: Three years, minimum.
 3. Locksets and Cylinders: Three years, minimum.
 4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:



1. Applicable provisions of federal, state, and local codes.
 2. Accessibility: ADA Standards and ICC A117.1.
 3. Applicable provisions of NFPA 101.
 4. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
 5. Listed and certified compliant with specified standards by BHMA (CPD).
 6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
 7. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
 8. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
- D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
1. See Section 281000 for additional access control system requirements.
- E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Door Hardware Schedule.
- F. Fasteners:
1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
 - a. Self-drilling (Tek) type screws are not permitted.
 3. Provide wall grip inserts for hollow wall construction.
 4. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
 5. Fire-Rated Applications: Comply with NFPA 80.
 - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
 - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 HINGES

- A. Hinges: Comply with BHMA A156.1, Grade 1.
1. Provide hinges on every swinging door.
 2. Provide following quantity of butt hinges for each door:

2.03 FLUSH BOLTS

- A. Flush Bolts: Comply with BHMA A156.16, Grade 1.
1. Flush Bolt Throw: 3/4 inch, minimum.



2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
 - a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.

2.04 EXIT DEVICES

- A. Exit Devices: Comply with BHMA A156.3, Grade 1.
 1. Lever design to match lockset trim.
 2. Provide cylinder with cylinder dogging or locking trim.
 3. Provide exit devices properly sized for door width and height.
 4. Provide strike as recommended by manufacturer for application indicated.
 5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.05 ELECTRIC STRIKES

- A. Electric Strikes: Comply with BHMA A156.31, Grade 1.
 1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
 2. Provide non-handed 24 VDC electric strike suitable for door frame material and scheduled lock configuration.

2.06 ELECTROMAGNETIC LOCKS

- A. Electromagnetic Locks: Comply with BHMA A156.23, Grade 1.
 1. Holding Force: 600 lbs, minimum.
 2. Voltage: 12 VDC, and provide power supplies by same manufacturer as locks.
 3. Mounting: Surface mounted to door and frame on secure side, with fasteners, brackets, and spacer bars as required for application.

2.07 LOCK CYLINDERS

- A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
 1. Provide cylinders from same manufacturer as locking device.
 2. Provide cams and/or tailpieces as required for locking devices.

2.08 CYLINDRICAL LOCKS

- A. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
 1. Bored Hole: 2-1/8 inch diameter.
 2. Latchbolt Throw: 1/2 inch, minimum.
 3. Backset: 2-3/4 inch unless otherwise indicated.
 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.

2.09 MORTISE LOCKS

- A. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
 1. Latchbolt Throw: 3/4 inch, minimum.
 2. Deadbolt Throw: 1 inch, minimum.



3. Backset: 2-3/4 inch unless otherwise indicated.
4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.

2.10 ELECTROMECHANICAL LOCKS

- A. Electromechanical Locks: Comply with BHMA A156.25, Grade 1.
 1. Provide motor-driven or solenoid-driven locks, with strike that is applicable to frame.
 2. Type: Mortise deadbolt.

2.11 AUXILIARY LOCKS (DEADLOCKS)

- A. Auxiliary Locks (Deadlocks): Comply with BHMA A156.36, Grade 1.

2.12 DOOR PULLS AND PUSH PLATES

- A. Door Pulls and Push Plates: Comply with BHMA A156.6.
 1. Pull Type: Straight, unless otherwise indicated.
 2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
 - a. Edges: Beveled, unless otherwise indicated.
 3. Material: Aluminum, unless otherwise indicated.

2.13 DOOR PULLS AND PUSH BARS

- A. Door Pulls and Push Bars: Comply with BHMA A156.6.
 1. Bar Type: Bar set, unless otherwise indicated.
 2. Material: Aluminum, unless otherwise indicated.

2.14 COORDINATORS

- A. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
 1. Type: Bar, unless otherwise indicated.
 2. Material: Aluminum, unless otherwise indicated.
 3. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.15 CLOSERS

- A. Closers: Comply with BHMA A156.4, Grade 1.
 1. Type: Surface mounted to door.
 2. Provide door closer on each exterior door.

2.16 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
 1. Provide stop for every swinging door, unless otherwise indicated.

2.17 PROTECTION PLATES

- A. Protection Plates: Comply with BHMA A156.6.
- B. Metal Properties: Aluminum material.



- C. Edges: Beveled, on four sides unless otherwise indicated.
- D. Fasteners: Countersunk screw fasteners.
- E. Drip Guard: Provide at head of exterior doors unless covered by roof or canopy.

2.18 KICK PLATES

- A. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
 - 1. Size: 8 inch high by 2 inch less door width (LDW) on push side of door.

2.19 MOP PLATES

- A. Mop Plates: Provide along bottom edge of push side of doors to provide protection from cleaning liquids and equipment damage to door surface.
 - 1. Size: 6 inch high by 1-1/2 inch less door width (LDW) on pull side and 2 inch LDW on push side of door.

2.20 DOOR HOLDERS

- A. Door Holders: Comply with BHMA A156.16, Grade 1.
 - 1. Type: Lever, or kick down stop, with rubber bumper at bottom end.
 - 2. Material: Aluminum.

2.21 ELECTROMAGNETIC DOOR HOLDERS

- A. Electromagnetic Door Holders: Comply with BHMA A156.15.
 - 1. Type: Wall mounted, single unit, standard duty, with strike plate attached to door.
 - 2. Holding Force, Standard Duty: 40 lbs-force, minimum.
 - 3. Voltage: 12 VDC, and provide power supplies by same manufacturer as holders.
 - 4. Provide interface with fire detectors and fire-alarm system for fire-rated door assemblies.

2.22 FLOOR STOPS

- A. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 - 1. Type: Manual hold-open, with pencil floor stop.
 - 2. Material: Aluminum housing with rubber insert.

2.23 WALL STOPS

- A. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
 - 1. Type: Bumper, concave, wall stop.
 - 2. Material: Aluminum housing with rubber insert.

2.24 THRESHOLDS

- A. Thresholds: Comply with BHMA A156.21.
 - 1. Provide threshold at each exterior door, unless otherwise indicated.
 - 2. Type: Flat surface.
 - 3. Material: Aluminum.
 - 4. Threshold Surface: Fluted horizontal grooves across full width.



5. Field cut threshold to profile of frame and width of door sill for tight fit.
6. Provide non-corroding fasteners at exterior locations.

2.25 WEATHERSTRIPPING AND GASKETING

- A. Weatherstripping and Gasketing: Comply with BHMA A156.22.
 1. Head and Jamb Type: Adjustable.
 2. Door Sweep Type: Encased in retainer.
 3. Material: Aluminum, with brush weatherstripping.

2.26 SIGNAGE

- A. Signage (Room Name Plates and Numbers): Provide on doors for individuals to easily identify room names and/or numbers.
 1. Text Required: "RESTROOM" with symbols and braille text.
 2. Material: In plastic or metal with paint used to create necessary text, adhered to door.

2.27 SILENCERS

- A. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
 1. Single Door: Provide three on strike jamb of frame.
 2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
 3. Material: Rubber, gray color.

2.28 VIEWER

- A. Viewer: Provide at inside of door at eye level to see who is on outside of door, with integral door knocker.
 1. Material: Brass.

2.29 KEY CONTROL SYSTEMS

- A. Key Control Systems: Comply with guidelines of BHMA A156.28.
 1. Provide keying information in compliance with DHI (KSN) standards.
 2. Keying: Grand master keyed.
 3. Include construction keying and control keying with removable core cylinders.
 4. Supply keys in following quantities:
 - a. 1 each Grand Master keys.
 - b. 6 each Construction Master keys.
 - c. 15 each Construction keys.
 - d. 2 each Construction Control keys.
 - e. 2 each Control keys if new system.

2.30 KEY CABINET

- A. Key Cabinet: Sheet steel construction, piano hinged door with key lock; BHMA A156.28.
 1. Mounting: Wall-mounted.
 2. Capacity: Actual quantity of keys, plus 25 percent additional capacity.
 3. Size key hooks to hold 6 keys each.
 4. Finish: Baked enamel, manufacturer's standard color.



5. Key cabinet lock to building keying system.

2.31 FIRE DEPARTMENT LOCK BOX

- A. Fire Department Lock Box:
 1. Capacity: Holds 10 keys.
 2. Finish: Manufacturer's standard dark bronze.

2.32 EXIT MOTION SENSOR

- A. Exit Motion Sensor: Interior passive infrared detection device to initiate door release of exit door magnetic lock.
 1. Power: 12 VDC.
 2. Provide adjustable detector face to allow for precise pattern configurations, and easy pattern adjustment.
 3. Provide relay that operates before transistor to prevent false alarms.
 4. Operating Temperature: 32 to 110 degrees F.

2.33 KEY PAD

- A. Key Pad: Indoor or outdoor use, 12-key digital keypad with silicone rubber keys, and compatible with access control systems using standard Wiegand output.
 1. Power: 12 VDC; 35mA Active and 7mA at Rest.
 2. Mounts on narrow mullion, 1-1/2 inch wide by 7 inch high by 1 inch deep.
 3. Operating Temperature: Minus 22 to 158 degrees F.
 4. Finish: Black.

2.34 POWER SUPPLY

- A. Power Supply: Hard wired, with multiple zones providing eight (8) breakers for each output panel with individual control switches and LED's; UL (DIR) Class 2 listed.
 1. Power: 24 VAC, 10 Amp; with 120 VAC power supply.
 2. Operating Temperature: 32 to 110 degrees F.
 3. Provide with emergency release terminals that release devices upon activation of fire alarm system.

2.35 FINISHES

- A. Finishes: Identified on Hardware Set Schedule.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.



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- C. Do not install surface mounted items until application of finishes to substrate are fully completed.
- D. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
- E. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Section 014000 - Quality Requirements.
- B. Provide an CONSULTANTural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

- A. Adjust work under provisions of Section 017000 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.06 PROTECTION

- A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

3.07 HARDWARE SCHEDULE

- A. See contract drawings for door sets.



**SECTION 087110
HARDWARE SETS**

Hardware Group No. 01 - INTERIOR STOREFRONT - SGL

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MORTISE CYLINDER	26-098 ICX X K510-711 36-083	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH

ALL HARDWARE BY STOREFRONT SUPPLIER
VERIFY IF CYLINDERS ARE REQUIRED

Hardware Group No. 02 - INTERIOR - PAIR

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	9827-L-LBR-M81-SNB	626	VON
1	EA	PANIC HARDWARE	9827-L-LBR-M81-SNB	626	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	PRIMUS CORE	20-740-XP	626	SCH
2	EA	SURFACE CLOSER	4040XP CUSH TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

Hardware Group No. 03 - STOREROOM - NON-RATED - PAIR

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	SET	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80TD BRK	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE



Hardware Group No. 04 - INTERIOR - RATED

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	98-L-M81-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

THRESHOLD PER SILL DETAIL

Hardware Group No. 05 - INTERIOR

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD BRK	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

THRESHOLD PER SILL DETAIL

BALANCE OF HARDWARE BY ALUMINUM DOOR SUPPLIER

Hardware Group No. 06 - INTERIOR-CONFERENCE

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S BRK	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

VERIFY ALL HARDWARE WITH DOOR/FRAME MANUFACTURER

THRESHOLD PER SILL DETAIL



Hardware Group No. 07 - INTERIOR

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD BRK	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488FSBK PSA	BK	ZER

THRESHOLD PER SILL DETAIL

BALANCE OF HARDWARE BY ALUMINUM DOOR SUPPLIER

Hardware Group No. 08 - STOREROOM - NON-RATED

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD BRK	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ STD TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

THRESHOLD PER SILL DETAIL

Hardware Group No. 09 - STOREROOM - NON-RATED

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD BRK	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

THRESHOLD PER SILL DETAIL



Hardware Group No. 10 - OFFICE - CLOSER- NON-RATED

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD BRK	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	FLOOR STOP	FS13	626	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

THRESHOLD PER SILL DETAIL

Hardware Group No. 11 - SINGLE USE RESTROOMS

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY W/COIN TURN	LV9044 M81A L583-363	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ STD TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

THRESHOLD PER SILL DETAIL

Hardware Group No. 12 - MULTI-USE RESTROOMS

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

THRESHOLD PER SILL DETAIL

Hardware Group No. 13 - EXISTING DOORS

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
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PROJECT: C23-MDPLS-01-ESP

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Miami, Florida 33130-1523
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miamidade.gov

Hardware Group No. 14 - EXISTING DOORS
For use on Door #(s):
Provide each SGL door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
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SECTION 088000 GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 8 by 8 inch in size of glass units.
- E. Samples: Submit 6 inch long bead of glazing sealant, color as selected.
- F. Certificate: Certify that products of this section meet or exceed specified requirements.
- G. Manufacturer's qualification statement.
- H. Installer's qualification statement.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.



1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.05 MOCK-UPS

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Provide mock-up of each typical unit including glass.
- C. Provide on-site glazing mock-up with the specified glazing components.
- D. Locate where directed.
- E. Approved mock-ups may remain as part of the Work.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Float Glass Manufacturers:
 1. AGC Glass Company North America, Inc: www.us.agc.com.
 2. Cardinal Glass Industries: www.cardinalcorp.com.
 3. Guardian Industries Corp: www.sunguardglass.com.
 4. Pilkington North America Inc: www.pilkington.com/na.
 5. PPG Industries, Inc: www.ppgideascape.com.
- B. Fire-Resistance-Rated Glass: Provide products as required to achieve indicated fire-rating period.
 1. Nippon Electric Glass Co. Ltd; Firelite; www.fireglass.com
 2. SAFTIFIRST, a division of O'Keeffe's Inc: www.safti.com/#sle.
 3. Technical Glass Products: www.fireglass.com/#sle.
 4. Vetrotech North America: www.vetrotechusa.com/#sle.

2.02 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.



4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.03 GLAZING UNITS

- A. Monolithic Interior Vision Glazing:
 1. Applications: Interior glazing unless otherwise indicated.
 2. Glass Type: Annealed or tempered, as scheduled or required float glass.
 3. Tint: Clear.
 4. Thickness: 1/4 inch, nominal.

2.04 PLASTIC FILMS

- A. Decorative Plastic Film: Polyvinyl butyral (PVB) type.
 1. Application: Locations as indicated on drawings.
 2. Series Type: Opaque.
 3. Color: As selected by Architect from full range.
 4. Thickness Without Liner: 0.002 inch.
 5. Width: 36 inch.
 6. Manufacturers:
 - a. Avery Dennison; AX900 Super Cast Series Decorative Window Film - Etchmark: www.averydennison.com/#sle.
 - b. LLumar, an Eastman Chemical Company; Decorative Window Film, LLumar: www.llumar.com/#sle.
 - c. XPEL, Inc; DECORATIVE: www.xpel.com/#sle.

2.05 GLAZING COMPOUNDS

- A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.
- B. Manufacturers:
 1. Dow Corning Corporation: www.dowcorning.com/construction/#sle.
 2. Momentive Performance Materials, Inc: www.momentive.com/#sle.
 3. Pecora Corporation: www.pecora.com/#sle.
 4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

2.06 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.



- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
- D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 INSTALLATION - WET/DRY GLAZING METHOD (TAPE AND SEALANT)



- A. Application - Interior Glazed: Set glazing infills from the interior of the building.
- B. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- D. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- E. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.
- F. Fill gaps between pane and applied stop with silicone type sealant to depth equal to bite on glazing, to uniform and level line.
- G. Carefully trim protruding tape with knife.

3.05 INSTALLATION - PLASTIC FILM

- A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.
- B. Place without air bubbles, creases or visible distortion.
- C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch to 1/8 inch gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.06 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- C. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

- A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.
- B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- C. Remove nonpermanent labels immediately after glazing installation is complete.
- D. Clean glass and adjacent surfaces after sealants are fully cured.
- E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.08 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.



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END OF SECTION

MIAMI-DADE PUBLIC LIBRARY SYSTEM
VOLUME II PROJECT
MANUAL DIVISION 09-
FINISHES

South Dade Regional Library Interior Renovations

C23-MDPLS-01-ESP



090561	Common Work Results for Floor Preparation
092116	Gypsum Board Assemblies
092216	Non-Structural Metal Framing
093000	Tiling
095100	Acoustical Panel and Ceiling Suspension Systems
095400	Specialty Ceilings
095416	Luminous Ceilings
096500	Resilient Flooring
096623	Resinous Matrix Terrazzo Flooring
096700	Fluid-Applied Flooring
096813	Tile Carpeting
096816	Sheet Carpeting
098430	Sound-Absorbing Wall and Ceiling Panels
099100	Interior Painting



**SECTION 090561
COMMON WORK RESULTS FOR FLOORING PREPARATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Visual Observation Report: For existing floor coverings to be removed.
- C. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- D. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
 - 1. Manufacturer's qualification statement.
 - 2. Certificate: Manufacturer's certification of compatibility with types of flooring applied over remedial product.
 - 3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
 - 4. Manufacturer's installation instructions.
 - 5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.
- E. Testing Agency's Report:
 - 1. Description of areas tested; include floor plans and photographs if helpful.
 - 2. Summary of conditions encountered.
 - 3. Moisture and alkalinity (pH) test reports.
 - 4. Copies of specified test methods.
 - 5. Recommendations for remediation of unsatisfactory surfaces.
 - 6. Product data for recommended remedial coating.
 - 7. Certificate: Include certification of accuracy by authorized official of testing agency.
 - 8. Submit report to Architect.
 - 9. Submit report not more than two business days after conclusion of testing.



- F. Adhesive Bond and Compatibility Test Report.
- G. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.
- H. Copy of RFCI (RWP).

1.04 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
 - 1. Provide access for and cooperate with testing agency.
 - 2. Confirm date of start of testing at least 10 days prior to actual start.
 - 3. Allow at least 4 business days on site for testing agency activities.
 - 4. Achieve and maintain specified ambient conditions.
 - 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- D. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.
- E. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS



- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
 - 3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
 - 4. Products:
 - a. ARDEX Engineered Cements; ARDEX Feather Finish: www.ardexamericas.com/#sle.
 - b. H.B. Fuller Construction Products, Inc; TEC Feather Edge Skim Coat: www.tecspecialty.com/#sle.
 - c. USG Corporation; Durock Brand Advanced Skim Coat Floor Patch: www.usg.com/#sle.
- B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
 - 1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
 - 2. Use product recommended by testing agency.
- D. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
 - 1. Thickness: 28 mil (0.028 inch).
 - 2. Products:
 - a. GCP Applied Technologies; Kovara MBX: www.gcpat.com/#sle.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Follow recommendations of testing agency.
- B. Perform following operations in the order indicated:
 - 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:



- a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
 - b. Removal of existing floor covering.
 2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
 - a. Remove existing coatings and curing agents from surface according to recommendations of remedial coating manufacturer.
 - b. Prepare surface according to recommendations of remedial coating manufacturer and according to ASTM D4259.
 3. Preliminary cleaning.
 4. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
 5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 7. Specified remediation, if required.
 8. Patching, smoothing, and leveling, as required.
 9. Other preparation specified.
 10. Adhesive bond and compatibility test.
 11. Protection.
- C. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive



laitance, mold, mildew, and other materials that might prevent adhesive bond.

- B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
 - 1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
 - 2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately



- to chart to determine alkalinity (pH) reading.
3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.
 - C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.07 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with recommendations of testing agency.
- C. Comply with requirements and recommendations of floor covering manufacturer.
- D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- E. Do not fill expansion joints, isolation joints, or other moving joints.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.09 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of coating manufacturer.

3.10 APPLICATION OF REMEDIAL FLOOR TREATMENT

- A. Comply with requirements and recommendations of treatment manufacturer.

3.11 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

- A. Install in accordance with sheet membrane manufacturer's instructions.

3.12 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION



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SECTION 092116 GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Install service utilities in an orderly and expeditious manner.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
 - 2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- D. Samples: Submit two samples of predecorated gypsum board, 12 by 12 inches in size, indicating finish color and texture.
- E. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, indicating finish color and texture.
- F. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
- G. Ballistic Test Reports: Indicate compliance of bullet-resistant sheathing and wallboard assemblies with specified requirements.
- H. SSFSA Manufacturer Qualification: Submit documentation of manufacturer association membership.
- I. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Florida.



- B. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 3 years of documented experience.
- C. Manufacturer Qualifications: Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.
- D. Manufacturer Qualifications: Member of Supreme Steel Framing System Association (SSFSA): www.ssfsa.com/#sle.
- E. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- F. Documents at Project Site: Maintain at the project site a copy of manufacturer's instructions, erection drawings, and shop drawings.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.
- C. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Grid Suspension Systems: Provide grid suspension systems in accordance with ASTM C840 and GA-216 complying with and local authorities having jurisdiction.
- D. Fire Rated Assemblies: Provide completed assemblies complying with applicable code.
 - 1. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
 - 2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
 - 3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 BOARD MATERIALS (NO IMPORTED MATERIALS ALLOWED)

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company: www.americangypsum.com/#sle.
 - 2. CertainTeed Corporation: www.certainteed.com/#sle.
 - 3. Continental Building Products: www.continental-bp.com/#sle.
 - 4. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.



5. National Gypsum Company: www.nationalgypsum.com/#sle.
 6. PABCO Gypsum: www.pabco gypsum.com/#sle.
 7. Temple-Inland Inc: www.templeinland.com.
 8. USG Corporation: www.usg.com/#sle.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold resistant board is required wall and ceiling in restrooms surfaces to be painted or tiled.
 4. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 5. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 1/2 inch.
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
- C. Backing Board For Wet Areas and Walls being tiled: One of the following products:
1. Application: Surfaces behind tile<>.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 1/2 inch, unless noted otherwise.
 - b. Products:
 - 1) Custom Building Products: www.custombuildingproducts.com/#sle.
 - 2) National Gypsum Company; www.nationalgypsum.com/#sle.
 - 3) USG Corporation; Fiberock Brand Aqua-Tough AR Interior Panels Regular 1/4 in.: www.usg.com/#sle.
 4. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
 - a. Thickness: 1/2 inch, unless noted otherwise.
 - b. Products:
 - 1) James Hardie Building Products, Inc: www.jameshardie.com/#sle.
 5. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
 - a. Standard Type: Thickness 1/2 inch unless noted otherwise.
 - b. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch.
 - c. Products:
 - 1) CertainTeed Corporation; 1/2" GlasRoc Tile Backer: www.certainteed.com/#sle.
 - 2) Georgia-Pacific Gypsum; DensShield Tile Backer: www.gpgypsum.com/#sle.



- 3) Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Tile Backer: www.goldbondbuilding.com/#sle.
 - 4) USG Corporation; Durock Brand Glass-Mat Tile Backerboard 1/2 in.: www.usg.com/#sle.
 - 5) Temple-Inland Inc; GreenGlass Tile Backer; www.templeinland.com.
- D. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
 2. Thickness: 1/2 inch.
 3. Edges: Tapered.
 4. Products:
 - a. American Gypsum; Interior Ceiling Board.
 - b. CertainTeed Corporation; ProRoc Interior Ceiling.
 - c. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board: www.gpgypsum.com/#sle.
 - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond High Strength LITE Gypsum Board: www.goldbondbuilding.com/#sle.
 - e. Lafarge North America Inc; Sagcheck.
 - f. National Gypsum Company; High Strength Brand Ceiling Board.
 - g. Pacific Coast Building Products, Inc; PABCO Ceiling Board.
 - h. Temple-Inland Inc; Span24 Ceiling Board; www.templeinland.com.
 - i. USG Corporation; Sheetrock Brand Sag-Resistant Interior Gypsum Ceiling Board.
- E. Gypsum Board For Curved Surfaces.
1. ASTM C 1396/C1396M
 2. Thickness: As shown
 - a. National Gypsum; Gold Bond Radius Gypsum Board; www.nationalgypsum.com

2.03 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness 3 inch.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
 1. Types: As detailed or required for finished appearance.
 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
 3. Products:
 - a. Same manufacturer as framing materials.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners.



- 2. Joint Compound: Drying type, vinyl-based, ready-mixed.
- E. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.
- F. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place two beads continuously on substrate before installation of perimeter framing members.
 - 2. Place continuous bead at perimeter of each layer of gypsum board.
 - 3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Double-Layer Non-Rated: Use gypsum board for first layer, placed perpendicular to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- G. Installation on Metal Framing: Use screws for attachment of gypsum board.
- H. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.
- I. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.04 INSTALLATION OF TRIM AND ACCESSORIES



- A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
- D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

3.05 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use fiberglass joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 - 2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
 - 3. Taping, filling, and sanding are not required at base layer of double-layer applications.
- E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.07 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

3.08 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION



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SECTION 092216 NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
 - 2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.
- C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.
- B. Manufacturer Qualifications: Member of Supreme Steel Framing System Association (SSFSA): www.ssfsa.com/#sle.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing, Connectors, and Accessories:
 - 1. CEMCO: www.cemcosteel.com/#sle.
 - 2. ClarkDietrich Building Systems: www.clarkdietrich.com/#sle.
 - 3. Jaimes Industries: www.jaimesind.com/#sle.
 - 4. Marino: www.marinoware.com/#sle.
 - 5. SCAFco Corporation: www.scafco.com/#sle.
 - 6. Simpson Strong Tie: www.strongtie.com/#sle.
 - 7. Steel Construction Systems: www.steelconsystems.com/#sle.
 - 8. The Steel Network, Inc: www.SteelNetwork.com/#sle.



2.02 FRAMING MATERIALS

- A. Fire Rated Assemblies: Comply with applicable code and as indicated on drawings.
- B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
 - 1. Studs: C shaped with knurled or embossed faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Radius Track: ASTM A653 20 Gage, G90 coated.
 - 4. Ceiling Channels: C shaped.
 - 5. Resilient Furring Channels: 1/2 inch depth, for attachment to substrate through one leg only.
 - a. Manufacturers - Resilient Furring Channels:
 - 1) Same manufacturer as other framing materials.
 - 6. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
 - 7. Resilient Sound Isolation Clips: Steel resilient clips with molded rubber isolators, attaches to framing; improves noise isolation for areas between gypsum board assemblies and adjacent sources of noise.
- C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
 - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot-dipped galvanized coating.
 - 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
- D. Non-Loadbearing Framing Accessories:
 - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 - 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
 - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
 - b. Height: 35-3/4 inches.
 - 3. Bracing and Bridging: ASTM A653/A653M G90 galvanized steel; for lateral bracing of wall studs with slots for engaging on-module studs.
 - 4. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
 - 5. Sheet Metal Backing: 0.036 inch thick, galvanized.
 - 6. Fasteners: ASTM C1002 self-piercing tapping screws.
 - 7. Anchorage Devices: Powder actuated.
 - 8. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness as required for STC.



9. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

2.03 FABRICATION

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.
- C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

- A. Comply with requirements of ASTM C754.
- B. Metal framing members to be delivered to site factory cut to size.
- C. Extend partition framing to structure where indicated and to ceiling in other locations.
- D. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- E. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- F. Align and secure top and bottom runners at 24 inches on center.
- G. At partitions indicated with an acoustic rating:
 1. Provide components and install as required to produce STC rating of 42, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
 2. Place two beads of acoustic sealant between runners and substrate, studs and adjacent construction.
- H. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- I. Install studs vertically at spacing indicated on drawings.
- J. Align stud web openings horizontally.
- K. Secure studs to tracks using crimping method. Do not weld.
- L. Stud splicing is not permissible.
- M. Fabricate corners using a minimum of three studs.
- N. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.



- O. Brace stud framing system rigid.
- P. Coordinate erection of studs with requirements of door frames; install supports and attachments.
- Q. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- R. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.
- S. Sound Isolation Clips: Mechanically attach to framing or structure with fasteners recommended by clip manufacturer. Install at spacing indicated on drawings.
- T. Furring: Coordinate with sound isolation clip spacing and locations. Lap splices a minimum of 6 inches.

3.03 CEILING FRAMING

- A. Comply with requirements of ASTM C754.
- B. Metal ceiling framing members to be delivered to site factory cut to size.
- C. Install furring after work above ceiling is complete. Coordinate the location of hangers with other work.
- D. Install furring independent of walls, columns, and above-ceiling work.
- E. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
- F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.
- H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.
- I. Laterally brace suspension system.

3.04 TOLERANCES

- A. Maximum Variation From True Position: 1/8 inch in 10 feet.
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION



**SECTION 093000
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.
- G. Installer's Qualification Statement:
 - 1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.
 - 2. Submit documentation of completion of apprenticeship and certification programs.
- H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 1 percent of each size, color, and surface finish combination, but not less than 10 square feet of each type.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- B. Installer Qualifications:



1. Company specializing in performing tile installation, with minimum of five years of documented experience.
 - a. Accredited Five-Star member of the National Tile Contractors Association (NTCA) or Trowel of Excellence member of the Tile Contractors' Association of America (TCAA).
2. Installer Certification:
 - a. Ceramic Tile Education Foundation (CTEF): Certified Tile Installer (CTI).
 - b. Apprenticeship Program: Installer has achieved Journeyworker status through an apprenticeship from the International Union of Bricklayers and Allied Craftworkers (IUBAC) or a U.S. Department of Labor (DOL)-recognized program.
 - c. Advanced Certifications for Tile Installers (ACT): Certification in the installation of membranes, large format tile, gauged porcelain tile/panels/slabs, and grouts.
 - d. International Masonry Training and Education Foundation (IMTEF): Supervisor Certification Program (SCP).

1.05 MOCK-UPS

- A. See Section 014000 - Quality Requirements for general requirements for mock-up.
- B. Construct one tile mock-up of each type of installation, incorporating all components specified for the location.
 1. Minimum size of mock-up is 6 feet x 6 feet , including components .
 2. Approved mock-up may remain as part of work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS (SEE FINISH SCHEDULE FOR MATERIAL SELECTIONS)

2.01 TILE

- A. Manufacturers: All products by the same manufacturer.
 1. American Olean Corporation: www.americanolean.com/#sle.
 2. Crossville Tile: www.crossvilleinc.com
 3. Dal-Tile Corporation: www.daltile.com/#sle.
 4. Emser Tile, LLC: www.emser.com/#sle.
 5. Lousiville Tile; www.lousieville-tile.com
 6. Summitville Tiles, Inc: www.summitville.com.

2.02 TRIM AND ACCESSORIES

- A. Ceramic Accessories: <> Finish, same color and finish as adjacent field tile; same manufacturer as tile.
- B. Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.



1. Applications:
 - a. Open Edges: Bullnose.
 - b. Inside Corners: Jointed.
 - c. Floor to Wall Joints: Cove base.
2. Manufacturers: Same as for tile.
- C. Non-Ceramic Trim: <>, Style and dimensions to suit application, for setting using tile mortar or adhesive.
 1. Applications:
 - a. Transition between floor finishes of different heights.
 - b. Thresholds at door openings.
 - c. Floor to wall joints.
 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com/#sle.
- D. Thresholds: 4 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
 1. Thickness: 1/2 inch.
 2. Material: Solid surface acrylic resin, mineral filler, and pigments; non-porous, color and pattern consistent throughout thickness.
 3. Color and Pattern: As selected by Architect from manufacturer's full line..
 4. Applications:
 - a. At doorways where tile terminates.
 - b. At open edges of floor tile where adjacent finish is a different height.

2.03 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 2. Bostik Inc: www.bostik-us.com/#sle.
 3. Custom Building Products: www.custombuildingproducts.com/#sle.
 4. H.B. Fuller Construction Products, Inc; <>: www.tecspecialty.com/#sle.
 5. LATICRETE International, Inc: www.laticrete.com/#sle.
 6. Merkrete, by Parex USA, Inc: www.merkrete.com/#sle.
 7. TEC, an H.B. Fuller Construction Products Brand: www.tecspecialty.com/#sle.
- C. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
 1. Products:
 - a. ARDEX Engineered Cements; S 28: www.ardexamericas.com/#sle.
 - b. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
 - c. H.B. Fuller Construction Products, Inc; TEC TotalFlex 150 Universal Mortar: www.tecspecialty.com/#sle.
 - d. LATICRETE International, Inc; MULTIMAX LITE: www.laticrete.com/#sle.



2.04 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 - 3. Color(s): As selected by Architect from manufacturer's full line.
- C. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.

2.05 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane at slab on grade only: Material complying with ANSI A118.12.
 - 1. Type: Trowel-applied.
 - 2. Thickness: 20 mils, maximum.
 - 3. Crack Resistance: No failure at 1/8 inch gap, minimum.
 - 4. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber or Acrylic.
 - b. Thickness: 20 mils, maximum.
 - c. Products:
 - 1) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
 - 2) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
 - 3) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
- B. Waterproofing Membrane Floors above grade: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
 - 1. Fluid or Trowel Applied Type:
 - a. Material: Acrylic.
 - b. Thickness: 25 mils, minimum, dry film thickness.
 - c. Products:
 - 1) USG Corporation; Durock Brand Liquid Waterproofing Membrane: www.usg.com/#sle.
 - 2) Sika Corp; SikaTile 100 Moisture Guard: www.sika.com/#sle.
- C. Sound Control Underlayment at Floors: Recycled rubber type, fully-adhered.
 - 1. Sound Reduction: Comply with ASTM E492.
 - 2. Thickness: 1/8 inch, nominal.
- D. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 7/16 inch thick; 2 inch wide coated glass fiber tape for joints and corners.



- E. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
 - 1. Standard Type: Thickness 1/2 inch.
 - 2. Fire Resistant Type: Type X core, thickness 5/8 inch.
- F. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
 - 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 - 2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.



- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Install thresholds where indicated.
- I. Sound tile after setting. Replace hollow sounding units.
- J. Keep control and expansion joints free of mortar, grout, and adhesive.
- K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
 - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
 - 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

3.05 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

3.06 CLEANING

- A. Clean tile and grout surfaces.

3.07 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION



**SECTION 095100
ACOUSTICAL PANEL- AND CEILING SUSPENSION SYSTEM**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Evaluation Service Reports: Show compliance with specified requirements.
- E. Samples: Submit two full size samples illustrating material and finish of acoustical units.
- F. Samples: Submit two samples each, 10 inches long, of suspension system main runner, cross runner, and perimeter molding.
- G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- H. Designer's qualification statement.
- I. Manufacturer's qualification statement.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: 20 sq ft of each type and size.
 - 3. Extra Suspension System Components: Quantity equal to 5 percent of total installed.

1.04 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.05 FIELD CONDITIONS



- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS (SEE FINISH SCHEDULE FOR MATERIAL SELECTIONS)

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrong.com.
 - 2. Acoustic Ceiling Products, Inc: www.acpideas.com.
 - 3. CertainTeed Corporation: www.certainteed.com.
 - 4. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
 - 5. Rockfon: www.rockfon.com/#sle.
 - 6. Hunter Douglas Contract: www.hunterdouglascontract.com.
 - 7. TECHLITE: www.techlite.com/sle.
 - 8. USG: www.usg.com.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Rating: Determined in accordance with test procedures in ASTM E119 and complying with Local authorities having jurisdiction.

2.03 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
 - 1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.
 - 2. VOC Content: Certified as Low Emission by one of the following:
 - a. Product listing in UL (GGG).
 - b. Product listing in CHPS (HPPD).
- B. Wood Fiber Acoustical Panels: Cementitious wood fiber.
 - 1. Size: 48 inches x 48 inches.
 - 2. Thickness: 1 inch.
 - 3. Noise Reduction Coefficient (NRC): 0.90 when tested in accordance with ASTM C423 for Type E mounting, per ASTM E795.
 - 4. Panel Edge: Square.
 - 5. Surface Pattern: Coarse.
 - 6. Surface Color: To be selected by Architect from manufacturer's full line.
 - 7. Suspension System: Concealed.
 - 8. Products:
 - a. Armstrong World Industries, Inc; Tectum Clouds: www.armstrongceilings.com/#sle.

2.04 SUSPENSION SYSTEM(S) (SEE FINISH SCHEDULE FOR MATERIAL SELECTIONS)

- A. Manufacturers:



1. Armstrong World Industries, Inc: www.armstrong.com.
 2. Acoustic Ceiling Products, Inc.: www.acpideas.com.
 3. CertainTeed Corporation: www.certainteed.com.
 4. Chicago Metallic Corporation: www.chicagometallic.com.
 5. Hunter Douglas Contract: www.hunterdouglascontract.com.
 6. USG: www.usg.com.
- B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, and perimeter moldings as required.
1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- C. Exposed Suspension System: Hot-dipped galvanized steel grid and cap.
1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
 2. Profile: Tee; 9/16 inch face width.
 3. Finish: Baked enamel.
 4. Color: White.
- D. Fire-Rated Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
1. Profile: Tee; 15/16 inch wide face.
 2. Construction: Double web.
 3. Fire Rating: Listed and classified for use in a <>fire-resistive assembly.
 4. Finish: Painted color as selected..

2.05 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
1. Size: As required for installation conditions.
 2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
 3. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
- E. Metal Edge Trim for "Cloud" Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
1. Trim Height: 6 inch.
 2. Color: White.
- F. Acoustical Insulation: ASTM C665 friction fit type, unfaced batts.
1. Thickness: 2 inch.
 2. Size: To fit acoustical suspension system.



- G. Gypsum Board: Fire rated type; 5/8 inch thick, ends and edges square, paper faced.
- H. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM C636/C636M, and ASTM C636/C636M and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.
- J. Form expansion joints <>. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.
- K. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.



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- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
 - 3. Double cut and field paint exposed reveal edges.
- F. Where round obstructions occur, provide preformed closures to match perimeter molding.
- G. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.
- H. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

- A. Replace damaged or abraded components.

END OF SECTION



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SECTION 095400 SPECIALTY CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.
- B. Preinstallation Meeting: Convene one week before starting work of this section.
- C. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of specialty ceiling panels to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on specialty ceiling components and suspension system components.
- D. Samples: Two full size samples illustrating material and finish of specialty ceiling components.
- E. Samples: Two samples each, 10 inches long, of suspension system main runner, cross runner, and perimeter molding.
- F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for fire and acoustical performance.
- G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- H. Designer's qualification statement.
- I. Manufacturer's qualification statement.
- J. Installer's qualification statement.
- K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements for additional provisions.
 - 2. Specialty Ceiling System Components: Provide a quantity equal to 2 percent of total product installed.

1.04 QUALITY ASSURANCE



- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section.
 - 1. Minimum 3 years documented experience.
 - 2. Approved by ceiling manufacturer.

1.05 MOCK-UP

- A. Provide 10 feet by 10 feet mock-up including ceiling panels, suspension members, trim, and installation accessories.
- B. See Section 014000 - Quality Requirements for additional requirements.
- C. Locate where directed.
- D. Approved mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver specialty ceiling components to project site in original, unopened packages.
- B. Store in fully enclosed space, flat, level and off the floor.

1.07 FIELD CONDITIONS

- A. Do not install specialty ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.

PART 2 PRODUCTS

2.01 SPECIALTY CEILING ASSEMBLIES

- A. Refer to Room Finish Schedule and Reflected Ceiling Plans on drawings for additional ceiling assemblies information.
 - 1. Tectum® by Armstrong World Industries, Inc.; Tectum® Shapes and or Clouds:
www.armstrongceilings.com
- B. Specialty Ceiling Assembly<>:
 - 1. Acoustical Panels:
 - a. Surface Texture: Coarse
 - b. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
 - c. Color: White
 - d. Size: As shown
 - e. Thickness: (Custom 1-1/2" or 2")
 - f. Edge Profile: Square edges.
 - g. Noise Absorption; (up to 0.41 Sabins S/F)
 - h. Flame Spread: ASTM E 1264; (Fire Class)
 - i. Light Reflectance (LR) White Panel: ASTM E 1477; (Light Reflectance)
 - j. Dimensional Stability: HumiGuard Plus
 - 2. Metal suspension System
 - a. Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM



A653. Main beams and cross tees are double-web steel construction with 15/16" type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.

- 1) Structural Classification: ASTM C 635 (Intermediate or Heavy) duty
 - 2) Color: (Standard White) unless noted otherwise.
 - 3) Acceptable Product: Prelude XL 15/16" as manufactured by Armstrong World Industries
- b. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- c. Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.

2.02 PERFORMANCE REQUIREMENTS:

- A. Design for maximum deflection of 1/360 of span.
- B. Design to support imposed loads of indicated elements without eccentric loading of supports. Where supported elements may induce rotation of ceiling system components, provide stabilizing reinforcement.
- C. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.03 COMPONENT PRODUCTS

- A. Panels:
 1. Preformed Panels:
 - a. Material: Tectum
 - b. Color: As indicated.
 - c. Pattern: As selected from manufacturer's standard patterns.
 - d. Accessories: Provide manufacturer's standard mounting hardware and attachment devices.
- B. Standard Suspension Systems:
 1. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings and splices as required.
 - a. Stabilizer Bars: Manufacturer's standard bars designed to provide system rigidity in large module applications.
 - 1) Lengths: As applicable to module dimensions, main tee spacing, and panel sizes of ceiling assemblies specified.
- C. Moldings and Trim:
 1. Edge Trim Molding and Splices: Same material, thickness, and finish as metal panels, unless otherwise indicated.

2.04 ACCESSORIES

- A. Support Channels, Carriers, and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.



- B. Suspension Wire: Size and type as required for application, seismic requirements, and ceiling system flatness requirement specified.
 - 1. Concealed Suspension:
 - a. Suspension Wire: Steel, annealed, galvanized finish, 12 gage, 0.0808 diameter.

2.05 FABRICATION

- A. Shop fabricate ceiling components to the greatest extent possible.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.
- C. Verify that field measurements are as indicated on shop drawings.
- D. Do not begin installation until after interior wet work is dry.
- E. Start of installation constitutes acceptance of project conditions.

3.02 PREPARATION

- A. Coordinate the location of hangers with other work.
- B. Install after major above-ceiling work is complete.
- C. Layout ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
- B. Install hangers and inserts coordinated with overhead work. Provide additional hangers and supports as required.
- C. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- D. Locate system on room axis according to reflected ceiling plan.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts, facility services, or equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.



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3.04 INSTALLATION - SPECIALTY CEILING UNITS

- A. Install in accordance with manufacturer's instructions.
- B. Fit components in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Cut to fit irregular grid and perimeter moldings.
 - 1. Shape and finish field-cut edges as recommended by manufacturer to match profile of factory edges and finish.
- D. Install specialty units level, in uniform curvilinear plane, and free from twist, warp, and dents.

3.05 TOLERANCES

- A. Maximum Variation from Indicated Planes: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

- A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

END OF SECTION



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SECTION 095416 LUMINOUS CEILINGS

<<<< UPDATE NOTES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate layout of luminaires, support locations and details for ceiling suspension, and orientation of the images or patterns on luminous panels.
- C. Product Data: Provide data showing ceiling component construction and finishes.
- D. Ceiling Support Samples: Submit two samples of exposed ceiling support members, 12 inches in length, illustrating material and finish.
- E. Luminous Element Samples: Submit two samples, 12 by 12 inches in size, illustrating material, finish, and support details.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Maintenance Data: Manufacturer's instructions for cleaning and replacement.
- H. Manufacturer's Qualification Statement.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Luminous Ceiling Components: Two percent of total product installed, but not less than 10 of each type.
 - 3. Extra Support Grid Members: Two percent of total product installed, but not less than 10 of each type.

1.04 QUALITY ASSURANCE

- A. Electrical Work: Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.



- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 MOCK-UP

- A. Provide mock-up of each type of luminous ceiling system, including at least one of each component.
 - 1. Locate where directed.
- B. Analyze mock-up to determine illumination level and comfort achieved.
- C. Approved mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Luminous Ceiling System: (SEE FINISH SCHEDULE FOR MATERIAL SELECTION)
 - 1. Basis of Design: Armstrong Worls Industries; Infusions Shapes; www.armstrong.com

2.02 LUMINOUS CEILINGS

- A. Metal Suspension System:
 - 1. General: Comply with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
 - a. Materials:
 - 1) Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
 - 2. Suspension System: Hot-dipped galvanized steel grid and cap.
 - a. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 3. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement.
 - 4. Perimeter Moldings: As required for installation conditions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that mechanical work above luminous ceiling has been completed and does not interfere with ceiling installation or performance.

3.02 PREPARATION

- A. Paint surfaces and mechanical installations in cavity above luminous elements. Use 90 percent reflectance white paint applied as specified in Section 099123.
- B. Lay out system on room axis as indicated.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of luminous ceiling panel size.

3.03 INSTALLATION

- A. General: Install luminous ceiling in accordance with manufacturer's instructions.
- B. Suspension System:



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1. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
 2. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
 3. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
 4. Do not eccentrically load system or produce rotation of runners.
 5. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.
- C. Luminous Infill Panels:
1. Fit panels in place, free from damaged edges or other defects detrimental to appearance and function.
 2. Install panels level, in uniform plane, and free from twist, warp, and dents.
 3. Cut to fit irregular grid and perimeter edge trim using panel manufacturer's recommended tools and methods.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

3.04 TOLERANCES

- A. Maximum Deflection: $1/360$ of span, maximum.
- B. Maximum Variation from Flat and Level Surface: $1/8$ inch in 10 feet.

END OF SECTION



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**SECTION 096500
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- E. Verification Samples: Submit two samples, 10 by 10 inch in size illustrating color and pattern for each resilient flooring product specified.
- F. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.
- G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- H. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- I. Manufacturer's Qualification Statement.
- J. Installer's Qualification Statement.
- K. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 5 square feet of each type and color.
 - 3. Extra Wall Base: 10 linear feet of each type and color.
 - 4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.



- C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.05 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 SHEET FLOORING (SEE FINISH SCHEDULE FOR MATERIAL SELECTION)

- A. Vinyl Sheet Flooring: Homogeneous without backing, with color and pattern throughout full thickness.
 - 1. Minimum Requirements: Comply with ASTM F1913.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or ASTM E 648.
 - 3. Static Load Resistance: 250 psi minimum, when tested as specified in ASTM F970.
 - 4. Seams: Heat welded.
- B. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

2.02 TILE FLOORING (SEE FINISH SCHEDULE FOR MATERIAL SELECTIONS)

- A. Feature Strips: Of same material as tile, ____ inch wide.

2.03 STAIR COVERING (SEE FINISH SCHEDULE FOR MATERIAL SELECTION)

- A. Stair Treads with Integral Risers: Rubber; full height of riser, full width and depth of tread in one piece; tapered thickness.
 - 1. Manufacturers:
 - a. Burke Flooring: www.burkeflooring.com.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com.
 - c. Roppe Corp: www.roppe.com.
 - d. Tarkett Group; www.tarkett.com
 - 2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
 - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.



4. Nominal Thickness: 0.1875 inch.
5. Nosing: Round.
6. Striping: 2 inch wide contrasting color abrasive strips.
7. Color: As indicated on drawings.

2.04 RESILIENT BASE: (SEE FINISH SCHEDULE FOR MATERIAL SELECTION)

- A. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic; top set Style B, Cove.
 1. Manufacturers:
 - a. Altro Stronghold 30; www.alrtofloors.com
 - b. Burke Flooring; www.burkeflooring.com.
 - c. Johnsonite, a Tarkett Company; www.johnsonite.com.
 - d. Mannington Commercial; www.manningtoncommercial.com#sle.
 - e. Roppe Corp; www.roppe.com.
 - f. Tarkett Group; www.tarkett.com.
 2. Height: 4 inch.
 3. Thickness: 0.125 inch.
 4. Finish: Satin.
 5. Length: Roll.
 6. Color: To be selected by Architect from manufacturer's full range.
 7. Accessories: Premolded external corners and internal corners.

2.05 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
 1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168.
- C. Adhesive for Vinyl Flooring:
- D. Moldings, Transition and Edge Strips: Same material as flooring.
- E. Filler for Coved Base: Plastic.
- F. Sound Control Underlayment: Membrane consisting of cork granules and ground ethylene vinyl acetate (EVA) with polyurethane binder.
 1. Thickness: 0.08 inch.
 2. Roll Width: 48 inch.
 3. Roll Length: 50 feet.
 4. Minimum of 55 dB transmission loss when tested in accordance with ASTM E90 or ASTM E492.

PART 3 EXECUTION

3.01 EXAMINATION



- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- D. Prohibit traffic until filler is fully cured.
- E. Clean substrate.
- F. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 - 1. Spread only enough adhesive to permit installation of materials before initial set.
 - 2. Fit joints and butt seams tightly.
 - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Loose-Laid Installation: Set flooring in place in accordance with manufacturer's instructions.
- E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Resilient Strips: Attach to substrate using adhesive.



- G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- H. Install flooring in recessed floor access covers, maintaining floor pattern.
- I. At movable partitions, install flooring under partitions without interrupting floor pattern.
- J. Install feature strips where indicated.

3.04 INSTALLATION - SOUND CONTROL UNDERLAYMENT

- A. Install in accordance with underlayment manufacturer's instructions.

3.05 INSTALLATION - SHEET FLOORING

- A. Lay flooring with joints and seams in accordance with seaming plan. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.
- B. Cut sheet at seams in accordance with manufacturer's instructions.
- C. Seal seams by heat welding..
- D. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

3.06 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Install loose-laid tile, fit interlocking edges tightly.
- D. Install plank tile with a random offset of at least 9 inches from adjacent rows.

3.07 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.08 INSTALLATION - STAIR COVERINGS

- A. Install stair coverings in one piece for full width and depth of tread.
- B. Adhere over entire surface. Fit accurately and securely.

3.09 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.10 PROTECTION



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A. Prohibit traffic on resilient flooring for 48 hours after installation.

3.11 SCHEDULE (SEE FINISH SCHEDULE FOR MATERIALS AND LOCATIONS)

END OF SECTION



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SECTION 096623 RESINOUS MATRIX TERRAZZO FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for divider strips, control joint strips, expansion joints, and sealer; include printed copy of current NTMA recommendations for type of terrazzo specified.
- C. Shop Drawings: Indicate divider strip and control and expansion joint layout, and details of adjacent components. For precast units, detail profile and anchorage requirements.
- D. Samples: Submit two samples, 10 inch by 10 inch in size illustrating color, chip size and variation, chip gradation, matrix color, and typical divider strip.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Cleaning and Maintenance Data: Include procedures for stain removal, stripping, and sealing.

1.03 QUALITY ASSURANCE

- A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
 - 1. Minimum five years of documented experience.
 - 2. Associate member firm of the National Terrazzo and Mosaic Association, Inc.
- C. Installer Qualifications: Company specializing in performing the type of work specified in this section.
 - 1. Minimum five years of documented experience.
 - 2. Approved by matrix manufacturer.
 - 3. Contractor member of the National Terrazzo and Mosaic Association, Inc.

1.04 MOCK-UP

- A. Construct mock-up of terrazzo illustrating appearance of finished work in each configuration required. Size mock-up to be not less than 10 square feet.
- B. Locate where directed.



- C. Approved mock-up may remain as part of the work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store terrazzo materials in a dry, secure area.
- B. Maintain minimum temperature of 60 degrees F.
- C. Keep products away from fire or open flame.

1.06 FIELD CONDITIONS

- A. Do not install terrazzo when temperature is below 50 degrees F or above 90 degrees F.
- B. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.
- C. Provide ambient lighting level of 50 ft candles, measured at floor surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design - Elite Crete Systems Inc; RES- 171 Reflector Enhancer Flooring System; www.elitecrete.com
- B. Other Acceptable Manufacturers - Resinous Matrix Terrazzo Flooring:
 - 1. Sherwin-Williams High Performance Flooring: www.sherwin-williams.com/resin-flooring/#sle.
 - 2. Sika Corporation: www.sikafloorusa.com/#sle.
 - 3. Terrazzco, a Brand of Concord Terrazzo Company, Inc: www.terrazzco.com/#sle.

2.02 EPOXY MATRIX TERRAZZO APPLICATIONS

- A. Floors:
 - 1. Thickness: 3/8 inch, nominal.
 - 2. Color(s): As indicated on drawings.
 - 3. Aggregate Size: No. 2.
- B. Wall Base:
 - 1. Thickness: Same as floors.
 - 2. Style: Coved.
 - 3. Color(s): Same as adjacent floor.
 - 4. Aggregate Type and Size: Same as floors.

2.03 MATERIALS

- A. Epoxy Matrix Terrazzo: Aggregate and matrix mix applied to substrate, troweled flat, and ground smooth.
 - 1. Mix Proportions: As required to achieve appearance specified.
- B. Matrix: Two component resin and epoxy hardener with mineral filler and color pigment, non-volatile, thermo-setting.
- C. Aggregate: Type as indicated; sized in accordance with NTMA aggregate gradation standards; color(s) as indicated, uniform in color.



- D. Finishing Grout: Epoxy, color to match terrazzo matrix.

2.04 ACCESSORIES

- A. Divider Strips: 1/8 inch thick zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.
- B. Divider and Control Joint Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.
- C. Sealer: Colorless, non-yellowing, penetrating liquid type to completely seal matrix surface; not detrimental to terrazzo components.
- D. Primer: _____.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive terrazzo.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive terrazzo.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for terrazzo flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Moisture Vapor Emission: ASTM F1869.
 - 2. Obtain instructions if test results are not within limits recommended by terrazzo flooring manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Clean substrate of foreign matter.
- B. Prepare concrete subfloor by mechanically abrading surface in accordance with manufacturer's instructions.
- C. Apply primer in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Saw cut substrate to install divider and control joint strips.
- B. Install control joint strips straight and flat to locations indicated.
- C. Install divider strips according to pattern approved on shop drawings.
- D. Place terrazzo mix over substrate to thickness indicated.

3.04 FINISHING



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- A. Finish terrazzo to NTMA requirements.
- B. Produce terrazzo finish surface to match approved mock-up, with 70 percent chip exposed.
- C. Grind terrazzo surfaces with power disc machine; sequence with coarse to fine grit abrasive, using a wet method or using a dry grinder with vacuum to control dust.
- D. Apply grout to fill voids exposed from grinding.
- E. Remove grout coat by grinding, using a fine grit abrasive.
- F. Hand grind vertical and curved surfaces similarly.

3.05 TOLERANCES

- A. Maximum Variation from Flat Surface: 1/4 inch in 10 feet.
- B. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch.

3.06 CLEANING

- A. Scrub and clean terrazzo surfaces with neutral pH cleaner in accordance with manufacturer's instructions. Let dry.
- B. Immediately after terrazzo has dried, apply sealer in accordance with manufacturer's instructions.
- C. Polish surfaces in accordance with manufacturer's instructions.

3.07 PROTECTION

- A. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

END OF SECTION



**SECTION 096700
FLUID-APPLIED FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples: Submit two samples, 10 x 10 inch in size illustrating color and pattern for each floor material for each color specified.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.
- F. Manufacturer's Qualification Statement.
- G. Applicator's Qualification Statement.
- H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Top Coat Materials: 2 gallons.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section.
 - 1. Minimum 3 years of documented experience.
 - 2. Approved by manufacturer.
- C. Supervisor Qualifications: Trained by product manufacturer , under direct full time supervision of manufacturer's own foreman.

1.04 MOCK-UPS

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.



1. Number of Mock-Ups to be Prepared: One.
 2. Use same materials and methods for use in the work.
 3. Use approved design samples as basis for mock-ups.
 4. Locate where directed.
 5. Minimum Size: 48 inches by 48 inches.
- C. See Section 014000 - Quality Requirements for additional requirements.
- D. Obtain approval of mock-up by Architect before proceeding with work.
- E. Approved mock-up may remain as part of the work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.06 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F.
- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS (SEE FINISH SCHEDULE FOR MATERIAL SELECTION)

2.01 FLUID-APPLIED FLOORING SYSTEMS

- A. Fluid-Applied Flooring: Epoxy base coat(s), polyurethane top coat, with aggregate.
 1. System Thickness: 50 mils, nominal, dry film thickness (DFT).
 2. Metallic Pigment: Mica powder.
 3. Texture: Slip resistant.
 4. Sheen: Matte.
 5. Color: As selected by Architect.
 6. Products:
 - a. Basis of Design: Elite Crete Systems; Reflector Enhancer Floor System: www.elitecrete.com/#sle.
 - b. Sika Corporation: www.sikafloorusa.com/#sle.
 - c. Stonhard; _____: www.stonhard.com/#sle.
 - d. TNEMEC: www.tnemec.com/#sle.

2.02 ACCESSORIES

- A. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
- B. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION



- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 - 2. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Prepare concrete surfaces according to ICRI 310.2R.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.
- E. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - FLOORING

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness required by manufacturer.
- C. Finish to smooth level surface.
- D. Install flooring in recessed type floor access covers.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Test installed floor surface in accordance with ANSI/ESD STM7.1 .

3.05 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

END OF SECTION



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**SECTION 096813
TILE CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate layout of joints.
- C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- D. Shop Drawings: Indicate layout of joints.
- E. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- F. Submit two, 10 inch long samples of edge strip and base cap.
- G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- H. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- I. Manufacturer's Qualification Statement.
- J. Installer's Qualification Statement.
- K. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.04 FIELD CONDITIONS



- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS (SEE FINISH SCHEDULE FOR MATERIAL SELECTIONS)

2.01 MANUFACTURERS

- A. Tile Carpeting:
 - 1. Basis Of Design: Forbo Flotex Flooring Systems; Flotex; www.forboflooring.com

2.02 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: Embossed aluminum, color as selected by Architect.
- C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove existing carpeting.
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- C. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- E. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.



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- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Locate change of color or pattern between rooms under door centerline.
- F. Fully adhere carpet tile to substrate.
- G. Adhere carpet tile as base finish up vertical surfaces to form base. Terminate top of base with cap strip.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- C. Clean and vacuum carpet surfaces.

END OF SECTION



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**SECTION 096816
SHEET CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings
- C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- D. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings.
- E. Samples: Submit two samples 10 x 10 inch in size illustrating color and pattern for each carpet and cushion material specified.
- F. Submit two, 12 inch long samples of edge strip for each color specified.
- G. Sustainable Design Submittal: Submit VOC content documentation for adhesives.
- H. Manufacturer's Installation Instructions: Indicate special procedures.
- I. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- J. Manufacturer's Qualification Statement.
- K. Installer's Qualification Statement.
- L. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- M. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional requirements.
 - 2. Extra Carpet: 50 sq ft of each type, color, and pattern installed.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.



1.04 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.
- B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.
- C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 CARPET (SEE FINISH SCHEDULE FOR MATERIAL SELECTIONS)

2.02 CUSHION (SEE FINISH SCHEDULE FOR MATERIAL SELECTIONS)

2.03 ACCESSORIES

- A. Subfloor Filler: Type recommended by carpet manufacturer.
- B. Adhesives:
 - 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GL) certified; in lieu of labeled product, independent test report showing compliance is acceptable.
- C. Seam Adhesive: Recommended by carpet manufacturer.
- D. Carpet Adhesive: Recommended by carpet manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesives to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove existing carpet and carpet cushion.
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.



- C. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- E. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Verify carpet match before cutting to ensure minimal variation between dye lots.
- D. Lay out carpet and locate seams in accordance with shop drawings.
 - 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
 - 2. Do not locate seams perpendicular through door openings.
 - 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
 - 4. Locate change of color or pattern between rooms under door centerline.
 - 5. Provide monolithic color, pattern, and texture match within any one area.
- E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DIRECT-GLUED CARPET

- A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.
- B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.
- C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
- D. Roll with appropriate roller for complete contact of adhesive to carpet backing.
- E. Trim carpet neatly at walls and around interruptions.
- F. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.

3.05 CLEANING

- A. Remove excess adhesive from floor and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

END OF SECTION



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SECTION 098430 SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout, fabric orientation, and wood grain orientation.
- D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.
- E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.
- F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.
- G. Manufacturer's qualification statement.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with at least three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
- B. Store units flat, in dry, well-ventilated space; do not stand on end.
- C. Protect edges from damage.

1.05 MOCK-UPS

- A. See Section 014000 - Quality Requirements for additional mock-up requirements.
- B. Construct mock-up of acoustical units at location as indicated by Architect.



1. Minimum mock-up dimensions; 96 by 96 inches.
2. Approved mock-up may remain as part of work.

PART 2 PRODUCTS

2.01 SOUND-ABSORBING AND SOUND-DIFFUSING PANELS

- A. Manufacturers:
 1. Basis Of Design: Frasch; Stratwood Acoustical Panels; www.frasch.com
- B. Material Performance Attributes:
 1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 2. Sound Absorption: Noise Reduction Coefficient (NRC) or Sound Absorption Average (SAA) of 0.70 to 0.80 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
 3. Acoustic Back-Up Material: Polyester (PET) felt, 55% pre-consumer recycled.
 - a. Thickness: As required to comply with NRC requirements indicated.
 - b. Panel Thickness: 9mm PET felt substrate
 - c. Edges: Exposed felt, machined edge.
 - d. Corners: Square, exposed felt, machined edge.
 4. Panel Slat Orientation: Vertical
 5. Panel Size: As shown.
 6. Panel Thickness: 3/4 inch.
 7. Surface Veneer Species: Walnut.
 - a. Grain Direction: Flat.
 - b. Factory Finish: Clear sealer.
 8. Mounting: Use fixing clips to attach to glue or screw anchored to wall substrate.
 - a. Edge Profile: Reveal.

2.02 FABRICATION

- A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
- B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.
- C. Factory-applied finishes on wood veneer panels to be uniform, smooth, and without blemishes.

2.03 ACCESSORIES

- A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal.
- B. Panel Adhesive: Acceptable to acoustical panel manufacturer for application as indicated.

PART 3 EXECUTION

3.01 EXAMINATION



- A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.
- B. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- C. Install mounting accessories and supports in accordance with shop drawings.
- D. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.
- E. Furring Mounted Wood Veneer Panels:
 - 1. For vertical panel layout, attach furring strip horizontally providing 1 inch clearance along length of strip from floor and ceiling.
 - 2. Install furring strip along meeting edges of adjacent panels to ensure they are attached to same furring strip along abutted edge; 24 inch on center, maximum.
 - 3. Install acoustic back-up material between furring as required for application.
 - 4. Adhere first panel from edge to furring strip, and attach subsequent panels using fixing clips.
- F. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
 - 1. Plumb and level.
 - 2. Flatness.
 - 3. Width of joints.

3.03 CLEANING

- A. Clean felt facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.
- B. Lightly vacuum occasionally to remove any particulate matter and air-borne debris or dust. Compressed air can be used to dust the material in difficult to reach areas or for large assemblies.

3.04 PROTECTION

- A. Provide protection of installed acoustical panels until Date of Substantial Completion.
- B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION



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SECTION 099123 INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
 - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
 - 3. Allow 30 days for approval process, after receipt of complete samples by Architect.
 - 4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
- D. Samples: Submit two paper chip samples, 3 x 3 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
- E. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 8 x 11-1/2 inch in size.
- F. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- G. Manufacturer's Instructions: Indicate special surface preparation procedures.



- H. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.05 MOCK-UP

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 8 feet long by 8 feet wide, illustrating paint color, texture, and finish.
- C. Provide door and frame assembly illustrating paint color, texture, and finish.
- D. Locate where directed by Architect.
- E. Approved mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.



PART 2 PRODUCTS (SEE FINISH SCHEDULE FOR MATERIAL SELECTIONS)

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. If a single manufacturer cannot provide specified products; minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 - 2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. Paints:
 - 1. Behr Process Corporation: www.behr.com/#sle.
 - 2. Dunn-Edwards Paint Co; www.dunnedwards.com
 - 3. Benjamin Moore & Co.; www.benjaminmoore.com
 - 4. PPG Paints: www.ppgpaints.com/#sle.
 - 5. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).
 - d. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
 - 1) Opaque, Flat: 50 g/L, maximum.
 - 2) Opaque, Nonflat: 150 g/L, maximum.
 - 3) Opaque, High Gloss: 250 g/L, maximum.
 - e. Architectural coatings VOC limits of Florida.



2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: To be selected from manufacturer's full range of available colors.
 1. Selection to be made by Architect after award of contract.

2.03 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, wood, uncoated steel, shop primed steel, galvanized steel, and aluminum.
 1. Two top coats and one coat primer.
 2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 1. Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
 2. Interior/Exterior Latex Block Filler; MPI #4.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.



3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- I. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- J. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- K. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.



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- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for field inspection.
- B. Owner will provide field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

MIAMI-DADE PUBLIC LIBRARY SYSTEM
VOLUME II PROJECT
MANUAL DIVISION 10-
SPECIALTIES

South Dade Regional Library Interior Renovations

C23-MDPLS-01-ESP



101400	Signage
101410	Signage Formatting
102113	Plastic Toilet Compartments
102310	Glazed Interior Wall and Door Assemblies
102800	Toilet and Restrooms Accessories
104400	Fire Protection Specialties



SECTION 101400 SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Verification Samples: Submit samples showing colors specified.
- G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- H. Manufacturer's Qualification Statement.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.



- C. Store tape adhesive at normal room temperature.

1.05 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 SIGNAGE APPLICATIONS

- A. See Current Elements "Interior Signage Standards" & "Exterior Signage Standards" for additional requirements.
- B. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- C. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
 - 1. Sign Type: Flat signs with engraved panel media as specified.
 - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 - 3. Character Height: 1 inch.
 - 4. Sign Height: 2 inches, unless otherwise indicated.
 - 5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
 - 6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
 - 7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 - 8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
- D. Interior Directional and Informational Signs:
 - 1. Sign Type: Same as room and door signs.
 - 2. Allow for 20 signs 4 inches high by 16 inches long.
 - 3. Wording of signs is scheduled on drawings.
- E. Emergency Evacuation Maps:
 - 1. Allow for one map at Lobby..
 - 2. Map content to be provided by Owner.
 - 3. Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-mounted.

2.02 SIGN TYPES

- A. Flat Signs: Signage media without frame.



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1. Edges: Bevelled.
 2. Corners: Radiused.
 3. Wall Mounting of One-Sided Signs: Tape adhesive.
- B. Color and Font: Unless otherwise indicated:
1. Character Font: Futura Md BT, Helvetica, Arial, or other sans serif font.
 2. Character Case: Upper case only.
 3. Background Color: Clear.
 4. Character Color: Contrasting color.

2.03 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
1. Total Thickness: 1/16 inch.

2.04 NON-TACTILE SIGNAGE MEDIA

- A. Silk Screened Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface:
1. Sign Color: Clear.
 2. Total Thickness: 1/8 inch.

2.05 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION



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SETCION 101410 SIGNAGE FORMATTING

GENERAL

1. All signs shall be in conformance with the Florida Building Code and must be coordinated with the design team room schedule or floor plans.
2. Pictograms (tactile and raised) shall be included on signs for restrooms, elevators, accessible phones, utility rooms, and elsewhere required by the Florida Building Code. Consultant to review floor plan and provide a list of all interior room signage required.

Scope of Work for Interior Signage

- 1 Awarded Vendor to Provide the following as required:

Propose design for:

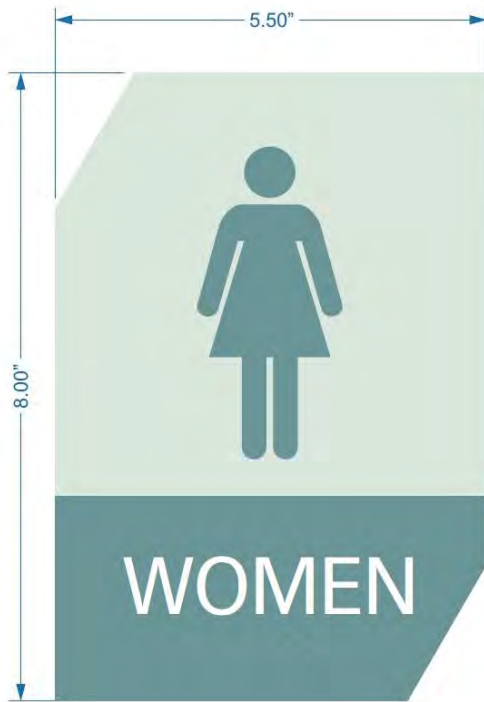
- a. Help Desk Informational sign depending on location of desk
- b. Bookstack signage; not fixed
- c. Interior wayfinding signage
- d. Elevators
- e. Restrooms
- f. Multipurpose Rooms / Meeting Rooms
- g. Children's Area
- h. Young Adult's Area
- I Study Room
- J YOUmedia Room
- K Computer Area
- L Innovation Lab
- M Conference Rooms
- N CATIO Area

ADA compliant signage for staff only areas

- a. Emergency Exit Signage
- b. Freight Elevator
- c. Mechanical / Electrical Room
- d. Staff Break Rooms
- e. Office Spaces

Examples

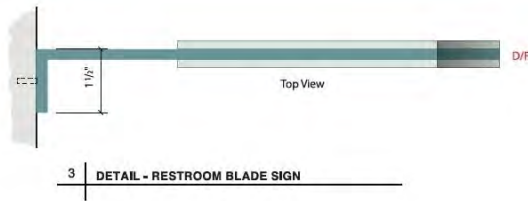




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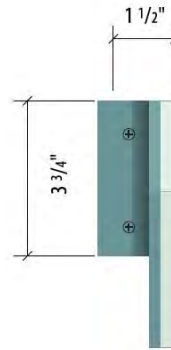


TEXT	○ Raised Tactile	White
BACKING	● 1/4in Acrylic	MP 08705 Jumping Juniper
TEXT	● Raised Tactile	MP 08705 Jumping Juniper
BACKING	● 1/4in Acrylic	SW 6462 Green Trance

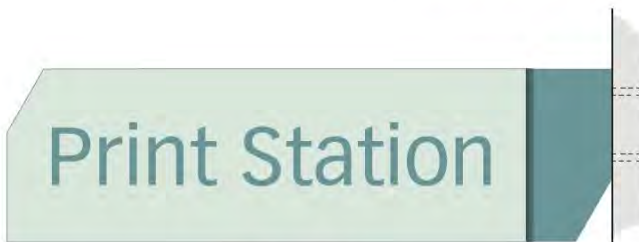


3 | DETAIL - RESTROOM BLADE SIGN

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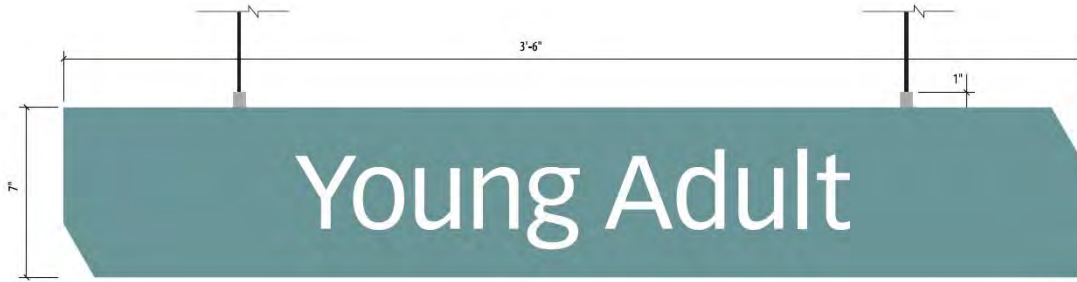


2 | DETAIL - RESTROOM BLADE SIGN

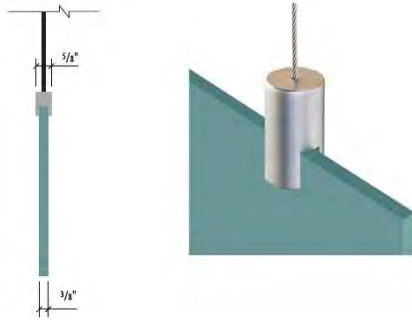


S/F - Loc 3.17 ONLY,
See Mess Schedule

TEXT	● Vinyl	Match MP 08705
MATERIAL	● 1/4in Aluminum	MP 08705 Jumping Juniper
MATERIAL	● 3/16in Aluminum	SW 6462 Green Trance

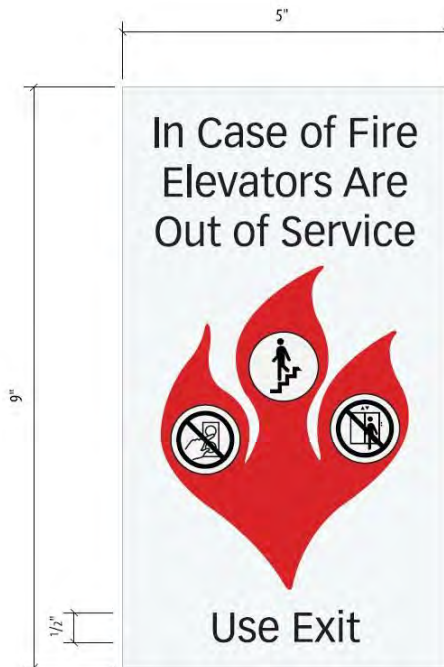


D/F



APPROVED

TEXT	○ Vinyl	White
MATERIAL	● 3/8in Aluminum	MP 08705 Jumping Juniper
MATERIAL	● Hardware	MBS Hanging Hardware



APPROVED

TEXT	● Raised Tactile	Red
TEXT	● Raised Tactile	Black
BACKING	○ 1/4in Acrylic	MP 07435 Carta Blanca





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SECTION 102113.19 PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 REFERENCE STANDARDS

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- C. Samples: Submit two samples of partition panels, 10 x 10 inch in size illustrating panel finish, color, and sheen.
- D. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solid Plastic Toilet Compartments:
 - 1. Ampco Products, Inc: www.ampco.com/#sle.
 - 2. Inpro: www.inprocorp.com/#sle.
 - 3. Bobrick Washroom Equipment; www.bobrick.com
 - 4. Metpar Corp: www.metpar.com/#sle.
 - 5. Scranton Products (Santana/Comtec/Capital): www.scrantonproducts.com/#sle.

2.02 PLASTIC TOILET COMPARTMENTS

- A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted unbraced.
 - 1. Color: Single color as selected.



- B. Doors:
 - 1. Thickness: 1 inch.
 - 2. Width: 24 inch.
 - 3. Width for Handicapped Use: 36 inch, out-swinging.
 - 4. Height: 55 inch.
- C. Panels:
 - 1. Thickness: 1 inch.
 - 2. Height: 55 inch.
 - 3. Depth: As indicated on drawings.
- D. Pilasters:
 - 1. Thickness: 1 inch.
 - 2. Width: As required to fit space; minimum 3 inch.

2.03 ACCESSORIES

- A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.
 - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Extruded aluminum, anti-grip profile.
 - 1. Size: Manufacturer's standard size.
- C. Pilaster Brackets: Natural anodized aluminum.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
 - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
- E. Hinges: Stainless steel, manufacturer's standard finish.
 - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
 - 2. Continuous-type hinge, self closing.
- F. Door Hardware: Stainless steel, manufacturer's standard finish.
 - 1. Door Latch: Slide type with exterior emergency access feature.
 - 2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
 - 3. Provide door pull for outswinging doors.
- G. Coat Hook: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.



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- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

END OF SECTION



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SECTION 102310 GLAZED INTERIOR WALL AND DOOR ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.
 - 1. Require attendance by representatives of installer and other entities directly affecting, or affected by, construction activities of this section.
 - 2. Notify Architect four calendar days in advance of scheduled meeting date.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for each component in partition assembly.
- C. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
 - 1. Include field measurements of openings.
 - 2. Include Elevations Showing:
 - a. Locations and identification of manufacturer-supplied door hardware and fittings.
 - b. Locations and sizes of cut-outs and drilled holes for other door hardware.
 - 3. Include Details Showing:
 - a. Requirements for support and bracing of overhead track.
 - b. Installation details.
 - c. Appearance of manufacturer-supplied door hardware and fittings.
- D. Selection Samples: Two sets, representing manufacturer's full range of available metal materials and finishes.
- E. Verification Samples: Two samples, minimum size of 2 inch by 3 inch, representing actual material and finish of exposed metal.
- F. Design Data: Design calculations, bearing seal and signature of structural engineer licensed to practice in Florida, showing loads at points of attachment to the building structure.
- G. Certificates: Contractor to certify that installer of partition assemblies meets specified qualifications.
- H. Operation and Maintenance Data: For manufacturer-supplied operating hardware.



- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Specimen Warranty.
- K. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
- L. Fabricator's Qualification Statement.
- M. Manufacturer's Qualification Statement.
- N. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Minimum three years of experience designing, assembling, and installing partition assemblies similar to those specified in this section.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
 - 1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.
 - a. Equivalent independent third-party ANSI accredited certification.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until installation.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against excessive degradation of metal finishes. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Framed Glazed Interior Wall and Door Assemblies:
 - 1. DORMA USA, Inc.; www.dorma.com/#sle.
 - 2. NanaWall; www.nanawall.com
 - 3. Transwall; One; www.transwall.com

2.02 PERFORMANCE REQUIREMENTS

- A. Acoustical Performance: Provide glass partitions and door assemblies tested by qualified testing agency, calculated in accordance with ASTM E413, tested in accordance with ASTM



E90, and rated for not less than Sound Transmission Class (STC) indicated.

1. Partition STC Rating: 45, minimum, for framed partition.

2.03 FRAMED GLAZED INTERIOR WALL AND DOOR ASSEMBLIES

- A. Framed Glazed Interior Wall Assembly: Factory fabricated assemblies consisting of center-glazed rectilinear aluminum framing with screw spline or clip joinery.
 1. Configuration: As indicated on drawings.
 2. Profile Width: 1-1/2 inch.
 3. Profile Depth: 5-11/16 inch overall.
 4. Profile Face Trim: 1-1/2 inch wide by 3/8 inch deep, snap in place.
 5. Wall Construction Width, Throat Size: 4-7/8 inch nominal, consisting of 3-5/8 inch wide metal studs with 5/8 inch gypsum board on each side.
 6. Surface mounted to face of wall as indicated on drawings.
 7. Frame Finish: Class I natural anodized.
 8. Provide wood blocking at sill of glazing frame to match height of floor finish.
 9. Exposed Fasteners: Stainless steel.
 10. Perimeter Anchors: Steel, properly separated from aluminum framing.
 11. Coordinate wall and door assembly preparation and provide hardware as necessary for fully operable installation.
 12. Design system to withstand normal operation without damage, racking, sagging, or deflection.
 13. Factory assembled to greatest extent practical; may be disassembled to accommodate shipping constraints.
- B. Aluminum Doors: Medium stile aluminum doors, alloy 6063, T5 temper, extruded aluminum.
 1. Door Configuration: As indicated on drawings.
 2. Stile Width: 5 inch.
 3. Top Rail Height: 5-1/2 inch.
 4. Bottom Rail Height: 9-1/2 inch.
 5. Glazing Infill: 1/4 inch, laminated.
 6. Glazing Stops : 1/2 inch high.
 7. Finish: Class I natural anodized.
 8. Finish Color: Clear anodized.
 9. Door Hardware: Ladder pulls, 1 inch diameter solid aluminum with 2-1/2 inch projection at lock stile.
 10. Provide accessories as required for complete installation.
 11. Provide metal backing plate at door hinges and securely fasten within partition framing.

2.04 FITTINGS AND HARDWARE

- A. Overhead Concealed Closers and Bottom Pivots: Non-handed closer for both single and double-acting doors with mechanical backcheck, and meeting requirements of BHMA A156.4, Grade 1.
 1. Application: Offset hung, with swing as indicated on drawings.
 2. Hold Open: Fixed.



3. Opening Force: Comply with requirements of authorities having jurisdiction.
4. Door Weight: Maximum 200 lbs for exterior doors, and 250 lbs for interior doors, including hardware.
5. Closer Dimensions: Compact closer body designed to fit 1-3/4 inch by 4 inch or smaller header, with aluminum cover plate.
6. Cover Plate Finish: As indicated.
7. Provide accessories as required for complete installation, including wall/floor stop.

B. Acoustic Seals: Provide acoustic seals in accordance with project requirements.

2.05 MATERIALS

- A. Glass: Flat glass meeting requirements of ASTM C1036, Type I - Transparent Flat Glass, Class 1 - Clear, Quality Q3, laminated and as follows:
 1. Thickness: 1/4 inch.
 2. Color: Clear.
 3. Glazing Stops: Square edge, with rubber glazing gaskets.
 4. Glazing Gaskets: Provide flexible vinyl for non-fire rated and elastomeric silicone for fire rated frames.
 5. Prepare glazing panels for indicated fittings and hardware before tempering.
 6. Polish edges that will be exposed in finished work to bright flat polish.
 7. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.
- B. Aluminum Components: Complying with ASTM B221 (ASTM B221M), alloy 6063, T5 temper.
- C. Sealant: One-part silicone sealant, complying with ASTM C920, clear.

2.06 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that track supports are properly braced, level within 1/4 inch of required position and parallel to the floor surface.
- C. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.
- D. Do not begin installation until supports and adjacent substrates have been properly prepared.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean substrates thoroughly prior to installation.



- B. Prepare substrates using the methods recommended by the manufacturer for achieving acceptable result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with glazed interior wall and door assembly manufacturer's instructions.
- B. Fit and align glazed interior wall and door assembly level and plumb.

3.04 ADJUSTING

- A. Adjust glazed interior wall and door assembly to operate smoothly from sliding or pivoting positions.
- B. Adjust swing door hardware for smooth operation.

3.05 CLEANING

- A. Remove protective film from exposed metal surfaces.
- B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents or other substances that may damage the material or finish.
- C. Glass and Glazing: Clean glazing surfaces; remove excess glazing sealant compounds, dirt, and other substances.
- D. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. Demonstrate operation of glazed interior wall and door assembly and identify potential operational problems.

3.07 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION



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**SECTION 102800
TOILET AND RESTROOM ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Samples: Submit two samples of each accessory, illustrating color and finish.
- D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS (SEE CONTRACT DRAWINGS FOR ITEM SELECTIONS AND LOCATIONS)

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. AJW Architectural Products: www.ajw.com.
 - 2. American Specialties, Inc: www.americanspecialties.com.
 - 3. Bobrick Washroom Equipment; www.bobrick.com
 - 4. Bradley Corporation: www.bradleycorp.com.
 - 5. Georgia-Pacific Professional: www.blue-connect.com.
- B. Provide products of each category type by single manufacturer.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Keys: Provide 3 keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.



- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- E. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- F. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. See Toilet Room contract drawings for schedule and location of toilet room accessories.
- B. Grab Bars: Stainless steel, smooth surface.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force, minimum.
 - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - c. Length and Configuration: As indicated on drawings.

2.05 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285. Provide 1 in each public restroom in the HC Stall and provide rigid support connections by providing in-wall solid blocking to support a 100 pound live load.
 - 1. Material: Stainless steel.
 - 2. Mounting: Surface.
 - 3. Color: #4 brushed satin.
 - 4. Minimum Rated Load: 250 pounds.

2.06 UTILITY ROOM ACCESSORIES



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- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
 - 1. Drying rod: Stainless steel, 1/4 inch diameter.
 - 2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
 - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - 4. Length: Manufacturer's standard length for number of holders/hooks.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.
- E. See Section 061000 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

3.05 SCHEDULE: SEE CONTRACT DRAWINGS FOR ITEMS AND LOCATIONS

END OF SECTION



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SECTION 104400 FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.03 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Basis of Design: Larsen's Manufacturing Co[<>]: www.larsensmfg.com/#sle.
 - 2. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
 - 3. Ansul, a Tyco Business: www.ansul.com/#sle.
 - 4. Kidde, a unit of United Technologies Corp: www.kidde.com.
 - 5. Nystrom, Inc: www.nystrom.com/sle.
 - 6. Potter-Roemer; <>: www.potterroemer.com/#sle.
 - 7. Pyro-Chem, a Tyco Business: www.pyrochem.com.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. Basis of Design: Larsen's Manufacturing Co[<>]: www.larsensmfg.com/#sle.
 - 2. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
 - 3. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
 - 4. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
 - 5. Nystrom, Inc: www.nystrom.com/#sle.
 - 6. Potter-Roemer: www.potterroemer.com/#sle.

2.02 FIRE EXTINGUISHERS



- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Stored Pressure Operated: Deep Drawn.
 - 2. Class: A:B:C type.
 - 3. Size: 10 pound.
 - 4. Finish: Baked polyester powder coat, color as selected.
 - 5. Temperature range: Minus 65 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Cabinet Construction: Non-fire rated.
 - 1. Formed primed steel sheet; 0.036 inch thick base metal.
- C. Fire Rated Cabinet Construction: One-hour fire rated.
 - 1. Steel; double wall or outer and inner boxes with 5/8 inch thick fire barrier material.
- D. Cabinet Configuration: "Occult" Series Recessed type, unless shown otherwise.
 - 1. Size to accommodate accessories.
 - 2. Projected Trim: Returned to wall surface, with 1/4 inch projection, and 1 inch wide face.
 - 3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- E. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.
- F. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
- G. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- H. Fabrication: Weld, fill, and grind components smooth.
- I. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.
- J. Finish of Cabinet Interior: Factory primed for custom field finishing.

2.04 ACCESSORIES

- A. Cabinet Signage: <>.
 - 1. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.



- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level, 40 inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.
- E. Marking and Identification
 - 1. Per code section 703.7 Marking and identification, where there is an accessible concealed floor, floor-ceiling or attic space, fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling in the concealed space. Such identification shall:
 - a. Be located within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition.
 - b. Include lettering not less than 3 inches (76 mm) in height with a minimum 3/8-inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording, "FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS," or other wording. Identify fire rating of wall in the text.
 - c. See code for possible exceptions.

3.03 MAINTENANCE - SELF-SERVICE FIRE EXTINGUISHERS

- A. Monthly Inspections: Inspect self-service fire extinguishers on monthly basis in accordance with manufacturer's instructions, and requirements of the authorities having jurisdiction (AHJ).
- B. Annual Inspections: Inspect self-service fire extinguishers on annual basis in accordance with manufacturer's instructions, and requirements of the authorities having jurisdiction (AHJ).
- C. Inspection Certification Tag: Provide new tag indicating acceptable condition of fire extinguisher, date of inspection, and name of self-service inspector for each inspection.

3.04 SCHEDULES (SEE CONTRACT DRAWINGS FOR MOUNTING AND LOCATIONS)

END OF SECTION



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113013 Residential Appliances



**SECTION 113013
RESIDENTIAL APPLIANCES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
- C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

1.04 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.
- C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.
- D. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES (SEE CONTRACT DRAWINGS FOR APPLIANCE SCHEDULE AND LOCATIONS)

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Anchor built-in equipment in place.



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3.03 ADJUSTING

- A. Adjust equipment to provide efficient operation.

3.04 CLEANING

- A. Remove packing materials from equipment and properly discard.
- B. Wash and clean equipment.

END OF SECTION

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122400	Shades
123600	Countertops



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SECTION 122400 WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
 - 2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.
- C. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
 - 1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
 - 1. Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
- D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.
- E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
- F. Selection Samples: Include fabric samples in full range of available colors and patterns.
 - 1. Motorized Shades: Include finish selections for controls.



- G. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.
- H. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- I. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.
- J. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
- K. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- L. Maintenance contracts.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum 3 years of documented experience with shading systems of similar size and type.
 - 1. Manufacturer's authorized representative.
 - 2. Factory training and demonstrated experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.05 MOCK-UP

- A. Mock-Up: Provide full size mock-up of window shade system complete with selected shade fabric including example of seams and batten pockets when applicable.
 - 1. Obtain Architect's approval of light and privacy characteristics of fabric prior to fabrication.
 - 2. Approved full-sized mock-up may become part of the final installation.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.07 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
 - 1. Shade Hardware: 25 years.
 - 2. Electric Motors: 5 years.



3. Electronic Control Equipment: 25 years.
4. Fabric: 25 years.
5. Aluminum and Steel Coatings: 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Interior Motorized Roller Shades, Motors and Motor Controls:
 1. Basis of Design: MechoShade Systems LLC; UrbanShade Single Roller - Motorized: www.mechoshade.com/#sle.
 2. Draper, Inc: www.draperinc.com/#sle.
 3. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
 4. Levolor: www.levolor.com/commercial/#sle.
 5. Lutron Electronics Co., Inc: www.lutron.com/#sle.
 6. SWFcontract, a division of Springs Window Fashions, LLC: www.swfcontract.com/#sle.

2.02 ROLLER SHADES

- A. General:
 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
 2. Provide shade system that operates smoothly when shades are raised or lowered.
 3. Motorized Shades: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed or recognized to UL 325.
 - a. Comply with NFPA 70.
 - b. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Where applicable, system components to be FCC compliant.
 - c. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view; fully compatible with controls to be installed.
 - d. Audible Noise: Maximum 50 dBA measured 3 feet from the motor unit; no audible clicks when motor starts and stops.
- B. Roller Shades:
 1. Description - Interior Roller Shades: Single roller, motor operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
 - a. Drop Position: Regular roll.
 - b. Roll Direction: Roll down, closed position is at window sill.
 - c. Roll Direction: Bottom-up, closed position is at top of window opening.
 - d. Mounting: As indicated on drawings.
 - e. Size: As indicated on drawings.
 - f. Fabric: As indicated under Shade Fabric article.
 2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - a. Material: Stamped steel.



3. Roller Tubes: As required for type of shade operation.
 - a. Material: Extruded aluminum, clear anodized finish.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
 - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
 - d. Take-Up Roller: Manufacturer's standard roller tube pretensioned for winding lift cable in bottom-up type shades.
4. Hembars: Designed to maintain bottom of shade straight and flat.
 - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
5. Accessories:
 - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
 - 1) Color: White.
 - 2) Profile: Square.
 - b. End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.
 - c. Lifting Cables: Nylon coated cable for lifting bottom-up type shades.
 - d. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

- A. Fabric: Black-out nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 1. Manufacturers:
 - a. Lutron Electronics Co., Inc: www.lutron.com/#sle.
 - b. MechoShade Systems LLC: www.mechoshade.com/#sle.
 - c. Mermet Corporation: www.mermetusa.com/#sle.
 2. Material Certificates and Product Disclosures:
 - a. Low-Emitting Material Certification: Greenguard Gold certified and listed in UL (GGG).
 3. Performance Requirements:
 - a. Flammability: Pass NFPA 701 large and small tests.
 - b. Fungal Resistance: No growth when tested according to ASTM G21.
 4. Roll Width: 72 inches.
 5. Color: As selected by Architect from manufacturer's full range of colors.
 6. Fabrication:
 - a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
 - b. If height of opening requires multiple panels of railroaded fabric, use battens at seams.
 - c. Battens: Full width of shade, enclose in welded shade fabric pocket.

2.04 MOTOR CONTROLS

- A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as



necessary for a complete operating system that provides the control intent indicated.

- B. Provide all components and connections necessary to interface with other systems as indicated.
- C. Digital Network Controls:
 - 1. Intelligent Motors and Devices: Identifiable over network without separate interface.
 - 2. Provide suitable interface modules as indicated or as required for connection to standard (nonintelligent) motors and devices.
 - 3. Capable of reprogrammed control without requiring wiring modifications.
 - 4. Capable of assigning shade motors to shade groups/sub-groups.
 - 5. Capable of storing programmable open and close limits and minimum of three intermediate preset stop positions for each shade.
 - 6. Capable of aligning adjacent shades within accuracy of plus/minus 0.25 inch.
 - 7. Provide 10 year nonvolatile power failure memory for system configuration settings.
 - 8. Basis of Design: MechoShade Systems LLC; MechoNet: www.mechoshade.com/#sle.
 - a. Low-voltage network utilizes standard Category 5/6 UTP cable; maximum of 4,000 feet, 250 nodes.
 - b. Network Interface Components:
 - 1) MechoNet Network Interface; MNI Series: Four configurable motor/EDU ports (models available for RJ45 or terminal block wiring); four configurable switch ports; one infrared (IR) remote control port; one configurable serial port for RS232/RS485 communication.
 - 2) IQ2 Dual Splitter: Two motor/EDU ports; two switch ports.
- D. Manual Controls:
 - 1. Control Functions:
 - a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
 - b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
 - c. Raise: Raise controlled shade(s) only while button is pressed.
 - d. Lower: Lower controlled shade(s) only while button is pressed.
 - e. Presets: For selection of predetermined shade positions.
 - f. Multiple Shade Groups: Provide individual controls for each shade group as indicated.
 - 2. Wall Controls: Provided by shade manufacturer.
 - a. Finish: To be selected by Architect.
 - b. Button Engraving: Manufacturer's standard engraving, unless otherwise indicated.

2.05 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
 - 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.



2. Horizontal Dimensions - Inside Mounting: Provide symmetrical light gaps on both sides of shade not to exceed 1/2 inch total.
- C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 SYSTEM STARTUP

- A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.
- C. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. See Section 017900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.
- D. Training: Train Owner's personnel on operation and maintenance of system.
 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.



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2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.07 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

3.08 MAINTENANCE

- A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, a proposal as an alternate to the base bid, a separate renewable maintenance contract for the service and maintenance of a motorized shade system for one year from date of Substantial Completion. Include a complete description of preventive maintenance, systematic examination, adjustment, parts and labor, cleaning, and testing, with a detailed schedule.

END OF SECTION



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SECTION 123600 COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

1.03 MOCK-UP

- A. Provide mock-up of countertops, including components specified elsewhere <>.
- B. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- C. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- D. Installer's qualification statement.
- E. Installation Instructions: Manufacturer's installation instructions and recommendations.
- F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Natural Stone Institute (NSI) Accredited Natural Stone Fabricator; www.naturalstoneinstitute.org/#sle.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- C. Quality Certification:



1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
2. Provide designated labels on shop drawings as required by certification program.
3. Provide designated labels on installed products as required by certification program.
4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.039 inch nominal thickness.
 - a. Manufacturers:
 - 1) Formica Corporation: www.formica.com/#sle.
 - 2) Lamin-Art, Inc: www.laminart.com/#sle.
 - 3) Panolam Industries International, Inc. Nevamar: www.nevamar.com.
 - 4) Panolam Industries International, Inc. Pionite: www.pionitelaminates.com.
 - 5) Wilsonart: www.wilsonart.com/#sle.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. NSF approved for food contact.
 - d. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
 - e. Laminate Core Color: Same as decorative surface.
 - f. Finish: Matte or suede, gloss rating of 5 to 20.
 - g. Surface Color and Pattern: As selected by Architect from the manufacturer's full line.
 2. Exposed Edge Treatment: Postformed laminate; front edge substrate built up to minimum 1-1/4 inch thick with raised radiused edge, integral coved backsplash with radiused top edge.
 3. Back and End Splashes: Same material, same construction.



4. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.
- C. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
 1. Flat Sheet Thickness: 1-1/4 inch, minimum.
 2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Dal-Tile Corporation: www.daltile.com/#sle.
 - 2) LG Hausys America, Inc: www.lghausysusa.com/#sle.
 - 3) Cambria; www.cambriausa.com
 - 4) Seieffe Corporation; OKITE®: www.okite.us/#sle.
 - 5) Wilsonart: www.wilsonart.com/#sle.
 - b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).
 - c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - d. NSF approved for food contact.
 - e. Finish on Exposed Surfaces: Polished.
 - f. Color and Pattern: As selected by Architect from manufacturer's full line.
 3. Other Components Thickness: 3/4 inch, minimum.
 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.
 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
 6. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 1. Join lengths of tops using best method recommended by manufacturer.
 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - a. Rout a 1/8 inch drip groove at underside of exposed overlapping edges, set back 1/2 inch from face of edge.



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3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Height: 4 inches, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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MIAMI-DADE PUBLIC LIBRARY SYSTEM
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210000	Basic Fire Protection Requirements
210517	Sleeves and Sleeve Seals for Fire-Suppression Piping
210518	Escutcheons for Fire-Suppression Piping
210529	Hangers and Supports for Fire Suppression Piping and Equipment
210553	Identification for Fire-Suppression Piping and Equipment
210800	Commissioning Fire Protection Systems
211100	Facility Fire-Suppression Water-Service Piping
211101	Leak Test Fire Protection Piping Systems
211313	Wet-Pipe Sprinkler and Standpipe Systems



**SECTION 210000
BASIC FIRE PROTECTION REQUIREMENTS**

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 21. REVIEW ALL SECTIONS OF DIVISION 1 TO ENSURE THAT REQUIREMENTS FOR MECHANICAL INSTALLATIONS ARE ADEQUATELY COVERED. REQUIREMENTS COVERED IN DIVISION 1 SHOULD NOT BE REPEATED IN THIS SECTION. THIS SECTION COVERS ONLY REQUIREMENTS PECULIAR TO DIVISION 15 AND COMMON TO MORE THAN ONE SECTION OF DIVISION 15. REFER TO EVALUATIONS AND SPEC COORD SHEETS FOR FURTHER DISCUSSION.

1.02 SUMMARY

- A. This Section includes the requirements for the following:
1. Codes, standards, organizations, and abbreviations
 2. Fire protection design criteria and requirements
 3. Designer/installer qualifications
 4. Submittals
 5. Site Visit
 6. Outages
 7. Performance requirements
 8. Materials and equipment
 9. Coordination
 10. Demolition
 11. Fire safe materials
 12. UL requirements
 13. Coordination drawings
 14. Construction record documents
 15. Operation and maintenance manuals
 16. Warranty / Guarantee
 17. Listed manufacturers
 18. Approved equal equipment layouts
 19. Fire stops and smoke seals
 20. General requirements - Execution
 21. Existing fire protection system
 22. Equipment roughing
 23. Installation – fire protection
 24. Cutting and patching
 25. Cutting, welding and burning
 26. Erection of metal supports and anchorage
 27. Demolition
 28. Penetration of waterproof construction
 29. Excavation and backfilling
 30. Cleaning and Finishes
 31. Lintels
 32. Electrical requirements



33. Provisions for access
34. Demonstration and instructions
35. Wall and floor penetrations
36. Construction record drawings
37. Final cleaning
38. Project punchout

1.03 **CODES, STANDARDS, ORGANIZATIONS, AND ABBRIVIATIONS**

A. The following list of codes, standards, organizations, and abbreviations are utilized within Division 21 Specification Sections and are provided as a reference.

B. Codes and Standards: All material and equipment provided and installed as part of these construction documents shall be in compliance with the edition of codes and standards which are applicable within the State at the time of contract execution:

1. FBC: Florida Building Code
2. FMC: Florida Mechanical Code
3. FECC: Florida Energy Conservation Code
4. State Fire Prevention Code
5. NFPA 1: Fire Code
6. NFPA 13: Standard for the Installation of Sprinkler Systems
7. NFPA 14: Standard for the Installation of Standpipes and Hose Systems
8. NFPA 20: Standard for the Installation of Stationary Fire Pumps for Fire Protection
9. NFPA 24: Standard for the Installation of Private Fire Service Mains and Their Appurtenances
10. NFPA 70: National Electrical Code
11. NFPA 72: National Fire Alarm Code and Signaling Code
12. NFPA 101: Life Safety Code
13. NFPA 241: Standard For Safeguarding Construction, Alteration, and Demolition Operations
14. NFPA 1963: Standard for Fire Hose Connections
15. PHCC: National Standard Plumbing Code Illustrated

C. Organizations: Referenced organizations are as follows:

1. ANSI: American National Standards Institute
2. ASME: American Society of Mechanical Engineers
3. ASTM: American Society for Testing and Materials
4. AWS: American Welding Society
5. FM: Factory Mutual
6. IEEE: Institute of Electrical and Electronic Engineers
7. NFPA: National Fire Prevention Association
8. NRTL: Nationally Recognized Testing Laboratory
9. NPS: National Pipe Standard
10. OSHA: Occupational Safety and Health Administration
11. SAE: Society of Automotive Engineers
12. UL: Underwriters' Laboratories

D. Abbreviations: Referenced abbreviations are as follows:

1. AC: Alternating Current



- 2. A/E: Architect/Engineer
- 3. ATL: Across the Line
- 4. CAD: Computer Aided Design
- 5. CB: Change Bulletin
- 6. CD-ROM: Compact Disk – Read Only Material
- 7. CM: Construction Manager
- 8. CxA: Commissioning Agent
- 9. DOC: Document
- 10. Dwg: Drawing
- 11. EMT: Electrical Metallic Tubing
- 12. HOA: Hand Off Automatic
- 13. MC: Metal Clad
- 14. MG: Motor Generator
- 15. MPa: Megapascal
- 16. NBR: Acrylonitrile-Butadiene, Buna-N, or Nitrile Rubber
- 17. NPS: National Pipe Standard
- 18. NRTL: Nationally Recognized Testing Laboratory
- 19. pdf: Portable Document Format
- 20. PSI: Pounds per Square Inch
- 21. Psig: Pounds per Square Inch Gauge
- 22. PVC: Polyvinyl Chloride
- 23. RFI: Request For Information
- 24. RMS: Root Mean Square
- 25. RPM: Revolutions Per Minute
- 26. SAE: Society of Automotive Engineers
- 27. xl: Excel Spread Sheet

1.04 FIRE PROTECTION DESIGN CRITERIA AND REQUIREMENTS

A. Fire Protection Design Criteria: Sprinkler design, installation, and water supply requirements shall be designed to a minimum hazard classification of Ordinary Hazard (Group 1), unless otherwise approved by the Fire Marshal.

B. New and Existing Work: All work, including both new construction and modifications to the existing sprinkler systems shall be performed in accordance with the edition of NFPA 13 which is applicable within the State at the time of the contract execution and as approved by the Fire Marshal.

1.05 DESIGNER/INSTALLER QUALIFICATIONS

A. Designer: Field survey, design, and preparation of the submittals required by the specifications shall be performed and certified by an individual who is a registered professional engineer or who is certified as a Level III or IV Technician by NICET in Water-Based Systems Layout. The designer shall have a minimum of five (5) years' experience in the preparation of sprinkler shop drawings, hydraulic calculations, and field surveying. The system designer shall sign (with certification/license number) each sheet included in the set of drawings.

B. Installer: The field sprinkler foreman shall hold a current valid certification from a nationally recognized sprinkler apprenticeship school or government agency or be recognized as "Journey Level" by a local fire sprinkler labor union. The installing contractor shall be licensed by the State.

1.06 SUBMITTALS



A. General: For general requirements see Architectural Specification Division 01 Section "Submittals".

B. In addition to the requirements identified in Architectural Specification Division 01 Section "Submittals" the fire protection contractor shall also comply with the following:

1. Coordinate fire protection system installation with all other trades prior to shop drawing development and submittal. Changes to approved shop drawings that alter the performance of the sprinkler system shall be resubmitted to the A/E for Approval.
2. Submit drawings, hydraulic calculations, diagrams, schedules, samples and manufacturers catalogue cuts as one (1) complete set. The complete submittal set must be reviewed and approved by Fire Marshal and Engineer before installation can take place. Partial Submittals will be rejected.
3. Shop drawings shall note ceiling heights and shall depict the ceiling grid, lighting fixtures, air devices, etc.
4. Submittal approval does not relieve the contractor of their responsibility to provide a code compliant system. Any installation by the contractor that does not meet code or specification requirements shall be corrected to be in full-compliance at no cost to the Owner.
5. Fire protection shop drawings must be developed by computer software. Any shop drawings submitted for review that are hand drawn or have hand written notes will be rejected.

C. Fire Protection Submittals: Provide submittals for all material, equipment and/or supports as specified in Division 21 and where indicated on the drawings and details. For additional material and data submission requirements, see Division 21 Specification Sections. At a minimum, the following submittals shall be provided as required by the project:

1. Sleeves, sleeve seals, and escutcheons.
2. Labels and signs.
3. Pipe, fittings and joints.
4. Valves and inspectors test assembly.
5. Supervisory and flow switches.
6. Cabinets.
7. Pressure gauges.
8. Hangers and supports.
9. Sprinklers.
10. Exterior fire department connection.
11. Wet pipe system and components.
12. Fire pump.
13. Fire pump controller and transfer switch.
14. Fire pump test header.
15. Jockey pump.
16. Hydraulic calculations.
17. Material and/or equipment samples when specified.
18. Coordinated drawings.

D. Submittal File Formats: File formats for each submittal shall be electronically as follows:



1. Product Data: "pdf" file format.
2. Shop Drawings: "pdf" and "dwg" file formats.
3. Coordinated Drawings: "pdf" or "dwg" file formats.
4. Schedules: "xl" file format.

E. Aside from the electronic submission, sprinkler shop drawings must also be submitted as a full size hard copy to the Fire Marshal. All requirements from the "Working Plans" Section of NFPA 13 must be met.

1.07 SITE VISIT

A. Prior to preparing the bid, the fire protection contractor shall visit the site and become familiar with all existing conditions. The fire protection contractor shall make all necessary investigations as to locations of utilities and all other matters which can affect the work. No additional compensation will be made to the contractor as a result of their failure to familiarize themselves with the existing conditions under which the work will be performed.

1.08 OUTAGES

A. For all work requiring an outage, the fire protection contractor shall submit an outage request to the Owner Project Manager. The existing fire protection systems shall remain operational unless turned off by Owner personnel during the construction of the project.

B. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled at least ten business days (10) days in advance with the Owner. Outages shall be performed during normal duty hours. If necessary some outage work may be performed outside normal hours if approved by the Owner.

C. All fire protection outages which will interfere with the normal use of the building in any manner shall be done at such times as shall be mutually agreed upon by the contractor, the Fire Marshal and the Owner.

D. The fire protection contractor shall include in his price the cost of all premium time required for outages and other work which interferes with the normal use of the building, which will be performed during other than normal work time and at the convenience of the Owner.

E. The operation of fire protection valves required to achieve an outage must be operated by Owner personnel only. Unauthorized operation of fire protection valves or other control devices by contractors and their personnel will result in extremely serious consequences for which the contractor will be held accountable.

1.09 PERFORMANCE REQUIREMENTS

A. Contract drawings are generally diagrammatic and do not indicate all offsets, fittings, transitions, access panels and other specialties required.

B. Furnish and install all items as may be required to fit the work to the conditions encountered.

C. Arrange piping, equipment and other work generally as shown on the contract drawings, and fire protection shop drawings providing proper clearances and access.



- D. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawing submittal for approval.
- E. The A/E may make reasonable changes in location of equipment piping and ductwork up to the time of rough-in or fabrication.

1.10 MATERIALS AND EQUIPMENT

- A. The contract drawings and system performances have been designed on the basis of using the particular manufacturer's products specified or scheduled on the contract drawings.
- B. Products of other manufacturer's listed in the specification shall be permitted provided as follows:
 - 1. Products meet all of the requirements of the specifications.
 - 2. Make, without additional cost to the Owner, all adjustments for deviations, such that the final installation is complete and functions as the basis of design product is intended.
- C. Products with dimensions or other characteristics different from the basis of design product that render their use impractical or cause functional fit, access, or connection problems, shall not be acceptable.
- D. Each item of equipment shall be capable of performing its function over an extended period of time with minimum attention and maintenance. All equipment and material shall be constructed using new materials designed and built in accordance with the best practices of the industry. Each item of equipment shall be listed in the Underwriters Laboratories Fire Protection Equipment List or Factory Mutual Approval Guide. Each major item of equipment shall bear the manufacturer's name or trademark; serial number; UL or FM label; operating instructions and hydraulic characteristic conditions, etc., where applicable.

1.11 COORDINATION

- REVISE ITEMS IN THE FOLLOWING EXAMPLES TO COVER PROJECT REQUIREMENTS.
- A. Coordination: Coordinate fire protection systems, equipment, and material installation with all other building components.
 - B. Utilities: Coordinate connection of fire protection systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
 - C. Chases: Arrange for chases, slots, and openings in building structure during progress of construction to allow for fire protection installations.
 - D. Sleeves: Coordinate the installation of required supporting devices and set sleeves in poured in place concrete and other structural components as they are constructed.
 - E. Sequencing: Sequence, coordinate, and integrate installations of fire protection material and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 - F. Electrical Services: Coordinate connection of electrical services.



G. Access: Coordinate requirements for access panels and doors where fire protection items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Architectural Specification Section "Access Doors."

H. Scheduling: Schedule and coordinate the delivery of material and equipment with other trades to avoid delivery conflicts.

I. New Construction: For new construction, sprinkler system piping and equipment cannot be used to support any other non-system components. Any other building element resting on sprinkler piping is assumed to be supported by the sprinkler system. No contact is permitted between sprinkler systems and non-system components. Existing systems will be evaluated on a case-by-case basis.

J. Do not install sprinkler valves or controls partially in walls. The entire assembly must be accessible.

1.12 FIRE SAFE MATERIALS

A. Unless otherwise indicated, materials shall conform to UL, NFPA or ASTM standards for fire safety with smoke and fire hazard rating not exceeding flame spread of twenty five (25) and smoke development of fifty (50).

REFER TO DIVISION 1 SECTION "MATERIALS AND EQUIPMENT," TEXT AND EVALUATIONS, FOR GENERAL REQUIREMENTS BEFORE EDITING THIS ARTICLE. SPECIFY ONLY MECHANICAL-RELATED REQUIREMENTS HERE.

1.13 UL REQUIREMENTS

A. All equipment containing electrical components and provided as part of the fire protection specifications shall bear the UL label, as a complete packaged system.

1. Equipment not provided with a UL label shall be tested in the field, certified and provided with a UL label at the installer's expense.

2. Field testing shall be performed by a testing agency approved by the Fire Marshal.

REFER TO DIVISION 1 SECTION "PROJECT COORDINATION," TEXT AND EVALUATIONS, FOR GENERAL REQUIREMENTS BEFORE EDITING THIS ARTICLE. SPECIFY ONLY MECHANICAL-RELATED REQUIREMENTS HERE.

1.14 COORDINATION DRAWINGS REVISE THE FOLLOWING EXAMPLES TO INCLUDE SPECIFIC ROOMS, RESTRICTED SPACE LOCATIONS, EQUIPMENT INSTALLATIONS, SYSTEM INTERFACES, AND SIMILAR CRITICAL WORK (ACTUAL PROJECT CONDITIONS)

A. Coordination Drawings: In addition to the requirements outlined in Division 01, prepare the fire protection part for the coordination drawing effort. Work with all other trades to ensure the material and equipment installed as part on the fire protection system will not conflict with the installation of material and equipment by other contractors. Unless otherwise indicated, the coordination drawings, including plans, sections, and elevations shall be prepared at a scale of not less than one quarter (1/4) inch = one (1) foot- zero (0) inches. At a minimum, prepare coordination drawings for all mechanical rooms, electrical rooms and substation rooms.

B. File Format: Coordination drawings shall be in a layered structure form as CAD Files or PDF Files for each floor with searchable text as follows:



1. File Structure: The "pdf" or "dwg" files shall have separate layered structure for:
 - a. Building Elements: Indicate each building element on separate layers, such as:
 - 1) Walls.
 - 2) Reflected ceiling plan.
 - 3) Room numbers.
 - b. Systems and Sub Systems: Indicate each system or sub system as warranted by congestion or complexity on separate layers such as:
 - 1) Examples of Systems:
 - a) Wet Sprinkler System.

2. The layered electronic files shall allow building elements, building systems and sub systems to be viewed in isolation or in combinations that are user selectable when the drawing files are being displayed.

C. Coordination Effort: This coordination effort shall include detailing major elements, components, and systems of fire protection equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation

and access and where sequencing and coordination of installations are of importance to the efficient flow of the work, including (but not necessarily limited to) the following:

3. Indicate the proposed locations of fire protection piping, valves, equipment, and materials. Include the following:
 - a. Clearances for servicing and maintaining equipment, including, the space for equipment disassembly required for periodic maintenance.
 - b. Exterior wall and foundation penetrations.
 - c. Sizes and location of required concrete pads and bases.
 - d. Size and location of pipe hangers and other components for pipe supports.
 - e. Access doors.

4. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

5. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations. Show all wall mounted access doors for mechanical devices.

6. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, cable trays, sprinklers, access doors and other ceiling mounted items.

REFER TO DIVISION 1 SECTIONS "FIELD ENGINEERING" AND "PROJECT CLOSEOUT," TEXT AND EVALUATIONS, FOR GENERAL REQUIREMENTS BEFORE EDITING THIS ARTICLE.

SPECIFY ONLY MECHANICAL-RELATED REQUIREMENTS HERE.

1.15 CONSTRUCTION RECORD DOCUMENTS

A. The sprinkler contractor shall maintain a set of construction record documents during the construction period in accordance with Specification Division 01 Section "Contract Closeout." REFER TO DIVISION 1 SECTION "PROJECT CLOSEOUT," TEXT AND EVALUATIONS, FOR GENERAL REQUIREMENTS BEFORE EDITING THIS ARTICLE. SPECIFY ONLY MECHANICAL-RELATED REQUIREMENTS HERE.



1.16 OPERATION AND MAINTENANCE MANUALS

A. Prepare one (1) electronic maintenance manual file in "pdf" format in accordance with Specification Division 01 Section "Project Closeout." REFER TO DIVISION 1 SECTION "MATERIALS AND EQUIPMENT," TEXT AND EVALUATIONS, FOR GENERAL REQUIREMENTS BEFORE EDITING THIS ARTICLE. SPECIFY ONLY MECHANICAL-RELATED REQUIREMENTS HERE.

1.17 WARRANTY/GUARANTEE

A. All materials, equipment, etc. provided by the general contractor and/or his subcontractors shall be warranted and guaranteed to be free from defects in workmanship and materials for a period of two (2) years from the date of substantial completion and acceptance of work by the Owner. Any defects in workmanship, materials, or performance which appear within the guarantee period shall be corrected by the contractor without cost to the owner, within a reasonable time, to be specified by the Owner. In default thereof, owner may have such work done and charge the cost of same to the contractor. In addition to the above statement the Warranty/Guarantee Period shall also include all labor cost related to all warranty work. For compressorized equipment, include an additional three (3) year Warranty/Guarantee Period.

PART 2 – PRODUCTS

2.1 LISTED MANUFACTURERS:

A. Listed Manufacturers: The listed manufacturers indicated in Part 2 of each specification section as the basis of design represents the minimum level of quality for materials and equipment that is acceptable to the Owner. Unless otherwise indicated in each specification section, contractors may submit material and equipment by non-listed manufacturers provided said submittals meet all of the requirements of these specifications. All submitted materials and equipment are subject to approval by the A/E and the Owner.

2.2 APPROVED EQUAL EQUIPMENT LAYOUTS

A. Approved Equal Equipment Layouts: The equipment layouts and the related mechanical and electrical service connections, access space and supports indicated on the construction documents represents the specified equipment. If the successful contractor chooses to provide "or approved equal" equipment by one (1) of the other listed manufacturers in the specifications, the contractor shall be responsible for providing all adjustments and modifications to the services necessary to make connections to the equipment. The contractor shall be responsible for installing the equipment such that all required clear access space is maintained, and for providing all adjustments and modifications to the equipment mounting and supports. All adjustments and modifications shall be provided by the contractors at no additional cost to the project.

2.3 FIRE STOPS & SMOKE SEALS

A. Provide fire stops and smoke seals for all new and existing fire protection piping in the project area that pass through fire rated partitions, wall, floors etc. The area around penetrations including any voids between them must be filled in and sealed with UL fire rated materials equal to the adjoining materials. All fire stop insulation devices and sealants shall maintain the fire resistance integrity of the partition, wall, floor, etc. and meet ASTM 814-83 F&T rating for time, hours and temperature rise. All fire stopping and sealants shall allow for expansion and contraction



movement without pumping free of openings. Provide UL System Numbers in product submittals for each fire stop & smoke seal application.

B. The installer of firestop and smoke seal materials shall be a firm licensed or otherwise approved by the manufacturer of the materials and have at least five (5) years' experience installing firestop and smoke seal materials. Installer shall comply with the material manufacturer's recommendations and installation requirements and ASTM and applicable code requirements.

C. All fire stop and smoke seal materials shall be as manufactured by any one of the following manufacturers:

1. Specified Technologies Inc. (STI)
2. DOW Corning Corp.
3. 3M Inc.
4. Hilti

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS – EXECUTION

A. All construction work that creates excessive noise will not be permitted during normal business hours. See Division 01 Specification Section 01045 "Cutting and Patching" for requirements.

3.02 EQUIPMENT ROUGH INS

A. Verify final locations for rough in's with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to approved equipment submittals for actual rough in requirements.

3.03 INSTALLATION - FIRE PROTECTION

REVISE ITEMS IN THE FOLLOWING EXAMPLES TO COVER PROJECT REQUIREMENTS.

A. Verify all dimensions by field measurements.

B. Where fire protection systems, materials and equipment are intended for overhead installation, and where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible. Notify Owner - PM prior to installation of sprinkler system components when headroom is less than 7'-6" and/or where existing system components will be below the new finished ceiling height. Notification shall be through the "RFI" process.

C. Install fire protection systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated

by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, identify the conflict and submit and "RFI" for each conflict to the Architect.

D. Install fire protection systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components. Unnecessary fittings and non-approved fittings shall not be installed.



E. REFER TO DRAWING COORDINATION CHECKLIST. Install fire protection equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

F. Install fire protection systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

1. REFER TO DIVISION 1 SECTION "CUTTING AND PATCHING," TEXT AND EVALUATIONS, FOR GENERAL REQUIREMENTS BEFORE EDITING THIS ARTICLE. SPECIFY ONLY MECHANICAL-RELATED REQUIREMENTS HERE.

3.04 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Specification Division 01 Section "Cutting and Patching" In addition to the requirements specified in Specification Division 01, the following requirements apply:

1. Patch Materials: Patch finished surfaces and building components using new materials specified for the original installation and using experienced installers.

B. Cut, remove and legally dispose of selected fire protection equipment, components, and materials as indicated, including but not limited to removal of fire protection piping, sprinklers and trim made obsolete by the new work.

REFER TO DIVISION 1 SECTION "CUTTING AND PATCHING," TEXT AND EVALUATIONS, FOR GENERAL REQUIREMENTS BEFORE EDITING THIS ARTICLE. SPECIFY ONLY MECHANICAL-RELATED REQUIREMENTS HERE.

3.05 CUTTING, WELDING, BURNING

A. Before the contractor and/or any sub-contractor commences any cutting, welding, burning, brazing (pipe sweating), or other type of hot work, the contractor shall obtain a hot work permit.

B. The hot work permit copy shall remain on the job site at the hot work location until such work is completed.

3.06 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code-Steel."

3.07 PENETRATION OF WATERPROOF CONSTRUCTION

A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls and interior waterproof construction.

B. Furnish and install drains, curbs, vent assemblies, sleeves, flashing, etc. specifically designed for application to the particular construction. Install system in accordance with the roofing manufacturer's instructions.

3.08 EXCAVATION AND BACKFILLING



A. General: Perform all necessary excavation and backfilling necessary for the installation of underground fire protection work as part of Division 21 in accordance with the requirements of the architectural specifications.

3.09 CLEANING AND FINISHES

- A. Clean surfaces prior to application of insulation, adhesives, coating, and paint.
- B. Provide factory applied finish where specified.
- C. Protect all finishes and restore all finishes to their original condition if damaged as a result of work installed as part of the mechanical specifications.
- D. Remove all construction marking and writing from exposed equipment, piping and building surfaces.

3.10 LINTELS

- A. Lintels shall be provided for openings in masonry, brick, concrete, etc. walls to accommodate the work of this division.
 - 1. Lintels shall be provided under this division when not being provided under other divisions. Lintels shall be approved by the Architect.

3.11 ELECTRICAL REQUIREMENTS

- A. Unless otherwise indicated, furnish and install control and interlock wiring for the equipment furnished under this division. In general, power wiring and motor starting equipment will be provided as specified in the Division 26 Specifications.
 - 1. Where the electrical requirements of the equipment furnished differ from the provisions made in the Division 26 Specifications, make the necessary allowances as part of the Mechanical Specifications.
 - 2. Where no electrical provisions are included in the Division 26 Specifications, include all necessary electrical work as part of the Mechanical Specifications.
- B. All electrical work performed as part of the mechanical specifications shall be provided in accordance with Division 26 Specifications.

3.12 PROVISIONS FOR ACCESS

- A. Ensure adequate access is provided to all fire protection system components. The following list shall be used as a guide only:
 - 1. Equipment.
 - 2. Valves.
 - 3. Drain points.
- B. Access shall be adequate as determined by the A/E and the Owner.
- C. Refer to contract drawings where access panels have been specifically located.



D. Where access is by means of lift out ceiling tiles or panels mark each access panel using small color coded or numbered tabs. Provide an index chart for identification. Place markers in the corner of tile.

3.13 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of equipment and systems to Owner's personnel a minimum of two (2) weeks prior to date of final inspection.

1. For equipment requiring seasonal operation, perform instructions for other seasons at the same time.
2. The training period shall be performed within one (1), two (2) week period.

B. Use operation and maintenance manuals and video as basis of instruction. Review contents of manual and video with personnel in detail to explain all aspects of operation and maintenance.

C. Demonstrate the following:

1. Start up.
2. Operation.
3. Control.
4. Servicing.
5. Maintenance.
6. Shutdown.

D. Provide at least forty (40) hours straight time instruction to the operating personnel.

1. This instruction period shall consist of not less than five (5) eight (8) hour days.
2. Time of instruction shall be designated by the Owner.
3. This instruction shall be in addition to instructional requirements of specific equipment specified elsewhere in the mechanical specifications.

3.14 WALL AND FLOOR PENETRATION

A. All penetrations of partitions, walls and floors by sprinkler piping and/or conduit installed under Division 21 shall be sealed and caulked. Provide UL listed fire stopping systems at penetrations through fire walls as specified in the Architectural Specifications.

3.15 CONSTRUCTION RECORD DRAWINGS

A. As the work progresses, the contractor shall record on one (1) set of prints, the installed locations, sizes, and depths of pipes, services, equipment, etc. which may differ from the approved contract drawings.

B. The contractor shall not deviate from the approved drawings unless approval in writing has been obtained from the Fire Marshal.

C. Upon completion of the fire protection system installations, the sprinkler contractor shall deliver to the construction manager one (1) complete set of marked-up blueprints of the fire protection

system installation drawings along with the electronic "dwg" file indicating the "As Built" condition. The "As Built" condition shall include all construction revisions due to field conditions, "RFI's", "CB's", "ASI's" and/or owner requested revisions.



1. The mark-ups shall be legibly marked in red pencil to show all changes and departures of the installation as compared with the original design.
 2. Refer to General Requirements of Specification Division 01 for additional requirements pertaining to Submittals and Record Drawings.
 3. Unless otherwise directed by the Owner, the electronic file shall be submitted to the construction manager in Auto Cad Release 2016 or latest edition on a CD with All "Record Drawing" information neatly recorded thereon in red ink. The A/E shall verify that all "Record Drawing" information has been recorded on the electronic file. The electronic file and mark up set shall be turned over to the Owner by the A/E.
- D. At a minimum include the following installed conditions shall be recorded:
1. Location of all low point drain valves with assigned valve tag numbers.
 2. Actual entering/leaving invert elevations for fire protection water service for the building.

3.16 CLEAN UP

- A. Excessive debris and dirt, such as occurs from cutting through masonry or plaster walls shall be cleaned up from the equipment and removed immediately after the work of cutting through the walls.
- B. Debris shall be removed from the Owner's property.
- C. Ceiling panels shall be replaced as soon as work is finished in the area, and shall be kept free of dirty finger prints. Where work is being done in corridors used by patients and ceiling panels shall be replaced at the close of the day's work even if work is at the particular location is incomplete.
- D. All areas shall be left broom-clean at the end of the work period.
- E. Remove all mechanical clipping, wiring, nuts, bolts, etc. left on top of ceilings and ceiling tiles.

3.17 PROJECT PUNCH OUT

- A. Architect/Engineer will perform punch out reviews and will provide the Contractor with a list of punch list items to be completed before contract close out. Each and every punch list item shall be initialed and dated by the Contractor when the work is complete. The Architect/Engineer will not perform any punch list verification until all items have been completed, initialed, dated and the list returned to the Architect/Engineer. If any items have been initialed as being completed by the Contractor and the Architect/Engineer determines that the work is not complete, the Architect/Engineer shall be reimbursed by the Contractor at his regular hourly rate for any and all items requiring revisiting of the site by the Architect/Engineer. Reimbursement shall be made by deducting the Architect/Engineer fee from the Contractor's final payment.

END OF SECTION



**SECTION 210517
SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING**

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.
4. Silicone sealants.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 – PRODUCTS

2.01 SLEEVES

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized, with plain ends and integral welded waterstop collar.
- C. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

2.02 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.



2. Designed to form a hydrostatic seal of 20 psig (137 kPa) minimum.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 of length required to secure pressure plates to sealing elements.

2.03 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.04 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

PART 3 – EXECUTION

3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.



2. Using [grout] [or] [silicone sealant], seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.04 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than 6": Cast-iron pipe sleeves.
 - b. Piping 6" and Larger: Cast-iron pipe sleeves



2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than 6": Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping 6" and Larger: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than 6": Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping 6" and Larger: Cast-iron pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
 - a. Piping Smaller Than 6": PVC pipe sleeves.
 - b. Piping 6" and Larger: PVC pipe sleeves.
5. Interior Partitions:
 - a. Piping Smaller Than 6": PVC pipe sleeves.
 - b. Piping 6" and Larger: Galvanized-steel sheet sleeves.

END OF SECTION



**SECTION 210518
ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING**

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Escutcheons.
2. Floor plates.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 – PRODUCTS

2.01 ESCUTCHEONS

- A. One-Piece, Steel Type: With [polished, chrome-plated] [polished brass] finish and setscrew fastener.
B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped [steel] [brass] with polished, chromeplated finish and spring-clip fasteners.
C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
D. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; [concealed] [and] [exposed-rivet] hinge; and spring-clip fasteners.

2.02 FLOOR PLATES

- A. Split Floor Plates: Cast brass with concealed hinge.

2.03 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
1. Escutcheons for New Piping and Relocated Existing Piping:



- a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
 - b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece steel with [polished, chrome-plated] [polished brass] finish.
 - d. Insulated Piping: One-piece stamped steel [or split-plate, stamped steel with concealed hinge] [or split-plate, stamped steel with exposed-rivet hinge] with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with [polished, chrome-plated] [polished brass] finish.
 - f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel with polished, chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with [polished, chrome-plated] [polished brass] finish.
 - h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel with polished, chrome-plated finish.
2. Escutcheons for Existing Piping to Remain:
- a. Chrome-Plated Piping: Split-casting, stamped steel with concealed hinge with polished, chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 1. New Piping and Relocated Existing Piping: Split floor plate.
 - 2. Existing Piping: Split floor plate.

2.04 FIELD QUALITY CONTROL

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION



SECTION 210529
HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal hanger-shield inserts.
4. Fastener systems.
5. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 210516 "Expansion Fittings and Loops for Fire-Suppression Piping" for pipe guides and anchors.
3. [Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment"] [Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment"] for vibration isolation devices [and seismic restraints].

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:[Signed and sealed by a qualified professional engineer.] Show fabrication and installation details and include calculations.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.03 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.04 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.



B. Pipe Welding Qualifications: Qualify procedures and operators according to "2015 ASME Boiler and Pressure Vessel Code, Section IX."

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Comply with [NFPA 13] [NFPA 13R] <Insert standard>.
- B. UL Compliance: Comply with UL 203.

2.02 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

- 1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
- 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
- 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

- 1. Description: Copper-coated-steel, factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
- 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.03 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.04 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear

capacities appropriate for supported loads and building materials where used.

- 1. Indoor Applications: Zinc-coated or Stainless steel.
- 2. Outdoor Applications: Stainless steel.



2.05 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.06 MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M).

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 – EXECUTION

3.01 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.02 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.



2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
 2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

3.03 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.



3.04 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.

3.05 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.06 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting.
Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099113 "Exterior Painting.",
Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.07 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.

3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).

5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).

6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbonsteel plate, and with U-bolt to retain pipe.

9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Comply with NFPA requirements.

K. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. C-Clamps (MSS Type 23): For structural shapes.

3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.



L. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

M. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners] or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION



SECTION 210553
IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 21.

1.02 SUMMARY

B. This section includes the requirements for identification of fire protection piping, valves, pumps and related equipment using the following:

1. Equipment labels.
2. Signs.
3. Pipe labels.
4. Valve tags and schedule.
5. Ceiling markers.
6. Hydraulic design information sign.
7. General information sign.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product specified include the following:

1. Samples: For color, letter style, and graphic representation required for each identification material and device.
2. Data: Installation details, material descriptions, dimensions of individual components for each type tag and sign.
3. Equipment Label Schedule: Submit a sample equipment label schedule for each fire protection system. Include a list of all equipment to be labeled, the proposed content for each label and the location in an "xl" file format.
4. Valve Numbering Schedule: Submit a sample valve tag schedule for each fire protection system. Include equipment tag designation, name and location in an "xl" file format.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Include a copy of the approved submittal for each product and material along with any applicable maintenance data in the project operation and maintenance manual.

B. Equipment Label Schedule: Include a complete equipment label schedule for each fire protection system. Include equipment tag designation, name and location, and the operation and maintenance manual, in an "xl" electronic file format.



C. Valve Numbering Schedule: Include a complete valve tag numbering schedule for each fire protection system. Include the system identification, valve number and location, and the operation and maintenance manual, in an "xl" electronic file format.

1.05 COORDINATION

- A. Coordinate installation of fire protection system identification with covering and painting of other surfaces.
- B. Coordinate installation of fire protection system identification with locations of access panels and doors.
- C. Install fire protection system identification before installing acoustical ceilings and similar concealment.

1.06 WARRANTY/GUARENTEE

- A. See Division 21 Specification Section "Basic Fire Protection Requirements" for warranty and guarantee requirements.

PART 2 – PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

- A. Labels, Signs and Tags: All labels, signs and tags shall conform to ANSI/OSHA and NFPA requirements for letter/color combinations.
- B. Acceptable Manufacturers: Subject to compliance with requirements, provide fire protection identifications material from one (1) of the following:
 - 1. Seton Fire Protection Signage
 - 2. Craft Mark Fire Protection Signage
 - 3. Industrial Safety Supply
 - 4. Allen
 - 5. Badger Powhattan
 - 6. Elkhart
 - 7. Reliable

2.2 METAL EQUIPMENT LABELS

- A. Metal Equipment Labels:
 - 1. Metal equipment labels required by NFPA shall be affixed securely to all fire-suppression system equipment.
 - 2. Material and Thickness: Anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
 - 3. Letter Color: Engraved letters in natural aluminum color.



4. Background Color: Screen printed fade resistant red ink.
5. Minimum Label Size: Length and width vary for required label content, but not less than five (5) inch by seven (7) inch.
6. Minimum Letter Size: One quarter (1/4) inch for name of units if viewing distance is less than twenty four (24) inches, one half (1/2) inch for viewing distances up to seventy two (72) inches, and proportionally larger lettering for greater viewing distances. Include secondary lettering two thirds (2/3) to three fourths (3/4) the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Sign shall be firmly affixed to the sprinkler equipment. Magic markers, crayons, pencil, embossed tape, etc. shall not be used.
9. The exterior fire department standpipe connection(s) shall be labeled "AUTOMATIC SPRINKLER" or "AUTOMATIC SPRINKLER AND STANDPIPE" with raised letters at least one (1) inch in size cast on the face.

2.3 SIGNS FOR FIRE PROTECTION SYSTEMS

- A. Identification signs shall be provided as required by NFPA 13 and NFPA 14.
- B. All signs shall be red in color, Reliable Model 'A,' Style A or B or approved equivalent. Signs shall be provided with engraved laminated red on white finish phenolic nameplate with one quarter (1/4) inch high etched white letters and beveled edges. The signs shall be secured to the sprinkler system firmly by a chain. Markers, crayons, pencil, embossed tape, etc. shall not be used.
 1. Inspector's Test Connection signs shall have a sign stating "INSPECTORS TEST".
 2. Exterior Drain location signs shall have a sign stating "SPRINKLER SYSTEM DRAIN".
 3. Riser Drain shall have a sign stating "RISER DRAIN" or "DRAIN".
 4. Auxiliary Drain signs shall have a sign stating "AUXILIARY DRAIN".
 5. Combined Inspector's Test and Drain shall have sign stating: "TEST & DRAIN"
 6. All sprinkler system control valves shall have an identification sign stating "CONTROL VALVE". Sign shall identify the portion of the building served or controlled, shall note that the valve must be kept open, and shall have a blank space for notification information.
- C. Minimum Label Size: Length and width vary for required label content, but not less than five (5) inch by seven (7) inch.
- D. Minimum Letter Size: One quarter (1/4) inch for name of units if viewing distance is less than twenty four (24) inches, one half (1/2) inch for viewing distances up to seventy two (72) inches, and proportionally larger lettering for greater viewing distances. Include secondary lettering two-thirds (2/3) to three-fourths (3/4) the size of principal lettering.
- E. The exterior fire department standpipe connection(s) shall be labeled "AUTOMATIC SPRINKLER" or "AUTOMATIC SPRINKER AND STANDPIPE" with raised letters at least one (1) inch in size cast on face.

2.4 PIPE LABELS

- A. Self Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.



B. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on the drawings; pipe size; and an arrow indicating flow direction.

1. Flow Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least one and one half (1-1/2) inches high.

C. Pipe-Label Colors:

1. Background Color: Red.

2. Letter Color: White.

3. Lettering:

a. "Wet Sprinkler System"

b. "Main Drain"

c. "Fire Protection Standpipe"

2.5 VALVE TAGS AND SCHEDULE

A. General: Valve tags and schedule are required to identify where valves are located and what duty the valve perform. Valve duty usually includes the following:

1. Shut off duty for service.
2. Shut off duty for back flow preventer.
3. Shut off duty for floor.
4. Shut off duty for pumps
5. Drain valves.
6. Floor zone control valves.
7. Hose stations.

B. Valve Tags:

1. Description: Stamped or engraved with one quarter (1/4) inch letters for piping system abbreviation and one half (1/2) inch numbers

a. Brass Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

b. Fasteners: Brass wire-link chain

2. Valve Tag Data: See chart on the next page.

FIRE PROTECTION VALVE SERVICE	VALVE TAG DISIGNATION
Fire Protection Water Service	FPWS - #
Fire Protection Water Service - BFP	FPWSBFP - #
Isolation Valve	FPIV - #
Main Drain Valve	FPMDV - #
Floor Zone Valve	FPFZCV - #
Floor Drain Valve	FPFDV - #
Low Point Drain	FPLPD - #



C. Valve Schedule: Provide a valve schedule in an "xl" file format for each fire protection piping system. Include the valve schedule file in the electronic operation and maintenance manual. File shall include the valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room, space, equipment, pipe riser), and valve duty. Also mark valves for emergency shutoff and similar special uses as required by the project.

1. Numbering System: Valves shall be in numerical order starting with one (1) for each fire protection system.

2.6 CEILING MARKERS

A. Ceiling Grid and Access Panel Markers: Provide Kroy type clear adhesive printed labels with three sixteenth (3/16) inch high letters to identify the location and type of concealed valves and sprinkler system components.

B. Ceiling Marker Data: For Fire Protection printed data shall be as follows:

1. FP Valve – Low Point Drain.

2.7 HYDRAULIC CALCULATION SIGN

A. Provide hydraulic design information signs as required by NFPA 13 for each hydraulically designed area.

2.8 GENERAL INFORMATION SIGN

A. Provide general information sign as required by NFPA 13.

PART 3 – EXECUTION

2.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

2.2 INSTALLATION – PIPE LABELS

A. Install or permanently fasten labels on each major item of sprinkler equipment.

B. Locate equipment signs and pipe labels where accessible and visible. Pipe labels shall be visible from the floor.

C. Piping Color Coding: Where indicated painting of fire protection piping shall be in compliance with the requirements in Architectural Specification Sections for "Interior Painting" and/or "High Performance Coatings".



D. Pipe Label Locations: Locate pipe labels as follows:

1. Within three (3) feet of each valve and control device.
2. At access doors, manholes, and similar access points that permit view of concealed piping.
3. Near major equipment items and other points of origination and termination.
4. Spaced at maximum intervals of twenty five (25) feet along each run.

2.3 VALVE TAG SCHEDULE

A. Include the valve schedule file in the electronic operation and maintenance manual.

2.4 INSTALLATION – CEILING MARKERS

A. Location: Install each ceiling marker label on the surface of the ceiling grid 'T' bar and/or on the frame of an access door.

2.5 INSTALLATION – SIGNS

A. Where valves are installed in concealed spaces, install the standard sign in a visible location adjacent to the control valve. Valves hidden by a suspended ceiling shall have a sign mounted on the ceiling or wall under the valve. Obtain final approval of the Architect and the Fire Marshal for all sign locations in finished spaces.

2.6 ADJUSTING AND CLEANING

- A. Adjusting: Relocate any identification device which has become visually blocked by work of this division or other divisions.
- B. Cleaning: Clean face of identification devices.

END OF SECTION



**SECTION 210800
COMMISSIONING FIRE PROTECTION SYSTEMS**

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 21.
- B. The OPR and BOD documentation are included by reference for information only.

1.02 SUMMARY

- A. This section includes the requirements for commissioning the fire protection systems, assemblies and equipment.

1.03 DESCRIPTION

- A. The following equipment and/or accessories shall be commissioned as part of this project:
 - 1. Fire Protection Equipment
 - 2. Wet System
 - 3. Fire Pumps

1.04 SUBMITTALS

- A. Refer to Division 01 Specification Section "COMMISSIONING" for CxA's role.
- B. Refer to Division 01 Specification Section "SUBMITTAL PROCEDURES" for specific requirements.
- C. Refer to Division 01 Specification Section "COMMISSIONING" for additional submittal requirements related to submittals of equipment to be commissioned and Cx specific submittals.

1.05 COORDINATION

- A. Refer to Division 01 Specification Section "COMMISSIONING" for requirements pertaining to coordination during the commissioning process.

1.06 GENERAL DOCUMENTATION

- A. With assistance from the installing contractors, the CxA will prepare Pre-Functional Checklists for all commissioned components, equipment, and systems.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT



A. Refer to Division 01 Specification Section "COMMISSIONING" for requirements pertaining to testing equipment.

PART 3 – EXECUTION

3.01 TESTING PREPARATION

- A. Certify in writing to the CxA that the fire protection systems, subsystems, equipment, and accessories have been installed, calibrated and are operating according to the contract documents.
- B. Place systems, subsystems, and equipment into operating mode to be tested. (e.g. for pumps, normal shutdown, normal auto position, normal manual position, emergency power, and alarm conditions).
- C. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.02 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, response of building automation system controllers and sensors.
- C. The CxA along with the fire protection contractor shall provide detailed testing plans, procedures, and checklists for applicable fire protection systems, subsystems, and equipment.
- D. Tests will be performed using design conditions whenever possible.

3.03 FIRE PROTECTION SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Testing and commissioning shall be performed in accordance with NFPA requirements.
- B. Procedures: Where applicable follow manufacturer's written procedures. If no procedures are prescribed by the manufacturer, proceed as follows:
 - 1. Fire Protection Equipment: Includes fire pump, jockey pump, pump controller's valves, backflow preventers and flow switches.
 - a. Verify that all equipment and accessories have been installed in accordance with the manufacturer's recommendations and all equipment can be easily accessed for maintenance and operates as intended.
 - b. Verify that all connections, controls, and accessories have been installed correctly and operates as intended.
 - c. Verify that all equipment test, training, and startup procedures have been completed per the specifications.
 - d. Verify that all required interfaces with Life Safety and/or the BAS have been installed correctly and operates as intended.



- e. Operate equipment as intended to ensure the design conditions are obtained.
- 2. Wet Systems:
 - a. Verify that specialty valves, trim, fittings, controls, and accessories have been installed correctly and operate as intended.
 - b. Verify that excess pressure pumps and accessories have been installed correctly and operate as intended.
 - c. Verify that specified tests of piping are complete.
 - d. Coordinate with fire alarm system tests. Operate systems as required.
 - e. Coordinate with fire pump tests. Operate systems as required.
- 3. Fire Pumps:
 - a. Final Checks Before Startup: Before startup perform the following preventive maintenance operations and checks:
 - 1) Lubricate oil lubricated bearings.
 - 2) Remove grease lubricated bearing covers and flush bearings with kerosene and thoroughly clean. Fill with new lubricant according to manufacturer's recommendations.
 - 3) Disconnect coupling and check electric motor for proper rotation. Rotation shall match direction of rotation marked on pump casing.
 - 4) Check that the pump is free to rotate by hand. Do not operate the pump if it is bound or if it drags even slightly until cause of trouble is determined and corrected.
 - b. Starting procedure for pumps:
 - 1) Prime pump by opening suction valve and closing drains, and prepare pump for operation.
 - 2) Open sealing liquid supply valve if pump is so fitted.
 - 3) Start motor.
 - 4) Open discharge valve slowly.
 - 5) Observe leakage from stuffing boxes and adjust sealing liquid valve for proper flow to ensure lubrication of packing. Do not tighten gland immediately, but let packing run in before reducing leakage through stuffing boxes.
 - 6) Check general mechanical operation of pump and motor.
 - c. Fire Hoses:
 - 1) Provide fire hoses in number, size, and of length required to reach a storm drain or other acceptable location to dispose of fire pump test water. These fire hoses are for field acceptance tests only and are not intended to become property of the Owner.

END OF SECTION



SECTION 211100
FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 21.

1.02 SUMMARY

B. This section includes the requirements for facility fire protection service mains and specialties below grade from five (5) feet outside the building to the points of connection to the meter vault and includes the following:

1. Pipes and fittings.
2. Special pipe fittings.
3. Flexible expansion joints.
4. Encasements for piping.

1.03 ACTION SUBMITTALS

A. Product Data: For each specified product, include manufacturers cut sheets, dimensional data, performance data, installation instructions and warranty information.

B. Shop Drawings: Comply with the following:

1. Include plans, elevations, sections, details, and attachments to other work for fire protection service piping, valves and fittings, vaults, protective enclosures and post indicator valves.
2. Include construction details, material descriptions, dimensions of individual components and profiles, required clearances, method of field assembly, and location and size of each field connection.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Include a copy of each approved submittal along with any applicable maintenance data in the project operation and maintenance manual.

B. As Built Drawings: See Division 21, Specification Section "Basic Fire Protection Requirements" for requirements.

1.05 COORDINATION



A. Coordinate the installation of the fire protection service main with all other trades that have work close to and/or in the same area of the project site.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for transport according to the following:
1. Ensure valves are dry and internally protected against rust and corrosion.
 2. Protect valves against damage to threaded ends and flange faces.
 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. Use precautions during storage for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Use sling to handle valves if size required handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.

1.07 QUALITY ASSURANCE

- A. Material and Installation Specifications: Refer to County Specific Design and Construction Standards.
- B. Standard Details: Refer to County Specific Design and Construction Standards.
- C. Water Service Components and Accessories: All water service components and accessories shall be installed using new materials designed and built in accordance with the best practices of the industry. Each major item or material shall bear the manufacturer's name and nominal size, if applicable.
- D. Installing Contractor: The contractor installing the exterior water mains, shall be licensed and approved by the County and has been a contractor in good standing with the County for at least ten (10) years.
- E. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.08 PROJECT CONDITIONS



A. Interruption of Existing Facility Water Service: Do not interrupt the existing facility water service unless permitted under the following conditions and then only after arranging to provide

temporary facility water service according to requirements indicated:

1. Notify Owner no fewer than ten (10) business days in advance of proposed interruption of utility services.
2. Do not proceed with interruption of existing facility water service without written permission from the Owner.

1.09 WARRANTY/GUARANTEE

A. See Division 21, Specification Section “Basic Fire Protection Requirements” for warranty and guarantee requirements.

PART 2 – PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

A. Material Design and Selection: Facility fire protection water piping, fittings, and specialties shall be designed and selected, for the intended use, and in accordance with the sizes on the drawings and the requirements of the specification.

B. Acceptable Manufacturers:

1. Ductile Iron Fire Protection Service Pipe: All ductile iron pipe and fittings shall be by one (1) of the following manufacturers:
 - a. American (American Cast Iron Pipe Company).
 - b. US Pipe Company.
 - c. Atlantic States Cast Iron Pipe Company.
 - d. Tyler Pipe Company.

C. PIPE APPLICATION SCHEDULE

Pipe System	Pipe Material	Fitting Material	Joint Method
Fire Protection Water Service Mains Below Grade from five (5) feet beyond the building to the Meter Vault	Ductile Iron: AWWA C151/A21.15 or AWWA C104 cement mortar lining.	Piping 3 inch and larger: Ductile Iron: AWWA C110 or AWWA C153/A21.53 with AWWA C104 cement mortar lining.	Push on or mechanical joints and gaskets. Joints – AWWA C151. Gaskets – AWWA C111/A21.11 rubber.

2.02 SPECIAL PIPE FITTINGS



A. Ductile Iron Flexible Expansion Joints:

1. Description: Compound, ductile iron fitting with combination of flanged and mechanical joint ends complying with AWWA C110 or AWWA C153. Include two (2) gasketed ball

joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.

2. Pressure Rating: 250 psig minimum.

B. Ductile Iron Deflection Fittings:

1. Description: Compound, ductile iron coupling fitting with sleeve and one (1) or two (2) flexing sections for up to 15° deflection, gaskets, and restrained joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile iron glands, rubber gaskets, and steel bolts.

2. Pressure Rating: 250 psig minimum.

2.03 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Material: Linear low-density PE film of 0.008-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

2.04 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.

2. Standard: AWWA C219.

3. Center Sleeve Material: Manufacturer's standard.

4. Gasket Material: Natural or synthetic rubber.

5. Pressure Rating: 150 psig minimum.

6. Metal Component Finish: Corrosion resistant coating or material.

2.05 CURB VALVES

A. Curb Valves: Comply with AWWA C800 for high-pressure, service line valves. Valve has bronze body, ground key plug or ball, wide tee head, and inlet and outlet matching service piping material.



PART 3 – EXECUTION

3.01 GENERAL

- A. Install all fire service main components as required in accordance with the applicable codes and the best practices of the industry.
- B. Coordinate clearance requirements with general contractor for piping penetrating walls and floor slabs.
- C. Install accessories that do not corrode or soften in either a wet or dry state.

3.02 EARTHWORK

- A. Comply with excavating, trenching, and backfilling requirements in Division 31, Specification Section "Earth Moving."

3.03 PIPING INSTALLATION

- A. Comply with NFPA 24 for fire service main piping materials and installation.
- B. Install ductile iron, fire suppression water service piping according to AWWA C600 and AWWA M41 and in accordance with BCDPW Specifications and Standard Details.
- C. Bury piping with depth of cover over top at least thirty (30) inches, with top at least twelve (12) inches below level of maximum frost penetration, and according to the following.
 - 1. Under Driveways: With at least thirty-six (36) inches of cover over top.
- D. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- E. Extend and connect fire suppression water service piping to the water supply source and to the building fire suppression water service piping systems at locations and pipe sizes indicated.
- F. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained joint piping, thrust blocks, anchors, tie rods and clamps, and other supports.

3.04 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.
- B. Ream ends of tubes and remove burrs.
- C. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.



- D. Ductile Iron Piping, Gasketed Joints for Fire Service Main Piping: UL 194.
- E. Do not use flanges or unions for underground piping.

3.05 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water distribution piping with restrained joints. Anchorages and restrained joint types that may be used include the following:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.
 - 3. Set screw mechanical retainer glands.
 - 4. Bolted flanged joints.
 - 5. Heat-fused joints.
 - 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire suppression water service piping according to NFPA 24 and the following.
 - 1. Gasketed Joint, Ductile Iron, Water Service Piping: According to AWWA C600.
 - 2. Gasketed Joint, PVC Water Service Piping: According to AWWA M23.
- C. Apply full coat of asphalt or other acceptable corrosion resistant material to surfaces of installed ferrous anchorage devices.

3.06 CONNECTIONS

- A. Connect fire suppression water service main to each interior fire suppression water service main five (5) feet from the building and to the connections at each meter vault.

3.07 FIELD QUALITY CONTROL

- A. Test Procedure: Use the test procedure prescribed described below, or as required by the Fire Marshal.
- B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline twenty-four (24) hours before testing and apply test pressure to stabilize system. Use only potable water.
- C. Hydrostatic Tests: Test at not less than one and one half (1-1/2) times the working pressure for four (4) hours.
 - 1. Increase pressure in 50 psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero 0 psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is two (2) quarts per hour per one hundred (100) joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.



D. Test and Inspection Reports: Submit test and inspection reports in an electronic 'pdf' file format to the Project Manager.

3.08 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground fire suppression water service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Specification Section "Earth Moving."

3.09 CLEANING

A. Clean and disinfect fire suppression water service piping as follows:

1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by the Fire Marshal or use the procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed in AWWA C651 as described below, or as required by the Fire Marshal:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for twenty-four (24) hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least two hundred (200) ppm of chlorine; isolate and allow it to stand for three hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to the Fire Marshal. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION



**SECTION 211101
LEAK TEST FIRE PROTECTION PIPING SYSTEMS**

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 21.

1.02 SUMMARY

A. This Section includes the requirements for leak testing the following systems:
1. Wet pipe fire protection system.

1.03 SUBMITTALS

A. General: Submit completed certified test reports in "pdf" format for each item in this Section according to the conditions of the contract and Division 01 Specification Sections.

1.04 QUALITY ASSURANCE

A. Testing shall be performed by the installer of system being tested in presence of the Fire Marshall or their representative.

1.05 WARRANTY/GUARENTEE

A. See Division 21, Specification Section "Basic Fire Protection Requirements" for warranty and guarantee requirements.

PART 2 - PRODUCTS

2.1 PIPE SYSTEM LEAK TEST APPARATUS

A. The contractor conducting the test shall arrange for and provide all temporary services, all test apparatus, all gauges, hoses and qualified personnel necessary to conduct the required testing. All leak tests shall be witnessed by the Fire Marshal. Owner requires a minimum of five (5) business days' notice for all leak test. Prior to scheduling the test with the Owner, the contractor shall pretest the system or segment to ensure all joints, connections etc are leak free.

B. Test apparatus shall include a pump of appropriate size and pressure for all pressurized systems and an oil free air compressor or gaseous nitrogen to pressurize all gaseous piping systems to the required test pressures. Gauges used for testing shall be as follows:

1. Gauges shall be four (4) inch diameter dial type gauges.
2. Tests requiring a pressure of 10 pounds per square inch (psi) or less shall utilize a testing gauge having increments of 0.10 psi or less.



3. Tests requiring a pressure of greater than 10 psi but less than or equal to 100 psi shall utilize a testing gauge having increments of 1 psi or less.
 4. Tests requiring a pressure of greater than 100 psi shall utilize a testing gauge having increments of 2 psi or less.
- C. Pressure gauges used for the test shall be in the required range and increment for the appropriate test.
- D. All gauges must be calibrated and set at zero (0) before pressure is applied to the test segment.
- E. The contractor conducting the test shall utilize the "Standard Pipe System Leak Test Summary Form" for each pipe test to record the test results. Where multiple tests are conducted on the same pipe section a summary report of each test (pass and failed test) shall be prepared. Each summary report shall be signed by each of the parties witnessing the test. The completed reports shall be forwarded to the Construction Manager (CM) or the General Contractor (GC). The CM or GC shall provide a copy of the reports to the Owner Project Manager.

PART 3 – EXECUTION

3.1 TEST PROCEDURES

- A. Test each pipe system as a whole or in segments as required by progress of the work. Perform tests prior to installation of piping insulation.
- B. All required tests shall be performed by the sprinkler contractor as part of this contract. The contractor shall see that proper representatives of the Owner, the Engineer, Fire Marshall, Office of Facilities Management, and any other individuals desiring to witness the tests shall be notified at least five (5) business days prior to the scheduled test time.
- C. All Piping Systems include piping exposed above grade within the building, piping below floor slabs within the building, piping below grade five (5) feet beyond the exterior foundation wall, and / or piping above the building roof elevation and are defined as follows:
1. Wet Pipe Fire Protection System: Wet piping systems, including standpipes, serving all areas of the building and/or the project area.
- D. Arrangements shall be made by the contractor to separate new systems from existing risers or systems with blank testing gaskets to prevent damage to the riser or other existing fire protection equipment.
- E. Use ambient temperature water as the testing medium.
- F. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at low points for complete removal of the liquid after testing is complete.
- G. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.
- H. Subject fire protection system to a hydrostatic test pressure which at every point in the system is not less than one and one half (1-1/2) times the design pressure. The test pressure shall not



exceed the maximum pressure of any vessel, pump, valve, or other component in the system under test. Verify that the stress due to pressure at the bottom of vertical runs does not exceed either 90% of specified minimum yield strength, or 1.7 times the "SE" value in Appendix A of ASME B31.9, Code For Pressure Piping, Building Services Piping.

I. After the hydrostatic test pressure has been applied for two (2) hours and with no allowable drop in pressure, the tested system or segment has passed the leak test. If after the two (2) hour test period there is a greater than a 5 psi change in pressure, the test has failed and the contractor

shall examine piping, joints, and connections for leakage. After all leaks have been corrected by tightening, repairing, and/or replacing components as appropriate, the hydrostatic test shall be rescheduled with the Owner. Retesting can occur no sooner than five (5) days after a failed test. The test procedure shall be repeated as specified above until there are no leaks and there is less than a 5 psi change in pressure.

J. Where backflow preventers are installed in piping systems scheduled for testing isolate the backflow preventer from the piping to be tested.

K. The contractor shall furnish a written statement to the effect that all work covered under this contract has been completed and tested in accordance with specifications and plans. Copies of the written statement shall be provided to the Owner and the Fire Marshal.

3.2 STANDARD TEST SUMMARY FORMS

A. General: Contractor shall use the "Standard Pipe System Leak Test Summary Form."

1. Sample Form: The following page contains a sample of the Standard Pipe System Leak Test Summary Form.



STANDARD PIPE SYSTEM LEAK TEST SUMMARY FORM

Date: _____ Project Number: _____ <

Location: _____ <

Pipe System Tested (Service): _____ <

Location and Description: _____ <

Pipe Materials: _____ <

Operating Pressure: _____ <

Specified Test Pressure: _____ <

Actual Test Pressure: _____ <

Pressure Test Type: _____

 Test Start Time: _____ Recorded Test Pressure: _____

 Test Completion Time: _____ Recorded Test Pressure: _____

 Test Duration: _____ Pressure Drop or Rise: _____

 Test Result (Pass/Fail): _____ Weather Conditions: _____

Construction Manager: _____

Construction Manager Representative: _____

Mechanical Contractor: _____

Mechanical Contractor Forman: _____

Owner Witness: _____

Remarks: _____

END OF SECTION



**SECTION 211313
WET-PIPE SPRINKLER AND STANDPIPE SYSTEMS**

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 21.

1.02 SUMMARY

A. This section includes requirements for furnishing, a complete fire protection system and/or modifying an existing system, including the following:

1. Pipe, fittings, and joints.
2. Valves and inspector's test assemblies.
3. Supervisory and flow switches.
4. Cabinets.
5. Pressure gauges.
6. Hangers.
7. Sprinklers.
8. Exterior fire department connections.
9. Fire department hose valves.
10. Wet pipe systems.

1.03 ACTION SUBMITTALS

A. Product Data: For each specified product, include manufacturers cut sheets, dimensional data, performance data, installation instructions, wirings diagrams, power requirements, specified options, and warranty information.

B. Shop Drawings: For each fire protection system, include a complete fire protection system layout indicating the location, elevation, and sizes of the distribution piping, standpipes, floor zone valves, hangers, and sprinklers and include all required dimensional data. Also include the location of the water service entrance to the building, the fire pump, and electrical components if needed. The system layout must be coordinated with the work of all other trades.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Sprinkler type shall be identified on the drawings by the manufacturer's model number.
3. Fire protection shop drawings must be developed by computer software. Any shop drawings submitted for review that are developed by hand will not be reviewed and will be rejected.



1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Product Data: Include a copy of the approved submittal for each product and material along with applicable maintenance data in the project operation and maintenance manual.
- B. Final As-Built Drawings: Include a copy of the final as-built drawings and hydraulic calculations for each type of fire protection system in the operation and maintenance manual.
- C. File Format: See specification section "Basic fire protection requirements" for file formats.

1.06 PROJECT REQUIREMENTS

- A. Except as modified herein, the system shall be designed in accordance with NFPA 13, NFPA14. Pipes sizes shall be determined by hydraulic calculations.
- B. Contractor shall comply with NFPA 241 Safeguarding Construction, Alteration, and Demolition Operations while construction is underway to provide reasonable safety to life and property from fire. Contractor is responsible for ensuring the applicable sections are reviewed and enacted.
- C. A minimum of 10% or 10 psi safety margin, whichever is greater, above the system pressure demand shall be provided in the hydraulic calculations of all fire protection systems.
- D. Provide a standpipe calculation demonstrating that the NFPA 14 required flow rates at a minimum residual pressure of 100 psi can be obtained at the most remote hose valve with a flat supply pressure of 150 psi at the fire department connection.
- E. Comply with the following:
 - 1. Floor Zones: Each floor shall be separate zone.
 - 2. Standpipes: Provide a standpipe riser for each stairwell with a fire hose connection on each level.

1.07 QUALITY ASSURANCE

- A. During the two (2) year guarantee period, the contractor shall be responsible for the proper adjustment of all systems, equipment, and apparatus, installed by them and perform all the work necessary to ensure safe, efficient, and proper functioning of the systems and equipment at no cost to the Owner.

1.08 WARRANTY/GUARANTEEE



A. See Division 21 Specification Section "Basic Fire Protection Requirements" for warranty and guarantee requirements.

PART 2 – PRODUCTS

2.01 LISTED MANUFACTURERS

A1 The manufacturers indicated in Part 2 represent the basis for design and identify the minimum level of quality for materials and equipment, specified in this section, that are acceptable to the owner. Unless otherwise indicated in this Section, contractors may submit material and equipment by non listed manufacturers provided said submittals meet the requirements of these specifications. All submitted materials and equipment are subject to approval by the A/E and the owner.

2.02 SPRINKLER SYSTEM PIPE, FITTINGS, & JOINTS

A. General: All pipe, fittings, joints and couplings used for standpipe and sprinkler systems shall be as specified.

. 1 All grooved couplings and fittings shall be the product of one (1) manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. The Contractor

shall be responsible for replacing any fitting, coupling, gasket or device that was installed and was not included in the approved submittal.

B. Pipe Material: All piping shall be Grade B, Schedule 40 black steel pipe manufactured in the United States as follows:

1. Piping one half (1/2) inch to two (2) inch shall be threaded end type. Threads shall be per ANSI B.1.20.1.
2. Two (2) inch piping shall be either thread end type or rolled grooved end type. (Contractor Option)
3. Piping two and one half (2-1/2) inches and larger shall be rolled grooved end type.

C. Fitting Material: Comply with the following:

. 1 Fittings for piping one half (1/2) inch to two (2) inch shall be threaded Class 125 cast iron fittings.

21 Fittings for two (2) inch piping shall be either threaded Class 125 cast iron or ductile iron grooved end fittings per paragraph 3 below. (Contractor Option)

31 Fittings for piping two and one half (2-1/2) inches and larger shall be ductile iron grooved end fittings. Fittings shall be short pattern, with flow equal to standard pattern fittings.

D. Joints and Couplings: Comply with the following:



1. Joints for piping one half (1/2) inch to two (2) inch shall be Threaded Joints conforming to American Standard for Pipe Threads ANSI B2.1.
2. Joints for two (2) inch piping shall either be Threaded Joints per paragraph 1 above or Victaulic Quick Vic Rigid Coupling Style per paragraph 3 below. (Contractor Option)
3. Joints for non threaded piping shall be Victaulic Quick Vic Rigid Coupling Style 107N with offset angled bolt pads to accomplish rigidity and provide support in accordance with NFPA 13. Couplings shall be fully installed at visual pad to pad offset contact. Couplings that require gapping of bolt pads or specific torque ratings for proper installation are not permitted. Gasket Material shall be Grade 'EHP' EPDM.
4. Where seismic design requirements apply, provide Victaulic Quick Vic Flexible Coupling Style 177N.

E. Sprinkler Drops: The connection to the sprinkler drop must be made off of the top of the main or branch pipe.

1. In lieu of rigid pipe offsets or return bends for sprinkler drops, a flexible fitting system, as manufactured by Victaulic or approved equal, may be used. The system shall comply with the following:

- a. Approvals: FM-1637 (Braided) or UL 2443. The sprinkler fitting system shall be listed or approved for installation in the appropriate ceiling system.
- b. Mounting Bracket: Victaulic style AB or approved equal mounting bracket shall be a one (1) piece tubular steel bracket and metal anchors suitable attachment to the ceiling support system. The bracket shall be anchored into the ceiling with a screw for a permanent installation. No wing nut style brackets will be allowed.
- c. Hoses: Victaulic style AH flex hoses shall be a one (1) inch ID braided hose with a two (2) inch minimum bend radius and hydraulically calculated with a minimum of four (4) 90 degree bends. Hose length shall be limited up to forty eight (48) inches.
- d. Labels: A tamper resistant label shall be installed on the bracket ends to prevent relocation of the heads.
- e. Commissioning: The sprinkler contractor shall make arrangements for the factory representative to be on site to verify that the flexible fittings have been properly installed prior to system acceptance. The factory representative's visit must be coordinated with the Fire Marshal.

2.03 VALVES AND TEST CONNECTION

A. General: Valves shall be approved types and as specified in NFPA 13 and the UL. All valves controlling fire protection water supplies shall be Outside Stem and Yoke (OS&Y). Butterfly valves shall be used only in areas where OS&Y valves cannot be installed.

B. OS&Y Valves: OS&Y valves shall be by Victaulic Series 771H Groove by Groove or Series 771F Groove by Flange pressure rated up to 200 PSI, with ductile iron body (ASTM – 536), EPDM body gaskets, steel nuts and bolts, and cast iron hand wheel (ASTM 126 – B) or approved equal by Grinnell, Viking Stockham, Muller, or Nibco.



C. Butterfly Valves: Butterfly valves shall be Victaulic Series 705, pressure rated up to 300 psi with ductile iron body and disc (ASTM – 536) EPDM pressure responsive seat, teflon impregnated fiberglass with stainless steel backing stem bearings, EPDM O ring, carbon steel plated tap plug, bracket and weatherproof actuator or approved equal by Grinnell, Viking, Stockham, Muller, or Nibco. The valve stem shall be offset from the disc centerline to provide complete 360 degree circumferential seating.

D. Trim and Drain Valves: Trim and drain valves include ball valves, globe valves and plug valves. Trim and drain valves installed as part of an automatic sprinkler system or fire protection standpipe shall have a minimum pressure rating of 175 psi and be listed for use as part of a fire

protection system by UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide." Automatic (ball drip) drain valves shall comply with UL 1726. Ball drip valves shall be minimum NPS three-quarters (3/4) inch with threaded connections.

E. Check Valves: Provide check valves where required as follows:

1. Alarm Check Valve: An approved alarm check valve (variable pressure type) with all appropriate trimmings shall be installed on the system side of the water supply control valve. Alarm check valve shall be by Victaulic Series 751, with a high strength ductile iron body (ASTM A-536 Grade 65-45-12), aluminum bronze clapper, stainless steel shaft – 17-4, EPDM clapper seal (ASTM D2000), nitrile seat O rings, stainless steel springs, and all necessary trim for a complete assembly, pressure rated up to 300 psi or approved equal. The valves internal components shall be replaceable with the valve in the installed position. The top of the retard device or alarm line shall be fitted with an approved pressure switch Reliable Model 'G', Type 1, or equivalent. Conductors shall be provided under the electrical section to provide fire alarm and annunciation. Activation of the sprinkler system by one sprinkler or equivalent test shall cause the fire alarm system to activate and the appropriate lamp(s) to activate on the annunciator as "Main Water Flow".

2. Swing Check Valves: Swing-type check valves shall comply with UL 312 rated up to 300 psi with cast iron body. Subject to compliance with requirements, provide check valves manufactured by Grinnell, Viking, Stockham, Muller, or Nibco.

F. Indicating Post/Wall Valves and Indicators: Provide indicating post wall valves and indicators where required as follows for the project:

1. The valve shall be an iron body unit approved by UL and designed for use with wall or post indicators. The valves shall be non-rising stem. The valves shall be designed for either vertical or horizontal indicators.

2. The valves shall be Victaulic Series 773 wall post indicator and/or Victaulic Series 774 upright post indicator or approved equal by Grinnell, Viking Stockham, or Nibco.

3. The post indicator shall be supplied by the same manufacturer as the non-rising stem valve. The indicator shall have a handle for turning the valve on or off plus arranged to lock to the indicator body. The indicator shall be painted red.

4. The wall indicator shall be supplied by the same manufacturer as the non-rising stem valve.

G. Inspectors Test Connection: The inspector's test device shall be Victaulic's Test Master II Alarm Test Module, Style 720, with screw threads.

2.04 SUPERVISORY SWITCHES AND WATER FLOW SWITCHES



A. Valve Supervisory Switch: The valve supervisory switch shall be System Sensor or Potter Model OSYSU-1, Outside Screw and Yoke Valve Supervisory Switch. Valve supervisory switches shall be electrically supervised and comply with UL 346.

Components shall be single-pole, doublethrow switch with normally closed contacts. Valve supervisory switches shall send a signal to building fire alarm system when the controlled valve is in other than a fully open position

B. Indicator-Post Supervisory Switches: Indicator-post supervisory switches shall be electrically supervised and comply with UL 346. Components shall be single-pole, double-throw switch with normally closed contacts. Post indicator supervisory switches shall send a signal to building fire alarm system when the controlled valve is in other than a fully open position.

C. Water Flow Switch: Water flow switches shall be System Sensor Model WFD or Model VSR-F by Potter Electric Co. or equivalent and shall be installed where specified by design requirements. Electrical conductors shall be provided under the Electrical Division to provide fire alarm and annunciation. Activation of the sprinkler system by one sprinkler or equivalent test shall initiate an alarm sequence at the Fire Alarm Control Panel and activate the appropriate lamp(s) to activate on the Annunciator Panel. Water flow switches shall be set to activate at sixty (60) seconds of water flow.

2.05 CABINETS

A. Fire Protection Valve Cabinet: Provide and install where indicated on drawing Potter-Roemer Fig. No. 1810 recessed fire department valve cabinet with 20 gauge tubular steel door, and 18 gauge frame.

B. Sprinkler Cabinet: Provide a Metal Sprinkler Cabinet equipped with a supply of spare sprinklers. The spare sprinklers shall correspond with each type of sprinkler and temperature rating that was installed in the project. The cabinet shall be a red baked enamel steel box by Potter Roamer Figure 6162, Victaulic or equal.

2.06 PRESSURE GAUGE

A. Pressure gauges shall comply with UL 393. Dials shall be three and one half (3-1/2) inches to four and one half (4-1/2) inches in diameter. Pressure gauge shall range from 0 to 300 PSI. Water system piping gauges shall include "WATER" or "AIR/WATER" label on dial face. Air system piping gauge shall include retard feature and "AIR" or "AIR/WATER" label on dial face.

2.07 HANGERS

A. All pipe hangers and hanger spacing shall be in strict accordance with NFPA 13.

2.08 SPRINKLERS

A. General: Sprinklers shall be listed by UL and only new sprinklers shall be installed. Sprinklers shall be located and installed in accordance with NFPA 13, and properly coordinated with all other work.

B. Damage to Sprinklers: Any sprinkler that incurs damage, is painted, sprayed, caulked, or covered with any material before the system is accepted by the Owner shall be replaced by the contractor



at no cost to the Owner. Protective sprinkler caps cannot be removed until after the ceiling is in place or sprinklers will be subject to replacement.

C. Basis of Design: The basis of design shall be sprinklers manufactured by Viking, Tyco and/or Victaulic as specified.

D. Temperature Ratings: The correct temperature rating of every sprinkler shall be in accordance with NFPA 13 and based upon the maximum anticipated ceiling temperature.

E. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler. Guards shall be specifically listed for the sprinkler on which they are being installed. Guards shall be installed wherever sprinklers are potentially subject to damage. Guards shall be installed on all upright sprinklers located at the base of stairwells, on all sprinklers under ductwork, and on all sprinklers installed less than 6'-8" above the finished floor

F. Spare Sprinklers: The spare sprinklers shall correspond with each type of sprinkler and temperature rating that was installed in the project. Provide the necessary wrench(s) for each of the type sprinkler installed. Provide spare quantities as follows:

Type of Sprinklers Installed: Minimum Spare Sprinklers:

1-10	1
11-50	2
51-100	3
101-500	4
501+	6

In no case shall the total number of spare sprinklers provided be less than the number required by NFPA 13.

G. Coverage: Except for high hazard areas, all sprinklers shall be quick response standard coverage type sprinklers with a 'K' Factor of 5.6, unless prohibited by Code or otherwise directed by the Fire Marshal. Only the listed sprinklers below or approved equivalent may be installed, unless specific project requirements dictate a different type of sprinkler:

1. Pendent Sprinklers: Where pendant sprinklers are required, provide Viking VK402 - Horizon Quick Response Flush Pendent Sprinkler and escutcheon with a white polyester finish to match ceiling and/or walls.
2. Side Wall Sprinklers: Where sidewall sprinklers are required, provide Viking VK305 - Microfast Quick Response Horizontal Sidewall Sprinkler and escutcheon with a white polyester finish to match ceiling and/or walls.
3. Upright Sprinklers: Where upright sprinklers are required, provide Viking VK300 - Microfast Quick Response Upright Sprinkler with a chrome finish.
4. Corrosive Areas: Where sprinklers installed in corrosive areas provide Viking VK130 (Upright) or VK132 (Pendent) - Micromatic Stainless Steel Sprinkler.
5. Cold Rooms: In each new cold room provide Viking 200°F dry pendent Model VK176 Adjustable Sprinkler with a chrome finish



6. Concealed Sprinklers: Where concealed sprinklers are required, provide Viking VK462 - Mirage Quick Response Concealed Pendent Sprinkler and escutcheon with a white finish to match ceiling and/or walls.

2.09 EXTERIOR FIRE DEPARTMENT CONNECTION

A. Provide and install the required exterior fire department connection(s) and piping to the system. Each exterior fire department connection(s) shall be the Siamese type and equipped with a ball drip. Piping shall be of the required size, but in no case shall be less than four (4) inches.

B. The exterior fire department connection(s) shall be chrome or brass finish flush type in a straightaway pattern and the required number of two and one half (2-1/2) inch inlets with threads conforming to the NFPA 1963 Standard for Fire Hose Connections.

2.10 FIRE DEPARTMENT STANDPIPE AND HOSE SYSTEM

C. Fire Department Hose Connections: Fire department hose connections shall be for Class I service only. Additional requirements shall be as follows for the project:

1. Hose valves shall be designed and located as required by NFPA 14.

2. Fire department hose valves shall be two (2) inch to two and one half (2-1/2) inch with threads conforming to the National (American) Standard Fire Hose Coupling Screw Threads Standard, equipped with screw caps and pin lugs. Hose valves shall be Potter Roemer Figure 4065, two and one half (2-1/2) inch cast brass valve with a red handle, female NPT inlet by male hose thread outlet, polished brass finish, three hundred (300) pound rated or approved equal. Provide two and one half (2-1/2) inch to one and one half (1-1/2) inch reducers on each valve.

3. Approved two (2) way roof manifolds shall be provided where required by the appropriate code or standard. Roof manifolds will be minimum four (4) inch with two and one half (2- 1/2) inch gated outlets with the interior control valve operable from the roof location. Suitable and accessible manual drains and automatic drip shall be provided.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install all pipe, fittings, valves, controls, and hangers as required in accordance with NFPA 13.

B. The work under this contract shall be coordinated with that of all trades so that all work may be installed in the most direct and workmanlike manner and so that interference between piping, ducts, equipment, architectural and structural features will be avoided.

C. The sprinkler contractor shall install water flow alarms, valve supervisory devices, and any other sprinkler system equipment designed to be electrically interconnected into a fire alarm system but shall not connect to the fire alarm system.



D. All electrical devices incorporating electrical apparatus installed by the sprinkler contractor as part of the sprinkler system shall be interconnected electrically under another section of these specifications.

E. Connection(s) shall be made to an approved water supply capable of delivering the necessary volume. The connection between the system piping and underground piping shall be made with a cast iron flanged piece, properly fastened.

3.02 PIPING

A. All Piping shall be run concealed in areas with suspended ceilings. Piping shall be installed and arranged to protect it from corrosion and shall be pitched for drainage.

B. All sprinkler piping shall be substantially supported from the building structure which must support the added load of water filled pipe plus a minimum of two hundred fifty (250) pounds applied at

the point of hanging in accordance with NFPA 13.

C. All risers shall be equipped with drains sized as specified in NFPA 13.

3.03 PIPE JOINTS

A. Grooved Joints: Install in accordance with the manufacturer's latest published installation instructions. Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to (and including) groove. Gasket shall be manufactured by the coupling manufacturer and verified as suitable for the intended service. A factory trained representative (direct employee) of the coupling manufacturer shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. The representative shall periodically visit the job site and review installation to ensure best practices in grooved joint installation are being followed. Contractor shall remove and replace any improperly installed products.

3.04 DRAINS AND TEST PIPING

A. Drains and test piping shall be furnished and installed so that all parts of the fire protection system may be drained and tested properly.

B. All interior sectional control valves, including riser control valves, shall be provided with auxiliary drainage so located as to drain that portion of the system controlled by the sectional control valve.

C. Auxiliary drains shall be provided to properly drain all low points of the system when a change in direction prevents drainage through the main system.

3.05 SPRINKLERS

A. Center sprinklers in ceiling tiles and coordinate location with all other trades, including but not limited to ceilings, lights, diffusers, grilles etc.

B. Sprinklers shall be installed using rigid pipe offsets or return bends for the sprinkler drop or a flexible stainless steel sprinkler fitting system. Where rigid pipe offsets, return bends or flexible

fitting systems are used for the sprinkler drop, the connection to the drop must be off of the top of the pipe.

C. In finished ceilings where more than two (2) sprinklers are installed, the deflectors of all sprinklers shall be installed at the same elevation from the finished floor.

3.06 SPRINKLER CABINET

A. The reserve sprinkler cabinet shall be surface mounted and installed on a wall adjacent to the main sprinkler controls for the fire pump, if provided. In buildings where there is no fire pump coordinate the location the new sprinkler cabinet with the Fire Marshal.

B. Provide a sign for the new sprinkler cabinet that reads "NEW SPRINKLER HEAD CABINET - DATE INSTALLED - MO- DAY-YR".

3.07 INSPECTORS TEST CONNECTION

A. An inspector's test device shall be provided for testing each alarm device that leads to an approved drain discharge system.

3.08 VALVES

A. Provide one (1) approved valve in each source of water supply except the fire department connection(s).

B. Provide approved indicating valves at the base of each major riser, unless there is only one (1) riser.

C. Provide approved indicating valve on the supply side of the alarm check valve.

D. Drain and test valves shall be of approved types and in accordance with NFPA 13.

E. Drain and auxiliary valves shall be of an approved type and in accordance with NFPA 13 edition. Drain and auxiliary drain valves shall be either globe or angle valves as required and readily accessible for maintenance personnel.

3.09 EXTERIOR FIRE DEPARTMENT CONNECTIONS

A. Each exterior fire department standpipe connection(s) shall be arranged to provide water to all parts of the system(s). The connection shall be made on the system side of all riser shutoff valves.

B. The connection shall be located on a street side of the building, preferably on the front, not more than one hundred (100) feet from the nearest fire hydrant.

C. The connection shall be not less than two (2) feet and not more than three (3) feet six (6) inches in elevation, measured from the ground level to the center of the inlets.

3.10 FIRE DEPARTMENT HOSE VALVES



A. Where the Fire Department Hose Valves are installed in a Hose Cabinet the valve(s) shall be positioned in the cabinet at an angle (30° to 45°) with the cap positioned downward toward the floor.

B. Hose valves shall be located within building stairway enclosures, with additional corridor locations as required. The hose valves shall be installed at such an angle so that the fire hose is not obstructed or kinked when in use.

3.11 HOLE SAW DISCS

A. If the contractor is required to make openings in the piping by means of a hole saw, the contractor shall remove the resultant discs (slug) and hang the discs adjacent to the hole cut. Failure by the contractor to do this will result in the contractor completely disassembling the sprinkler system to satisfy the Engineer and the Fire Marshal that the discs is not in the system piping.

3.12 DUST, SOIL, DEBRIS

A. The contractor shall take such steps as necessary to protect the surface and contents of rooms in which work is in operation, from damage from his/her operation. The room contents shall be either moved out of the way or covered with waterproof coverings while work is in progress. The contractor shall remove and replace ceilings and protect them against dirt and damage.

B. Particular care shall be exercised to prevent staining damage from cutting oils used in the cutting and threading of pipe.

C. Suitable non-permeable drop cloths shall be used under all cutting and threading machines.

D. The contractor will be held responsible and accountable for any damage resulting from his/her operation.

3.13 CONNECTIONS AND ALTERATIONS TO EXISTING WORK

A. When the new work under this project requires connection to existing piping, rearranges existing piping, etc., the contractor shall perform all necessary cutting, fittings, etc., to the existing work as may be necessary or required to make satisfactory connections between the new work, as to leave the entire completed work finished in a workmanlike manner to the entire satisfaction of the Engineer and the Fire Marshal.

B. The contractor shall make the necessary arrangements with the engineer for all outages of utilities or fire protection systems. Such outages shall be made at least five (5) business days in advance of the anticipated outage requirement.

3.14 CUTTING AND PATCHING

A. The cutting of walls and floors for passage and accommodation of new piping, the closing of openings and removal of all debris caused by the work under this contract shall be performed by and at the expense of the contractor.

B. Patching shall be uniform in appearance and shall match the surrounding surfaces. New openings in existing concrete floors shall be drilled with diamond core drills.

MIAMI-DADE PUBLIC LIBRARY SYSTEM
VOLUME II
PROJECT MANUAL
DIVISION 22- PLUMBING

South Dade Regional Library Interior Renovations

C23-MDPLS-01-ESP



220500	Common Work Results for Plumbing
220513	Common Work Requirements for Plumbing Equipment
220516	Expansion Fitting and Loops for Plumbing Piping
220523	General-Duty Valves for Plumbing Piping
220529	Hangers and Supports for Plumbing Piping and Equipment
220700	Plumbing Insulation
221116	Domestic Water Piping
221119	Domestic Water Piping Specialties
221316	Sanitary Waste and Vent Piping
221319	Sanitary Waste Piping Specialties
221423	Storm Drainage Piping Specialties



**SECTION 220500
COMMON WORK RESULTS FOR PLUMBING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Plumbing demolition.
 - 9. Equipment installation requirements common to equipment sections.
 - 10. Painting and finishing.
 - 11. Concrete bases.
 - 12. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. PE: Polyethylene plastic.
 - 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.



1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.



2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 1. ASME B16.21, nonmetallic, flat, asbestos-free, **1/8-inch (3.2-mm)** maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 2. AWWA C110, rubber, flat face, **1/8 inch (3.2 mm)** thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BA_g1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
 1. ABS Piping: ASTM D 2235.
 2. CPVC Piping: ASTM F 493.
 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.



- d. JCM Industries.
- e. Smith-Blair, Inc.
- f. Viking Johnson.
- 2. Underground Piping **NPS 1-1/2 (DN 40)** and Smaller: Manufactured fitting or coupling.
- 3. Underground Piping **NPS 2 (DN 50)** and Larger: AWWA C219, metal sleeve-type coupling.
- 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturers:
 - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturers:
 - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - 1. Available Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for **250-psig (1725-kPa)** minimum working pressure at **180 deg F (82 deg C)**.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.



- g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
 - 1. Available Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
 - 1. Available Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Carbon steel. Include two for each sealing element.



4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: **0.0239-inch (0.6-mm)** minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: **5000-psi (34.5-MPa)**, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.



PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
 - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
 - h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - i. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.

- j. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches (50 mm)** above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than **NPS 6 (DN 150)**.
 - b. Steel Sheet Sleeves: For pipes **NPS 6 (DN 150)** and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to **2 inches (50 mm)** above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than **6 inches (150 mm)** in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves **6 inches (150 mm)** and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe



and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.



6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 1. Install unions, in piping **NPS 2 (DN 50)** and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping **NPS 2-1/2 (DN 65)** and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than **4 inches (100 mm)** larger in both directions than supported unit.



2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch (450-mm)** centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use **3000-psi (20.7-MPa)**, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.9 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION



**SECTION 220513
COMMON WORK RESULTS FOR PLUMBING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of **3300 feet (1000 m)** above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.



- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.



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PART 3 - EXECUTION (Not Applicable)

END OF SECTION



SECTION 220516
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Flexible-hose packless expansion joints.
 - 2. Metal-bellows packless expansion joints.
 - 3. Rubber packless expansion joints.
 - 4. Grooved-joint expansion joints.
 - 5. Pipe loops and swing connections.
 - 6. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

- A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
- B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
 - 2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
 - 3. Alignment Guide Details: Detail field assembly and attachment to building structure.
 - 4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
- C. Welding certificates.
- D. Product Certificates: For each type of expansion joint, from manufacturer.
- E. Maintenance Data: For expansion joints to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 PACKLESS EXPANSION JOINTS

A. Flexible-Hose Packless Expansion Joints:

1. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. **Basis-of-Design Product:** Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Flex-Hose Co., Inc.
 - b. Flexicraft Industries.
 - c. Flex Pression Ltd.
 - d. Metraflex, Inc.
 - e. Unisource Manufacturing, Inc.
3. **Description:** Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
4. **Flexible Hose:** Corrugated-metal inner hoses and braided outer sheaths.
5. **Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller:** Copper-alloy fittings with solder-joint end connections.
 - a. Bronze hoses and single-braid bronze sheaths with **450 psig at 70 deg F (3100 kPa at 21 deg C)** and **340 psig at 450 deg F (2340 kPa at 232 deg C)** ratings.
 - b. Bronze hoses and double-braid bronze sheaths with **700 psig at 70 deg F (4830 kPa at 21 deg C)** and **500 psig at 450 deg F (3450 kPa at 232 deg C)** ratings.
6. **Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100):** Copper-alloy fittings with threaded end connections.
 - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with **300 psig at 70 deg F (2070 kPa at 21 deg C)** and **225 psig at 450 deg F (1550 kPa at 232 deg C)** ratings.
 - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with **420 psig at 70 deg F (2890 kPa at 21 deg C)** and **315 psig at 450 deg F (2170 kPa at 232 deg C)** ratings.
7. **Expansion Joints for Steel Piping NPS 2 (DN 50) and Smaller:** Stainless-steel fittings with threaded end connections.
 - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with **450 psig at 70 deg F (3100 kPa at 21 deg C)** and **325 psig at 600 deg F (2250 kPa at 315 deg C)** ratings.
 - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with **700 psig at 70 deg F (4830 kPa at 21 deg C)** and **515 psig at 600 deg F (3550 kPa at 315 deg C)** ratings.
8. **Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6 (DN 65 to DN 150):** Stainless-steel fittings with flanged end connections.
 - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with **200 psig at 70 deg F (1380 kPa at 21 deg C)** and **145 psig at 600 deg F (1000 kPa at 315 deg C)** ratings.
 - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with **275 psig at 70 deg F (1900 kPa at 21 deg C)** and **200 psig at 600 deg F (1380 kPa at 315 deg C)** ratings.
9. **Expansion Joints for Steel Piping NPS 8 to NPS 12 (DN 200 to DN 300):** Stainless-steel fittings with flanged end connections.



- a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F (860 kPa at 21 deg C) and 90 psig at 600 deg F (625 kPa at 315 deg C) ratings.
- b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C) ratings.

B. Metal-Bellows Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Adscos Manufacturing LLC.
 - b. American BOA, Inc.
 - c. Badger Industries, Inc.
 - d. Expansion Joint Systems, Inc.
 - e. Flex-Hose Co., Inc.
 - f. Flexicraft Industries.
 - g. Flex Pression Ltd.
 - h. Flex-Weld, Inc.
 - i. Flo Fab inc.
 - j. Hyspan Precision Products, Inc.
 - k. Metraflex, Inc.
 - l. Proco Products, Inc.
 - m. Senior Flexonics Pathway.
 - n. Tozen Corporation.
 - o. Unaflex.
 - p. Unisource Manufacturing, Inc.
 - q. Universal Metal Hose; a subsidiary of Hyspan Precision Products, Inc.
 - r. U.S. Bellows, Inc.
 - s. WahlcoMetroflex.
3. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
4. Type: Circular, corrugated bellows with external tie rods.
5. Minimum Pressure Rating: 150 psig (1035 kPa) unless otherwise indicated.
6. Configuration: Single joint with base and double joint with base class(es) unless otherwise indicated.
7. Expansion Joints for Copper Tubing: Single- or multi-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
 - a. End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: Solder joint or threaded.
 - b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Solder joint or threaded.
 - c. End Connections for Copper Tubing NPS 5 (DN 125) and Larger: Flanged.

C. Rubber Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:



2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Amber/Booth Company, Inc.; a div. of Vibration Isolation Products of Texas, Inc.
 - b. Flex-Hose Co., Inc.
 - c. Flexicraft Industries.
 - d. Flex-Weld, Inc.
 - e. Garlock Sealing Technologies.
 - f. General Rubber Corporation.
 - g. Mason Industries, Inc.; Mercer Rubber Co.
 - h. Metraflex, Inc.
 - i. Proco Products, Inc.
 - j. Red Valve Company, Inc.
 - k. Tozen Corporation.
 - l. Unaflex.
 - m. Unisource Manufacturing, Inc.
3. Standards: ASTM F 1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
4. Material: Fabric-reinforced rubber complying with FSA-NMEJ-703.
5. Arch Type: Single or multiple arches with external control rods.
6. Spherical Type: Single or multiple spheres with external control rods.
7. Minimum Pressure Rating for NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 150 psig (1035 kPa) at 220 deg F (104 deg C).
8. Minimum Pressure Rating for NPS 5 and NPS 6 (DN 125 and DN 150): 140 psig (966 kPa) at 200 deg F (93 deg C).
9. Minimum Pressure Rating for NPS 8 to NPS 12 (DN 200 to DN 300): 140 psig (966 kPa) at 180 deg F (82 deg C).
10. Retain only those materials in first three subparagraphs below that are required. If retaining more than one, indicate location of each on Drawings. See Evaluations for discussion of rubber materials.
11. Material for Fluids Containing Gas, Hydrocarbons, or Oil: Buna-N.
12. Material for Water: BR.
13. End Connections: Full-faced, integral steel flanges with steel retaining rings.

2.2 GROOVED-JOINT EXPANSION JOINTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 1. Anvil International, Inc.
 2. Shurjoint Piping Products.
 3. Victaulic Company.
- C. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.
- D. Standard: AWWA C606, for grooved joints.
- E. Nipples: ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.



- F. Couplings: Five, flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water, and bolts and nuts.

2.3 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - a. Adscos Manufacturing LLC.
 - b. Advanced Thermal Systems, Inc.
 - c. Flex-Hose Co., Inc.
 - d. Flexicraft Industries.
 - e. Flex-Weld, Inc.
 - f. Hyspan Precision Products, Inc.
 - g. Metraflex, Inc.
 - h. Senior Flexonics Pathway.
 - i. Unisource Manufacturing, Inc.
 - j. U.S. Bellows, Inc.
3. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - a. Stud: Threaded, zinc-coated carbon steel.
 - b. Expansion Plug: Zinc-coated steel.
 - c. Washer and Nut: Zinc-coated steel.
5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
 - b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
 - c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

- A. Install expansion joints of sizes matching sizes of piping in which they are installed.
- B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."



- C. Install rubber packless expansion joints according to FSA-NMEJ-702.
- D. Install grooved-joint expansion joints to grooved-end steel piping

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

- A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.
- C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.
- D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
- C. Attach guides to pipe and secure guides to building structure.
- D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- E. Anchor Attachments:
 - 1. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
 - 3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
- F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
 - 1. Anchor Attachment to Steel Structural Members: Attach by welding.
 - 2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
- G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION



SECTION 220523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Bronze angle valves.
2. Brass ball valves.
3. Bronze ball valves.
4. Iron ball valves.
5. Iron, single-flange butterfly valves.
6. Iron, grooved-end butterfly valves.
7. Bronze lift check valves.
8. Bronze swing check valves.
9. Iron swing check valves.
10. Iron swing check valves with closure control.
11. Iron, grooved-end swing check valves.
12. Iron, center-guided check valves.
13. Iron, plate-type check valves.
14. Bronze gate valves.
15. Iron gate valves.
16. Bronze globe valves.
17. Iron globe valves.
18. Lubricated plug valves.
19. Chainwheels.

- B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.



- G. SWP: Steam working pressure.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves **NPS 8 (DN 200)** and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves **NPS 6 (DN 150)** and smaller except plug valves.
 - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.



5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
 1. Gate Valves: With rising stem.
 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 2. Grooved: With grooves according to AWWA C606.
 3. Solder Joint: With sockets according to ASME B16.18.
 4. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

- A. Class 125, Bronze Angle Valves with Bronze Disc:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hammond Valve.
 - b. Milwaukee Valve Company.
 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron, bronze, or aluminum.
- B. Class 125, Bronze Angle Valves with Nonmetallic Disc:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. NIBCO INC.
 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: PTFE or TFE.



- g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.
- C. Class 150, Bronze Angle Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Stockham Division.
 - b. Kitz Corporation.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron, bronze, or aluminum.
- D. Class 150, Bronze Angle Valves with Nonmetallic Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Powell Valves.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: PTFE or TFE.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

2.3 BRASS BALL VALVES

- A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Kitz Corporation.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Design: One piece.



- d. Body Material: Forged brass.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Brass.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.
- B. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. DynaQuip Controls.
 - d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
 - e. Hammond Valve.
 - f. Jamesbury; a subsidiary of Metso Automation.
 - g. Jomar International, LTD.
 - h. Kitz Corporation.
 - i. Legend Valve.
 - j. Marwin Valve; a division of Richards Industries.
 - k. Milwaukee Valve Company.
 - l. NIBCO INC.
 - m. Red-White Valve Corporation.
 - n. RuB Inc.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.
- C. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
 - d. Hammond Valve.
 - e. Jamesbury; a subsidiary of Metso Automation.
 - f. Kitz Corporation.
 - g. Marwin Valve; a division of Richards Industries.
 - h. Milwaukee Valve Company.
 - i. RuB Inc.
 - 2. Description:



- a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.
- D. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hammond Valve.
 - b. Jamesbury; a subsidiary of Metso Automation.
 - c. Legend Valve.
 - d. Marwin Valve; a division of Richards Industries.
 - e. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Regular.
- E. Two-Piece, Regular-Port, Brass Ball Valves with Stainless-Steel Trim:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Jamesbury; a subsidiary of Metso Automation.
 - b. Marwin Valve; a division of Richards Industries.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Brass or bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Regular.
- F. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Jomar International, LTD.
 - b. Kitz Corporation.
 - c. Red-White Valve Corporation.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Three piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Brass.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

G. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Jomar International, LTD.
 - b. Kitz Corporation.
 - c. Marwin Valve; a division of Richards Industries.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Three piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.4 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Design: One piece.



- d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.
- B. One-Piece, Reduced-Port, Bronze Ball Valves with Stainless-Steel Trim:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig (4140 kPa).
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel, vented.
 - i. Port: Reduced.
- C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Hammond Valve.
 - e. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - f. Legend Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Red-White Valve Corporation.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.
- D. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.
- E. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. DynaQuip Controls.
 - f. Hammond Valve.
 - g. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - h. Milwaukee Valve Company.
 - i. NIBCO INC.
 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Regular.
- F. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:



- a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
2. Description:
- a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Regular.
- G. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. DynaQuip Controls.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Red-White Valve Corporation.
 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Three piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.
- H. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Three piece.



- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

2.5 IRON BALL VALVES

A. Class 125, Iron Ball Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Kitz Corporation.
 - d. Sure Flow Equipment Inc.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-72.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Split body.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Ends: Flanged.
 - f. Seats: PTFE or TFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel.
 - i. Port: Full.

2.6 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
 - d. Crane Co.; Crane Valve Group; Jenkins Valves.
 - e. Crane Co.; Crane Valve Group; Stockham Division.
 - f. DeZurik Water Controls.
 - g. Flo Fab Inc.
 - h. Hammond Valve.
 - i. Kitz Corporation.
 - j. Legend Valve.
 - k. Milwaukee Valve Company.
 - l. NIBCO INC.
 - m. Norriseal; a Dover Corporation company.
 - n. Red-White Valve Corporation.
 - o. Spence Strainers International; a division of CIRCOR International, Inc.
 - p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.



2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze.
- B. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
 - d. Crane Co.; Crane Valve Group; Jenkins Valves.
 - e. Crane Co.; Crane Valve Group; Stockham Division.
 - f. DeZurik Water Controls.
 - g. Flo Fab Inc.
 - h. Hammond Valve.
 - i. Kitz Corporation.
 - j. Legend Valve.
 - k. Milwaukee Valve Company.
 - l. NIBCO INC.
 - m. Norriseal; a Dover Corporation company.
 - n. Red-White Valve Corporation.
 - o. Spence Strainers International; a division of CIRCOR International, Inc.
 - p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: NBR.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze.
- C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. American Valve, Inc.
 - c. Conbraco Industries, Inc.; Apollo Valves.
 - d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
 - e. Crane Co.; Crane Valve Group; Center Line.



- f. Crane Co.; Crane Valve Group; Stockham Division.
 - g. DeZurik Water Controls.
 - h. Flo Fab Inc.
 - i. Hammond Valve.
 - j. Kitz Corporation.
 - k. Legend Valve.
 - l. Milwaukee Valve Company.
 - m. Mueller Steam Specialty; a division of SPX Corporation.
 - n. NIBCO INC.
 - o. Norriseal; a Dover Corporation company.
 - p. Spence Strainers International; a division of CIRCOR International, Inc.
 - q. Sure Flow Equipment Inc.
 - r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Nickel-plated or -coated ductile iron.
- D. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. American Valve, Inc.
 - c. Conbraco Industries, Inc.; Apollo Valves.
 - d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
 - e. Crane Co.; Crane Valve Group; Center Line.
 - f. Crane Co.; Crane Valve Group; Stockham Division.
 - g. DeZurik Water Controls.
 - h. Flo Fab Inc.
 - i. Hammond Valve.
 - j. Kitz Corporation.
 - k. Legend Valve.
 - l. Milwaukee Valve Company.
 - m. Mueller Steam Specialty; a division of SPX Corporation.
 - n. NIBCO INC.
 - o. Norriseal; a Dover Corporation company.
 - p. Spence Strainers International; a division of CIRCOR International, Inc.
 - q. Sure Flow Equipment Inc.
 - r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.



- e. Seat: NBR.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Nickel-plated or -coated ductile iron.
- E. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. American Valve, Inc.
 - c. Conbraco Industries, Inc.; Apollo Valves.
 - d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
 - e. Crane Co.; Crane Valve Group; Jenkins Valves.
 - f. Crane Co.; Crane Valve Group; Stockham Division.
 - g. DeZurik Water Controls.
 - h. Flo Fab Inc.
 - i. Hammond Valve.
 - j. Kitz Corporation.
 - k. Legend Valve.
 - l. Milwaukee Valve Company.
 - m. Mueller Steam Specialty; a division of SPX Corporation.
 - n. NIBCO INC.
 - o. Norriseal; a Dover Corporation company.
 - p. Red-White Valve Corporation.
 - q. Spence Strainers International; a division of CIRCOR International, Inc.
 - r. Sure Flow Equipment Inc.
 - s. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: **200 psig (1380 kPa)**.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Stainless steel.
- F. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABZ Valves and Controls; A div. of ABZ Manufacturing, Inc.
 - b. American Valve, Inc.
 - c. Conbraco Industries, Inc.; Apollo Valves.
 - d. Cooper Cameron Valves; A div. of Cooper Cameron Corp.
 - e. Crane Co.; Crane Valve Group; Jenkins Valves.
 - f. Crane Co.; Crane Valve Group; Stockham Div.
 - g. DeZurik Water Controls.
 - h. Flo Fab Inc.



- i. Hammond Valve.
- j. Kitz Corporation.
- k. Legend Valve.
- l. Milwaukee Valve Company.
- m. Mueller Steam Specialty; a division of SPX Corporation.
- n. NIBCO INC.
- o. Norriseal; a Dover Corporation company.
- p. Red-White Valve Corporation.
- q. Spence Strainers International; a division of CIRCOR International, Inc.
- r. Sure Flow Equipment Inc.
- s. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: NBR.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Stainless steel.

2.7 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Kennedy Valve; a division of McWane, Inc.
 - b. Shurjoint Piping Products.
 - c. Tyco Fire Products LP; Grinnell Mechanical Products.
 - d. Victaulic Company.
- 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 175 psig (1200 kPa).
 - c. Body Material: Coated, ductile iron.
 - d. Stem: Two-piece stainless steel.
 - e. Disc: Coated, ductile iron.
 - f. Seal: EPDM.

B. 300 CWP, Iron, Grooved-End Butterfly Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Mueller Steam Specialty; a division of SPX Corporation.
 - d. NIBCO INC.
 - e. Shurjoint Piping Products.
 - f. Tyco Fire Products LP; Grinnell Mechanical Products.
 - g. Victaulic Company.
- 2. Description:
 - a. Standard: MSS SP-67, Type I.



- b. NPS 8 (DN 200) and Smaller CWP Rating: 300 psig (2070 kPa).
- c. NPS 10 (DN 250) and Larger CWP Rating: 200 psig (1380 kPa).
- d. Body Material: Coated, ductile iron.
- e. Stem: Two-piece stainless steel.
- f. Disc: Coated, ductile iron.
- g. Seal: EPDM.

2.8 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
- 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Flo Fab Inc.
 - b. Hammond Valve.
 - c. Kitz Corporation.
 - d. Milwaukee Valve Company.
 - e. Mueller Steam Specialty; a division of SPX Corporation.
 - f. NIBCO INC.
 - g. Red-White Valve Corporation.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: NBR, PTFE, or TFE.

2.9 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.



- c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Red-White Valve Corporation.
 - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - l. Zy-Tech Global Industries, Inc.
2. Description:
- a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corporation.
 - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.
- C. Class 150, Bronze Swing Check Valves with Bronze Disc:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corporation.



- i. Zy-Tech Global Industries, Inc.
- 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.

2.10 IRON SWING CHECK VALVES

- A. Class 125, Iron Swing Check Valves with Metal Seats:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Legend Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Red-White Valve Corporation.
 - k. Sure Flow Equipment Inc.
 - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - m. Zy-Tech Global Industries, Inc.
 - 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.



- f. Trim: Bronze.
- g. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
- 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Composition.
 - g. Seat Ring: Bronze.
 - h. Disc Holder: Bronze.
 - i. Disc: PTFE or TFE.
 - j. Gasket: Asbestos free.

C. Class 250, Iron Swing Check Valves with Metal Seats:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 500 psig (3450 kPa).
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.

2.11 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. NIBCO INC.
- 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Clear or full waterway.



- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.
- h. Closure Control: Factory-installed, exterior lever and spring.

B. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.
 - h. Closure Control: Factory-installed, exterior lever and weight.

2.12 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Shurjoint Piping Products.
 - c. Tyco Fire Products LP; Grinnell Mechanical Products.
 - d. Victaulic Company.
- 2. Description:
 - a. CWP Rating: 300 psig (2070 kPa).
 - b. Body Material: ASTM A 536, ductile iron.
 - c. Seal: EPDM.
 - d. Disc: Spring-operated, ductile iron or stainless steel.

2.13 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. APCO Willamette Valve and Primer Corporation.
 - c. Crispin Valve.



- d. DFT Inc.
 - e. Flo Fab Inc.
 - f. GA Industries, Inc.
 - g. Hammond Valve.
 - h. Metraflex, Inc.
 - i. Milwaukee Valve Company.
 - j. Mueller Steam Specialty; a division of SPX Corporation.
 - k. NIBCO INC.
 - l. Spence Strainers International; a division of CIRCOR International, Inc.
 - m. Sure Flow Equipment Inc.
 - n. Val-Matic Valve & Manufacturing Corp.
 - o. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Compact wafer.
 - e. Seat: Bronze.
- B. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Flomatic Corporation.
 - e. Hammond Valve.
 - f. Metraflex, Inc.
 - g. Milwaukee Valve Company.
 - h. Mueller Steam Specialty; a division of SPX Corporation.
 - i. NIBCO INC.
 - j. Spence Strainers International; a division of CIRCOR International, Inc.
 - k. Sure Flow Equipment Inc.
 - l. Val-Matic Valve & Manufacturing Corp.
 - m. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- C. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. Val-Matic Valve & Manufacturing Corp.



2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Compact wafer.
 - e. Seat: Bronze.
- D. Class 150, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. Val-Matic Valve & Manufacturing Corp.
 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- E. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Flo Fab Inc.
 - e. Hammond Valve.
 - f. Metraflex, Inc.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Sure Flow Equipment Inc.
 - j. Val-Matic Valve & Manufacturing Corp.
 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: Bronze.
- F. Class 250, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Flomatic Corporation.



- e. Hammond Valve.
- f. Metraflex, Inc.
- g. Milwaukee Valve Company.
- h. Mueller Steam Specialty; a division of SPX Corporation.
- i. NIBCO INC.
- j. Val-Matic Valve & Manufacturing Corp.
- 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- G. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. Val-Matic Valve & Manufacturing Corp.
 - 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig (3450 kPa).
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: Bronze.
- H. Class 300, Iron, Globe, Center-Guided Check Valves with Metal Seat:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. Val-Matic Valve & Manufacturing Corp.
 - 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig (3450 kPa).
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: Bronze.
- I. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Flo Fab Inc.



- e. Hammond Valve.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Spence Strainers International; a division of CIRCOR International, Inc.
- i. Sure Flow Equipment Inc.
- j. Val-Matic Valve & Manufacturing Corp.
- 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Compact wafer.
 - e. Seat: EPDM or NBR.
- J. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. APCO Willamette Valve and Primer Corporation.
 - c. Crispin Valve.
 - d. DFT Inc.
 - e. GA Industries, Inc.
 - f. Hammond Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Sure Flow Equipment Inc.
 - j. Val-Matic Valve & Manufacturing Corp.
 - 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: EPDM or NBR.
- K. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. Val-Matic Valve & Manufacturing Corp.
 - 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Compact wafer.
 - e. Seat: EPDM or NBR.
- L. Class 150, Iron, Globe, Center-Guided Check Valves with Resilient Seat:



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Val-Matic Valve & Manufacturing Corp.
 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: EPDM or NBR.
- M. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Flo Fab Inc.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Sure Flow Equipment Inc.
 - i. Val-Matic Valve & Manufacturing Corp.
 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: EPDM or NBR.
- N. Class 250, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. DFT Inc.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Val-Matic Valve & Manufacturing Corp.
 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Material: ASTM A 126, gray iron.
 - d. Style: Globe, spring loaded.



- e. Ends: Flanged.
 - f. Seat: EPDM or NBR.
- O. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. Val-Matic Valve & Manufacturing Corp.
 - 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig (3450 kPa).
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Compact wafer, spring loaded.
 - e. Seat: EPDM or NBR.
- P. Class 300, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crispin Valve.
 - c. Val-Matic Valve & Manufacturing Corp.
 - 2. Description:
 - a. Standard: MSS SP-125.
 - b. CWP Rating: 500 psig (3450 kPa).
 - c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - d. Style: Globe, spring loaded.
 - e. Ends: Flanged.
 - f. Seat: EPDM or NBR.

2.14 IRON, PLATE-TYPE CHECK VALVES

- A. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Flomatic Corporation.
 - d. Mueller Steam Specialty; a division of SPX Corporation.
 - 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Wafer, spring-loaded plates.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Seat: Bronze.
- B. Class 150, Iron, Dual-Plate Check Valves with Metal Seat:



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Mueller Steam Specialty; a division of SPX Corporation.
 - d. Val-Matic Valve & Manufacturing Corp.
 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Design: Wafer, spring-loaded plates.
 - d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - e. Seat: Bronze.
- C. Class 250, Iron, Dual-Plate Check Valves with Metal Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Design: Wafer, spring-loaded plates.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Seat: Bronze.
- D. Class 300, Iron, Dual-Plate Check Valves with Metal Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Mueller Steam Specialty; a division of SPX Corporation.
 - d. Val-Matic Valve & Manufacturing Corp.
 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 500 psig (3450 kPa).
 - c. Body Design: Wafer, spring-loaded plates.
 - d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - e. Seat: Bronze.
- E. Class 125, Iron, Single-Plate Check Valves with Resilient Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Flo Fab Inc.
 - b. Sure Flow Equipment Inc.
 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 200 psig (1380 kPa).



- c. Body Design: Wafer, spring-loaded plate.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Seat: EPDM or NBR.
- F. Class 125, Iron, Dual-Plate Check Valves with Resilient Seat:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Cooper Cameron Valves TVB Techno.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. NIBCO INC.
 - f. Spence Strainers International; a division of CIRCOR International, Inc.
 - g. Sure Flow Equipment Inc.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Wafer, spring-loaded plates.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Seat: EPDM or NBR.
- G. Class 150, Iron, Dual-Plate Check Valves with Resilient Seat:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Val-Matic Valve & Manufacturing Corp.
 - 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Design: Wafer, spring-loaded plates.
 - d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - e. Seat: EPDM or NBR.
- H. Class 250, Iron, Wafer, Single-Plate Check Valves with Resilient Seat:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Sure Flow Equipment Inc.
 - 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Design: Wafer, spring-loaded plate.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Seat: EPDM or NBR.
- I. Class 250, Iron, Dual-Plate Check Valves with Resilient Seat:



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Sure Flow Equipment Inc.
 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Design: Wafer, spring-loaded plates.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Seat: EPDM or NBR.
- J. Class 300, Iron, Dual-Plate Check Valves with Resilient Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. APCO Willamette Valve and Primer Corporation.
 - b. Val-Matic Valve & Manufacturing Corp.
 2. Description:
 - a. Standard: API 594.
 - b. CWP Rating: 500 psig (3450 kPa).
 - c. Body Design: Wafer, spring-loaded plates.
 - d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
 - e. Seat: EPDM or NBR.

2.15 BRONZE GATE VALVES

- A. Class 125, NRS Bronze Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Red-White Valve Corporation.
 - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - l. Zy-Tech Global Industries, Inc.
 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.



- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron.

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - k. Zy-Tech Global Industries, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

C. Class 150, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hammond Valve.
 - b. Kitz Corporation.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. Powell Valves.
 - f. Red-White Valve Corporation.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

D. Class 150, RS Bronze Gate Valves:



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Kitz Corporation.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Powell Valves.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - i. Zy-Tech Global Industries, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

2.16 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Flo Fab Inc.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Legend Valve.
 - h. Milwaukee Valve Company.
 - i. NIBCO INC.
 - j. Powell Valves.
 - k. Red-White Valve Corporation.
 - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - m. Zy-Tech Global Industries, Inc.
2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Flo Fab Inc.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Legend Valve.
 - h. Milwaukee Valve Company.
 - i. NIBCO INC.
 - j. Powell Valves.
 - k. Red-White Valve Corporation.
 - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - m. Zy-Tech Global Industries, Inc.
 2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.
- C. Class 250, NRS, Iron Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. NIBCO INC.
 2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 500 psig (3450 kPa).
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.
- D. Class 250, OS&Y, Iron Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Powell Valves.



- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-70, Type I.
 - b. CWP Rating: 500 psig (3450 kPa).
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Disc: Solid wedge.
 - g. Packing and Gasket: Asbestos free.

2.17 BRONZE GLOBE VALVES

- A. Class 125, Bronze Globe Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Kitz Corporation.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Powell Valves.
 - h. Red-White Valve Corporation.
 - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - j. Zy-Tech Global Industries, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron.
- B. Class 125, Bronze Globe Valves with Nonmetallic Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. NIBCO INC.
 - d. Red-White Valve Corporation.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem: Bronze.
 - f. Disc: PTFE or TFE.



- g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.
- C. Class 150, Bronze Globe Valves with Nonmetallic Disc:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Hammond Valve.
 - c. Kitz Corporation.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Powell Valves.
 - g. Red-White Valve Corporation.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - i. Zy-Tech Global Industries, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: PTFE or TFE.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron.

2.18 IRON GLOBE VALVES

- A. Class 125, Iron Globe Valves:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Powell Valves.
 - i. Red-White Valve Corporation.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - k. Zy-Tech Global Industries, Inc.
 - 2. Description:
 - a. Standard: MSS SP-85, Type I.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Packing and Gasket: Asbestos free.



B. Class 250, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-85, Type I.
 - b. CWP Rating: 500 psig (3450 kPa).
 - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - d. Ends: Flanged.
 - e. Trim: Bronze.
 - f. Packing and Gasket: Asbestos free.

2.19 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Nordstrom Valves, Inc.
2. Description:
 - a. Standard: MSS SP-78, Type II.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Nordstrom Valves, Inc.
2. Description:
 - a. Standard: MSS SP-78, Type II.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.

C. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:



- a. Homestead Valve; a division of Olson Technologies, Inc.
- b. Milliken Valve Company.
- c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.
- D. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
 2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.
- E. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded Ends:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Nordstrom Valves, Inc.
 2. Description:
 - a. Standard: MSS SP-78, Type II.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.
- F. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged Ends:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Nordstrom Valves, Inc.
 2. Description:
 - a. Standard: MSS SP-78, Type II.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.



- G. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
 2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.
- H. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Homestead Valve; a division of Olson Technologies, Inc.
 - b. Milliken Valve Company.
 - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
 2. Description:
 - a. Standard: MSS SP-78, Type IV.
 - b. CWP Rating: 400 psig (2760 kPa).
 - c. Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
 - d. Pattern: Regular or short.
 - e. Plug: Cast iron or bronze with sealant groove.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.



- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, or gate valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: Globe or ball valves.
 - 4. Pump-Discharge Check Valves:
 - a. **NPS 2 (DN 50)** and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. **NPS 2-1/2 (DN 65)** and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check valves.
 - c. **NPS 2-1/2 (DN 65)** and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, **NPS 2 (DN 50)** and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, **NPS 5 (DN 125)** and Larger: Flanged ends.
 - 4. For Steel Piping, **NPS 2 (DN 50)** and Smaller: Threaded ends.
 - 5. For Steel Piping, **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, **NPS 5 (DN 125)** and Larger: Flanged ends.
 - 7. For Grooved-End Copper Tubing: Valve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe **NPS 2 (DN 50)** and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Bronze Angle Valves: Class 150, bronze disc.



3. Ball Valves: Three piece, full port, brass or bronze with bronze trim.
4. Bronze Swing Check Valves: Class 150, bronze disc.
5. Bronze Gate Valves: Class 150, RS.
6. Bronze Globe Valves: Class 150, bronze disc.

B. Pipe **NPS 2-1/2 (DN 65)** and Larger:

1. Iron Valves, **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
4. Iron, Grooved-End Butterfly Valves: 300 CWP.
5. Iron Swing Check Valves: Class 250, nonmetallic-to-metal seats.
6. Iron Swing Check Valves with Closure Control: Class 125, lever and spring weight.
7. Iron, Grooved-End Swing Check Valves: 300 CWP.
8. Iron, Center-Guided Check Valves: Class 250, compact-wafer, resilient seat.
9. Iron, Plate-Type Check Valves: Class 250; dual plate; resilient seat.
10. Iron Gate Valves: Class 250, OS&Y.
11. Iron Globe Valves: Class 250.

3.6 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe **NPS 2 (DN 50)** and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze nonmetallic disc.
3. Ball Valves: Three piece, full port, brass or bronze with bronze trim.
4. Bronze Swing Check Valves: Class 125, bronze disc.
5. Bronze Gate Valves: Class 150, RS.
6. Bronze Globe Valves: Class 150, bronze disc.

B. Pipe **NPS 2-1/2 (DN 65)** and Larger:

1. Iron Valves, **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
5. Iron, Grooved-End Swing Check Valves: 300 CWP.
6. Iron Gate Valves: Class 125, OS&Y.
7. Iron Globe Valves: Class 125.
8. Lubricated Plug Valves: Class 125, regular gland, threaded or flanged.

END OF SECTION



SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Fiberglass strut systems.
 - 5. Thermal-hanger shield inserts.
 - 6. Fastener systems.
 - 7. Pipe stands.
 - 8. Pipe positioning systems.
 - 9. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
 - 3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
 - 4. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Fiberglass pipe hangers.



3. Thermal-hanger shield inserts.
 4. Powder-actuated fastener systems.
 5. Pipe positioning systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
1. Trapeze pipe hangers. Include Product Data for components.
 2. Metal framing systems. Include Product Data for components.
 3. Fiberglass strut systems. Include Product Data for components.
 4. Pipe stands. Include Product Data for components.
 5. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
 2. AWS D1.2, "Structural Welding Code--Aluminum."
 3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Available Manufacturers:
1. AAA Technology & Specialties Co., Inc.
 2. Bergen-Power Pipe Supports.
 3. B-Line Systems, Inc.; a division of Cooper Industries.
 4. Carpenter & Paterson, Inc.
 5. Empire Industries, Inc.
 6. ERICO/Michigan Hanger Co.
 7. Globe Pipe Hanger Products, Inc.
 8. Grinnell Corp.
 9. GS Metals Corp.
 10. National Pipe Hanger Corporation.



11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Available Manufacturers:
 1. B-Line Systems, Inc.; a division of Cooper Industries.
 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 3. GS Metals Corp.
 4. Power-Strut Div.; Tyco International, Ltd.
 5. Thomas & Betts Corporation.
 6. Tolco Inc.
 7. Unistrut Corp.; Tyco International, Ltd.

- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Available Manufacturers:
 1. Carpenter & Paterson, Inc.
 2. ERICO/Michigan Hanger Co.
 3. PHS Industries, Inc.
 4. Pipe Shields, Inc.
 5. Rilco Manufacturing Company, Inc.
 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.



- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend **2 inches (50 mm)** beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Available Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Available Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.7 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
 - 1. Available Manufacturers:
 - a. ERICO/Michigan Hanger Co.
 - b. MIRO Industries.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
 - 1. Available Manufacturers:
 - a. MIRO Industries.
- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 1. Available Manufacturers:
 - a. ERICO/Michigan Hanger Co.
 - b. MIRO Industries.
 - c. Portable Pipe Hangers.
 - 2. Base: Plastic.



3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
1. Available Manufacturers:
 - a. Portable Pipe Hangers.
 2. Bases: One or more plastic.
 3. Vertical Members: Two or more protective-coated-steel channels.
 4. Horizontal Member: Protective-coated-steel channel.
 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Available Manufacturers:
1. C & S Mfg. Corp.
 2. HOLDRITE Corp.; Hubbard Enterprises.
 3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, **NPS 1/2 to NPS 30 (DN 15 to DN 750)**.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of **120 to 450 deg F (49 to 232 deg C)** pipes, **NPS 4 to NPS 16 (DN 100 to DN 400)**, requiring up to **4 inches (100 mm)** of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, **NPS 3/4 to NPS 24 (DN 20 to DN 600)**, requiring clamp flexibility and up to **4 inches (100 mm)** of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, **NPS 1/2 to NPS 24 (DN 15 to DN 600)**, if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes, **NPS 1/2 to NPS 4 (DN 15 to DN 100)**, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, **NPS 3/4 to NPS 8 (DN 20 to DN 200)**.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, **NPS 1/2 to NPS 8 (DN 15 to DN 200)**.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, **NPS 1/2 to NPS 8 (DN 15 to DN 200)**.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, **NPS 1/2 to NPS 2 (DN 15 to DN 50)**.
 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, **NPS 3/8 to NPS 8 (DN 10 to DN 200)**.
 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, **NPS 3/8 to NPS 3 (DN 10 to DN 80)**.
 12. U-Bolts (MSS Type 24): For support of heavy pipes, **NPS 1/2 to NPS 30 (DN 15 to DN 750)**.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, **NPS 4 to NPS 36 (DN 100 to DN 900)**, with steel pipe base stanchion support and cast-iron floor flange.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, **NPS 4 to NPS 36 (DN 100 to DN 900)**, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, **NPS 2-1/2 to NPS 36 (DN 65 to DN 900)**, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, **NPS 1 to NPS 30 (DN 25 to DN 750)**, from 2 rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, **NPS 2-1/2 to NPS 20 (DN 65 to DN 500)**, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, **NPS 2 to NPS 42 (DN 50 to DN 1050)**, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, **NPS 2 to NPS 24 (DN 50 to DN 600)**, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, **NPS 2 to NPS 30 (DN 50 to DN 750)**, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, **NPS 3/4 to NPS 20 (DN 20 to DN 500)**.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, **NPS 3/4 to NPS 20 (DN 20 to DN 500)**, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to **6 inches (150 mm)** for heavy loads.
 2. Steel Clevises (MSS Type 14): For **120 to 450 deg F (49 to 232 deg C)** piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For **120 to 450 deg F (49 to 232 deg C)** piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (680 kg).
 - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.



- c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.



2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
 - I. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
 - J. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
 - K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
 - L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
 - M. Install lateral bracing with pipe hangers and supports to prevent swaying.
 - N. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2 (DN 65)** and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
 - O. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
 - P. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
 - Q. Insulated Piping: Comply with the following:
 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe **NPS 4 (DN 100)** and larger if pipe is installed on rollers.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe **NPS 4 (DN 100)** and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. **NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.**

- b. **NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.**
- c. **NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.**
- d. **NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.**
- e. **NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.**
5. Pipes **NPS 8 (DN 200)** and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to **1-1/2 inches (40 mm)**.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.



1. Apply paint by brush or spray to provide minimum dry film thickness of **2.0 mils** (0.05 mm).
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections. Section "High-Performance Coatings."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION



**SECTION 220700
PLUMBING INSULATION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Insulation Materials:
 - a. Calcium silicate.
 - b. Cellular glass.
 - c. Flexible elastomeric.
 - d. Mineral fiber.
 - e. Phenolic.
 - f. Polyisocyanurate.
 - g. Polyolefin.
 - h. Polystyrene.
 2. Insulating cements.
 3. Adhesives.
 4. Mastics.
 5. Lagging adhesives.
 6. Sealants.
 7. Factory-applied jackets.
 8. Field-applied fabric-reinforcing mesh.
 9. Field-applied cloths.
 10. Field-applied jackets.
 11. Tapes.
 12. Securements.
 13. Corner angles.
- B. Related Sections include the following:
1. Division 21 Section "Fire-Suppression Systems Insulation."
 2. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. LEED Submittal:
1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
- C. Shop Drawings:
1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 2. Detail attachment and covering of heat tracing inside insulation.



3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.



- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Calcium Silicate:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Industrial Insulation Group (The); Thermo-12 Gold.
 - 2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - 3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - 4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
- G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cell-U-Foam Corporation; Ultra-CUF.
 - b. Pittsburgh Corning Corporation; Foamglas Super K.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 6. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
 - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- H. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.



- I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; All-Service Duct Wrap.
- J. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville; HTB 23 Spin-Glas.
 - b. Owens Corning; High Temperature Flexible Batt Insulations.
- K. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Division 01 Section "Product Requirements."
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.
- L. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fibrex Insulations Inc.; FBX.
 - b. Johns Manville; 1000 Series Spin-Glas.
 - c. Owens Corning; High Temperature Industrial Board Insulations.
 - d. Rock Wool Manufacturing Company; Delta Board.
 - e. Roxul Inc.; Roxul RW.
 - f. Thermafiber; Thermafiber Industrial Felt.
- M. Mineral-Fiber, Preformed Pipe Insulation:



1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000(Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A,. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- N. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; CrimpWrap.
 - b. Johns Manville; MicroFlex.
 - c. Knauf Insulation; Pipe and Tank Insulation.
 - d. Manson Insulation Inc.; AK Flex.
 - e. Owens Corning; Fiberglas Pipe and Tank Insulation.
- O. Phenolic:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Kingspan Corp.; Koolphen K.
 2. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
 3. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
 4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
 5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
 - a. Preformed Pipe Insulation: [None] [ASJ].
 - b. Board for Equipment Applications: [None] [ASJ].
- P. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Apache Products Company; ISO-25.
 - b. Dow Chemical Company (The); Trymer.
 - c. Duna USA Inc.; Corafoam.



- d. Elliott Company; Elfoam.
 - 2. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F (0.027 W/m x K) at 75 deg F (24 deg C) after 180 days of aging.
 - 3. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less for thickness up to 1-1/2 inches (38 mm) as tested by ASTM E 84.
 - 4. Fabricate shapes according to ASTM C 450 and ASTM C 585.
 - 5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.
 - a. Pipe Applications: None.
 - b. Equipment Applications: None.
- Q. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armacell LLC; Tubolit.
 - b. Nomaco Inc.; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.
 - c. RBX Corporation; Therma-cell.
- R. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F (0.038 W/m x K) after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The); Styrofoam.
 - b. Knauf Insulation; Knauf Polystyrene.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Insulco, Division of MFS, Inc.; Triple I.
 - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. P. K. Insulation Mfg. Co., Inc.; Thermal-V-Kote.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.



1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Insulco, Division of MFS, Inc.; SmoothKote.
 - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
 - c. Rock Wool Manufacturing Company; Delta One Shot.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-97.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
 - c. Marathon Industries, Inc.; 290.
 - d. Mon-Eco Industries, Inc.; 22-30.
 - e. Vimasco Corporation; 760.
 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-96.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-33.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA Inc.; Aero seal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.



1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of **minus 20 to plus 140 deg F (29 to plus 60 deg C)**.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-96.
 - b. Foster Products Corporation, H. B. Fuller Company; 97-13.
- G. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- H. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-30.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-35.
 - c. ITW TACC, Division of Illinois Tool Works; CB-25.
 - d. Marathon Industries, Inc.; 501.
 - e. Mon-Eco Industries, Inc.; 55-10.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
 3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; Encacel.
 - b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
 - c. Marathon Industries, Inc.; 570.
 - d. Mon-Eco Industries, Inc.; 55-70.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
 3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.



5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-10.
 - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
 - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
 - d. Marathon Industries, Inc.; 550.
 - e. Mon-Eco Industries, Inc.; 55-50.
 - f. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-52.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-42.
 - c. Marathon Industries, Inc.; 130.
 - d. Mon-Eco Industries, Inc.; 11-30.
 - e. Vimasco Corporation; 136.
3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
4. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
5. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-76.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.



- f. Vimasco Corporation; 750.
 2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-70.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
 3. Materials shall be compatible with insulation materials, jackets, and substrates.
 4. Permanently flexible, elastomeric sealant.
 5. Service Temperature Range: **Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).**
 6. Color: White or gray.
 7. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: **Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).**
 5. Color: Aluminum.
 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-76.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: **Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).**
 5. Color: White.
 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 4. PVDC Jacket for Indoor Applications: **4-mil- (0.10-mm-)** thick, white PVDC biaxially oriented barrier film with a permeance at **0.02 perms (0.013 metric perms)** when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 5. PVDC Jacket for Outdoor Applications: **6-mil- (0.15-mm-)** thick, white PVDC biaxially oriented barrier film with a permeance at **0.01 perms (0.007 metric perms)** when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately **2 oz./sq. yd. (68 g/sq. m)** with a thread count of **10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm)** for covering pipe and pipe fittings.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Vimasco Corporation; Elastafab 894.
- B. Woven Glass-Fiber Fabric for Equipment Insulation: Approximately **6 oz./sq. yd. (203 g/sq. m)** with a thread count of **5 strands by 5 strands/sq. inch (2 strands by 2 strands/sq. mm)** for covering equipment.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:



- a. Childers Products, Division of ITW; Chil-Glas No. 5.
- C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm), in a Leno weave, for equipment and pipe.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.

2.9 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.10 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: Color-code jackets based on system. Color as selected by Architect.
 - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 - 5. Factory-fabricated tank heads and tank side panels.
- C. Metal Jacket:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.



2. Aluminum Jacket: Comply with **ASTM B 209 (ASTM B 209M)**, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: **2.5-mil- (0.063-mm-)** thick Polysurlyn.
 - d. Moisture Barrier for Outdoor Applications: **2.5-mil- (0.063-mm-)** thick Polysurlyn.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
 3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
 - a. Factory cut and rolled to size.
 - b. Material, finish, and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: **2.5-mil- (0.063-mm-)** thick Polysurlyn.
 - d. Moisture Barrier for Outdoor Applications: **2.5-mil- (0.063-mm-)** thick Polysurlyn.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- D. Underground Direct-Buried Jacket: **125-mil- (3.2-mm-)** thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pittsburgh Corning Corporation; Pittwrap.
 - b. Polyguard; Insulrap No Torch 125.

2.11 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.



1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches (75 mm).
 3. Thickness: 11.5 mils (0.29 mm).
 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches (75 mm).
 3. Thickness: 6.5 mils (0.16 mm).
 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 2. Width: 2 inches (50 mm).
 3. Thickness: 6 mils (0.15 mm).
 4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.



- c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
 2. Width: 2 inches (50 mm).
 3. Thickness: 3.7 mils (0.093 mm).
 4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.
- E. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
 2. Width: 3 inches (75 mm).
 3. Film Thickness: 6 mils ((0.15 mm)).
 4. Adhesive Thickness: 1.5 mils (0.04 mm).
 5. Elongation at Break: 145 percent.
 6. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.

2.12 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.



- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
 - c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.



- b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
- c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
- d. Adhesive-backed base with a peel-off protective cover.
- 6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- D. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

2.13 CORNER ANGLES

- A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch (25 by 25 mm), stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.



PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer **5 mils (0.127 mm)** thick and an epoxy finish **5 mils (0.127 mm)** thick if operating in a temperature range between **140 and 300 deg F (60 and 149 deg C)**. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between **32 and 300 deg F (0 and 149 deg C)** with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.



- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.



5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least **2 inches (50 mm)** below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least **2 inches (50 mm)**.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.



2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange



cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least **2 inches (50 mm)** over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 POLYSTYRENE INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:



1. Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
 2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
 3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed **1-1/2-inch (38-mm)** thickness.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness as pipe insulation.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed section of polystyrene insulation to valve body.
 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with **2-inch (50-mm)** overlap at seams and joints.
 2. Embed glass cloth between two **0.062-inch- (1.6-mm-)** thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with **1-1/2-inch (38-mm)** laps at longitudinal seams and **3-inch- (75-mm-)** wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with **1-inch (25-mm)** overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams



along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with **2-inch (50-mm)** overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands **12 inches (300 mm)** o.c. and at end joints.
- E. Where PVDC jackets are indicated, install as follows:
1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
 2. Wrap factory-presize jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of **2 inches (50 mm)** over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
 3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
 4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of **33-1/2 inches (850 mm)** or less. The **33-1/2-inch- (850-mm-)** circumference limit allows for **2-inch- (50-mm-)** overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
 5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.9 FINISHES

- A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.



- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
 - 2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Chilled Water (Potable):
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 - d. Phenolic: 1 inch (25 mm) thick.
 - e. Polyisocyanurate: 1 inch (25 mm) thick.
 - f. Polyolefin: 1 inch (25 mm) thick.
- B. Stormwater Horizontal Running Overhead in Conditioned Spaces:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Flexible Elastomeric: 1 inch (25 mm) thick.
- C. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches (38 mm) thick.
 - b. Flexible Elastomeric: 3/4 inch (19 mm) thick.



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PROJECT: C23-MDPLS-01-ESP**

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END OF SECTION



**SECTION 221116
DOMESTIC WATER PIPING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 2. Encasement for piping.
 3. Specialty valves.
 4. Flexible connectors.
 5. Water meters furnished by utility company for installation by Contractor.
 6. Water meters.
 7. Escutcheons.
 8. Sleeves and sleeve seals.
 9. Wall penetration systems.
- B. Related Section:
1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 SUBMITTALS

- A. Product Data: For the following products:
1. Specialty valves.
 2. Transition fittings.
 3. Dielectric fittings.
 4. Flexible connectors.
 5. Water meters.
 6. Backflow preventers and vacuum breakers.
 7. Escutcheons.
 8. Sleeves and sleeve seals.
 9. Water penetration systems.
- B. LEED Submittal:
1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
- C. Water Samples: Specified in "Cleaning" Article.
- D. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
1. Fire-suppression-water piping.
 2. Domestic water piping.
 3. Compressed air piping.



4. HVAC hydronic piping.

E. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components.

C. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Owner's written permission.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: **ASTM B 88, Type L (ASTM B 88M, Type B)** water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Elkhart Products Corporation; Industrial Division.
 - 2) NIBCO INC.
 - 3) Viega; Plumbing and Heating Systems.
 - b. **NPS 2 (DN 50)** and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
6. Copper Push-on-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) NVent LLC.



- b. Description: Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22; with stainless-steel teeth and EPDM-rubber O-ring seal in each end instead of solder-joint ends.
 - 7. Copper-Tube Extruded-Tee Connections:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) T-DRILL Industries Inc.
 - b. Description: Tee formed in copper tube according to ASTM F 2014.
 - 8. Grooved-Joint Copper-Tube Appurtenances:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Anvil International.
 - 2) Shurjoint Piping Products.
 - 3) Victaulic Company.
 - b. Copper Grooved-End Fittings: **ASTM B 75 (ASTM B 75M)** copper tube or ASTM B 584 bronze castings.
 - c. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.
- B. Soft Copper Tube: **ASTM B 88, Type L (ASTM B 88M, Type B)** water tube, annealed temper.
 - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 2. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Elkhart Products Corporation; Industrial Division.
 - 2) NIBCO INC.
 - 3) Viega; Plumbing and Heating Systems.
 - b. **NPS 2 (DN 50)** and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. **NPS 3 and NPS 4 (DN 80 and DN 100)**: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.
 - 2. Compact-Pattern, Mechanical-Joint Fittings: AWWA C153, ductile iron.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
 - a. Gaskets: AWWA C111, rubber.
 - 2. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.
 - a. Gaskets: AWWA C111, rubber.



- C. Plain-End, Ductile-Iron Pipe: AWWA C151.
 - 1. Grooved-Joint, Ductile-Iron-Pipe Appurtenances:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Anvil International.
 - 2) Shurjoint Piping Products.
 - 3) Star Pipe Products.
 - 4) Victaulic Company.
 - b. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
 - c. Grooved-End, Ductile-Iron-Pipe Couplings: AWWA C606 for ductile-iron-pipe dimensions. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

- A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B, Standard Weight. Include ends matching joining method.
 - 1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.
 - 2. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 - 3. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
 - 4. Flanges: ASME B16.1, Class 125, cast iron.
 - 5. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Anvil International.
 - 2) Shurjoint Piping Products.
 - 3) Star Pipe Products.
 - 4) Victaulic Company.
 - b. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - c. Grooved-End-Pipe Couplings for Galvanized-Steel Piping: AWWA C606 for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.5 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.



2.6 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105.
- B. Form: Sheet or Tube.
- C. Material: LLDPE film of 0.008-inch (0.20-mm) LLDPE film of 0.008-inch (0.20-mm) minimum thickness or high-density, cross-laminated PE film of 0.004-inch (0.10-mm) minimum thickness.
- D. Color: Black or Natural.

2.7 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.8 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. EPCO Sales, Inc.
 - d. Hart Industries International, Inc.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Water Control Products.
 - 2. Description:
 - a. Pressure Rating: 250 psig (1725 kPa) at 180 deg F (82 deg C).
 - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. EPCO Sales, Inc.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Factory-fabricated, bolted, companion-flange assembly.
 - b. Pressure Rating: 300 psig (2070 kPa).
 - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:



1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
2. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig (1035 kPa).
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Calpico, Inc.
 - b. Lochinvar Corporation.
2. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - c. End Connections: Female threaded.
 - d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Perfection Corporation; a subsidiary of American Meter Company.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Company.
2. Description:
 - a. Electroplated steel nipple complying with ASTM F 1545.
 - b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - c. End Connections: Male threaded or grooved.
 - d. Lining: Inert and noncorrosive, propylene.

2.9 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Flex-Hose Co., Inc.
 2. Flexicraft Industries.
 3. Flex Pression, Ltd.
 4. Flex-Weld, Inc.
 5. Hyspan Precision Products, Inc.
 6. Mercer Rubber Co.
 7. Metraflex, Inc.
 8. Proco Products, Inc.
 9. Tozen Corporation.



10. Unaflex, Inc.
 11. Universal Metal Hose; a Hyspan company
- B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
1. Working-Pressure Rating: Minimum 250 psig (1725 kPa).
 2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
 3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.
- C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: Minimum 250 psig (1725 kPa).
 2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
 3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

2.10 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated or rough-brass finish with setscrews.
- C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One Piece, Stamped Steel: Chrome-plated finish with setscrew or spring clips.
- E. Split Casting, Cast Brass: Polished, chrome-plated or rough-brass finish with concealed hinge and setscrew.
- F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew or spring clips.
- G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.11 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- C. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- D. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- E. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- F. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- G. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with setscrews.



2.12 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex, Inc.
 - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.13 WALL PENETRATION SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. SIGMA.
- B. Description: Wall-sleeve assembly, consisting of housing and gland, gaskets, and pipe sleeve.
 - 1. Carrier-Pipe Deflection: Up to 5 percent without leakage.
 - 2. Housing: Ductile-iron casting with hub, waterstop, anchor ring, and locking devices. Include gland, bolts, and nuts.
 - 3. Housing-to-Sleeve Gasket: EPDM rubber.
 - 4. Housing-to-Carrier-Pipe Gasket: AWWA C111, EPDM rubber.
 - 5. Pipe Sleeve: AWWA C151, ductile-iron pipe or ASTM A 53/A 53M, Schedule 40, zinc-coated steel pipe.

2.14 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.



- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- H. Install domestic water piping level without pitch and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping adjacent to equipment and specialties to allow service and maintenance.
- O. Install piping to permit valve servicing.
- P. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- Q. Install piping free of sags and bends.
- R. Install fittings for changes in direction and branch connections.
- S. Install PEX piping with loop at each change of direction of more than 90 degrees.
- T. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- U. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- V. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.



3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- I. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.
- J. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.
- K. Steel-Piping Grooved Joints: Cut or roll groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- M. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.
- N. PEX Piping Joints: Join according to ASTM F 1807.

- O. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping **NPS 2 (DN 50)** and smaller. Use butterfly or gate valves for piping **NPS 2-1/2 (DN 65)** and larger.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping **NPS 2 (DN 50)** and smaller and butterfly valves for piping **NPS 2-1/2 (DN 65)** and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.
- E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. **NPS 1-1/2 (DN 40)** and Smaller: Fitting-type coupling.
 - 2. **NPS 2 (DN 50)** and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping **NPS 2 (DN 50)** and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for **NPS 2 (DN 50)** and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: Use dielectric flange kits.
- D. Dielectric Fittings for **NPS 5 (DN 125)** and Larger: Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet (30 m) If Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - 4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 - 5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 - 6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 - 7. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
- F. Install supports for vertical copper tubing every 10 feet (3 m).
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - 3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - 4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 - 5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
 - 6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
 - 7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
 - 8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.
- H. Install supports for vertical steel piping every 15 feet (4.5 m).
- I. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.

3. **NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.**
 4. **NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.**
 5. **NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.**
 6. **NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.**
- J. Install supports for vertical CPVC piping every **60 inches (1500 mm)** for **NPS 1 (DN 25)** and smaller, and every **72 inches (1800 mm)** for **NPS 1-1/4 (DN 32)** and larger.
- K. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:
1. **NPS 1 (DN 25) and Smaller: 32 inches (815 mm) with 3/8-inch (10-mm) rod.**
- L. Install hangers for vertical PEX piping every **48 inches (1200 mm)**.
- M. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. **NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.**
 2. **NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.**
 3. **NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.**
 4. **NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.**
 5. **NPS 8 (DN 200): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.**
- N. Install supports for vertical PVC piping every **48 inches (1200 mm)**.
- O. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for **NPS 2-1/2 (DN 65)** and larger.

3.10 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.



- B. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish stamped steel with spring clips.
 - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
 - 5. Bare Piping in Equipment Rooms: One piece, cast brass.
 - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
- C. Escutcheons for Existing Piping:
 - 1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
 - 2. Insulated Piping: Split plate, stamped steel with concealed hinge and spring clips.
 - 3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
 - 4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
 - 5. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with rough-brass finish.
 - 6. Bare Piping in Equipment Rooms: Split casting, cast brass.
 - 7. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

3.11 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using wall penetration systems specified in this Section.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.

- a. Extend sleeves **2 inches (50 mm)** above finished floor level.
- b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to **2 inches (50 mm)** above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
3. Sleeves for Piping Passing through Gypsum-Board Partitions:
 - a. Steel pipe sleeves for pipes smaller than **NPS 6 (DN 150)**.
 - b. Galvanized-steel sheet sleeves for pipes **NPS 6 (DN 150)** and larger.
 - c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
4. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
5. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than **NPS 6 (DN 150)**.
 - b. Cast-iron wall pipe sleeves for pipes **NPS 6 (DN 150)** and larger.
 - c. Install sleeves that are large enough to provide **1-inch (25-mm)** annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
 - d. Do not use sleeves when wall penetration systems are used.
6. Sleeves for Piping Passing through Interior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than **NPS 6 (DN 150)**.
 - b. Galvanized-steel sheet sleeves for pipes **NPS 6 (DN 150)** and larger.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.12 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.13 WALL PENETRATION SYSTEM INSTALLATION

- A. Install wall penetration systems in new, exterior concrete walls.
- B. Assemble wall penetration system components with sleeve pipe. Install so that end of sleeve pipe and face of housing are flush with wall. Adjust locking devices to secure sleeve pipe in housing.

3.14 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.15 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:



1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.16 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.



3.17 CLEANING

- A. Clean and disinfect potable and non-potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Clean non-potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.18 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought- copper solder-joint fittings; and soldered joints.
- E. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought- copper solder-joint fittings; and brazed joints.



- F. Aboveground domestic water piping, **NPS 5 to NPS 8 (DN 125 to DN 200)**, shall be one of the following:
1. Hard copper tube, **ASTM B 88, Type L (ASTM B 88M, Type B)**; cast- or wrought- copper solder-joint fittings; and brazed joints.
 2. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
 3. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

3.19 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use ball or gate valves for piping **NPS 2 (DN 50)** and smaller. Use butterfly, ball, or gate valves with flanged ends for piping **NPS 2-1/2 (DN 65)** and larger.
 2. Throttling Duty: Use ball or globe valves for piping **NPS 2 (DN 50)** and smaller. Use butterfly or ball valves with flanged ends for piping **NPS 2-1/2 (DN 65)** and larger.
 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION



SECTION 221119
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Balancing valves.
 - 5. Temperature-actuated water mixing valves.
 - 6. Strainers.
 - 7. Outlet boxes.
 - 8. Hose stations.
 - 9. Hose bibbs.
 - 10. Wall hydrants.
 - 11. Drain valves.
 - 12. Water hammer arresters.
 - 13. Air vents.
 - 14. Trap-seal primer valves.
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Division 22 Section "Domestic Water Piping" for water meters.
 - 3. Division 22 Section "Domestic Water Filtration Equipment" for water filters in domestic water piping.
 - 4. Division 22 Section "Healthcare Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
 - 5. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.
 - 6. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: **125 psig (860 kPa)**, unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.



1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Rain Bird Corporation.
 - f. Toro Company (The); Irrigation Div.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Zurn Plumbing Products Group; Wilkins Div.
 - 3. Standard: ASSE 1001.
 - 4. Size: **NPS 1/4 to NPS 3 (DN 8 to DN 80)**, as required to match connected piping.
 - 5. Body: Bronze.
 - 6. Inlet and Outlet Connections: Threaded.
 - 7. Finish: Chrome plated.
- B. Hose-Connection Vacuum Breakers:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrowhead Brass Products, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. Legend Valve.
 - e. MIFAB, Inc.
 - f. Prier Products, Inc.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Woodford Manufacturing Company.
 - i. Zurn Plumbing Products Group; Light Commercial Operation.
 - j. Zurn Plumbing Products Group; Wilkins Div.



3. Standard: ASSE 1011.
4. Body: Bronze, nonremovable, with manual drain.
5. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
6. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide Insert manufacturer's name; product name or designation or a comparable product by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Toro Company (The); Irrigation Div.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Plumbing Products Group; Wilkins Div.
4. Standard: ASSE 1020.
5. Operation: Continuous-pressure applications.
6. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
7. Accessories:
 - a. Valves: Ball type, on inlet and outlet.

2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Honeywell Water Controls.
 - e. Legend Valve.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Plumbing Products Group; Wilkins Div.
3. Standard: ASSE 1012.
4. Operation: Continuous-pressure applications.
5. Size: NPS 3/4 (DN 20).
6. Body: Bronze.
7. End Connections: Union, solder joint.
8. Finish: Chrome plated.

B. Reduced-Pressure-Principle Backflow Preventers:



1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 4. Standard: ASSE 1013.
 5. Operation: Continuous-pressure applications.
 6. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
 7. Body: Bronze for NPS 2 (DN 50) and smaller; steel with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
 8. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
 9. Configuration: Designed for horizontal, straight through flow.
 10. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- C. Double-Check Backflow-Prevention Assemblies:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
 4. Standard: ASSE 1015.
 5. Operation: Continuous-pressure applications, unless otherwise indicated.
 6. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
 7. Body: Bronze for NPS 2 (DN 50) and smaller; steel with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
 8. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
 9. Configuration: Designed for horizontal, straight through flow.
 10. Accessories:



- a. Valves: Ball type with threaded ends on inlet and outlet of **NPS 2 (DN 50)** and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of **NPS 2-1/2 (DN 65)** and larger.
- D. Beverage-Dispensing-Equipment Backflow Preventers:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
 3. Standard: ASSE 1022.
 4. Operation: Continuous-pressure applications.
 5. Size: **NPS 1/4 or NPS 3/8 (DN 8 or DN 10)**.
 6. Body: Stainless steel.
 7. End Connections: Threaded.
- E. Dual-Check-Valve Backflow Preventers:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Ford Meter Box Company, Inc. (The).
 - f. Honeywell Water Controls.
 - g. Legend Valve.
 - h. McDonald, A. Y. Mfg. Co.
 - i. Mueller Co.; Water Products Div.
 - j. Watts Industries, Inc.; Water Products Div.
 - k. Zurn Plumbing Products Group; Wilkins Div.
 3. Standard: ASSE 1024.
 4. Operation: Continuous-pressure applications.
 5. Size: .See drawings.
 6. Body: Bronze with union inlet.
- F. Hose-Connection Backflow Preventers:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Woodford Manufacturing Company.
 3. Standard: ASSE 1052.



4. Operation: Up to 10-foot head of water (30-kPa) back pressure.
5. Inlet Size: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).
6. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
7. Capacity: At least 3-gpm (0.19-L/s) flow.

G. Backflow-Preventer Test Kits:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Conbraco Industries, Inc.
 - b. FEBCO; SPX Valves & Controls.
 - c. Flomatic Corporation.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
4. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
3. Standard: ASSE 1003.
4. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
5. Size: See drawings.
6. Body: Bronze with chrome-plated finish for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
7. Valves for Booster Heater Water Supply: Include integral bypass.
8. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

B. Water Control Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:



- a. CLA-VAL Automatic Control Valves.
- b. Flomatic Corporation.
- c. OCV Control Valves.
- d. Watts Industries, Inc.; Ames Fluid Control Systems.
- e. Watts Industries, Inc.; Watts ACV.
- f. Zurn Plumbing Products Group; Wilkins Div.
4. Description: Pilot-operation, diaphragm-type, single-seated main water control valve.
5. Pressure Rating: Initial working pressure of **150 psig (1035 kPa)** minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
6. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
 - a. Size: See drawings if applicable.
 - b. Pattern: Angle-valve design.
 - c. Trim: Stainless steel.
7. End Connections: Threaded for **NPS 2 (DN 50)** and smaller; flanged for **NPS 2-1/2 (DN 65)** and larger.

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armstrong International, Inc.
 - b. Flo Fab Inc.
 - c. ITT Industries; Bell & Gossett Div.
 - d. NIBCO INC.
 - e. TAC Americas.
 - f. Taco, Inc.
 - g. Watts Industries, Inc.; Water Products Div.
4. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
5. Body: bronze,
6. Size: Same as connected piping, but not larger than **NPS 2 (DN 50)**.
7. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armstrong International, Inc.
 - b. Flo Fab Inc.
 - c. ITT Industries; Bell & Gossett Div.
 - d. NIBCO INC.



- e. TAC Americas.
 - f. Watts Industries, Inc.; Water Products Div.
 4. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
 5. Size: Same as connected piping, but not smaller than **NPS 2-1/2 (DN 65)**.
- C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
- D. Memory-Stop Balancing Valves:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corp.
 3. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
 4. Pressure Rating: **400-psig (2760-kPa)** minimum CWP.
 5. Size: **NPS 2 (DN 50)** or smaller.
 6. Body: Copper alloy.
 7. Port: Standard or full port.
 8. Ball: Chrome-plated brass.
 9. Seats and Seals: Replaceable.
 10. End Connections: Solder joint or threaded.
 11. Handle: Vinyl-covered steel with memory-setting device.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
1. Pressure Rating: **125 psig (860 kPa)** minimum, unless otherwise indicated.
 2. Body: Bronze for **NPS 2 (DN 50)** and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for **NPS 2-1/2 (DN 65)** and larger.
 3. End Connections: Threaded for **NPS 2 (DN 50)** and smaller; flanged for **NPS 2-1/2 (DN 65)** and larger.
 4. Screen: Stainless steel with round perforations, unless otherwise indicated.
 5. Perforation Size:
 - a. Strainers **NPS 2 (DN 50)** and Smaller: **0.020 inch (0.51 mm)**.
 - b. Strainers **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: **0.045 inch (1.14 mm)**.
 - c. Strainers **NPS 5 (DN 125)** and Larger: **0.10 inch (2.54 mm)**.
 6. Drain: Pipe plug.

2.6 OUTLET BOXES

- A. Clothes Washer Outlet Boxes:



1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. Guy Gray Manufacturing Co., Inc.
 - c. IPS Corporation.
 - d. LSP Products Group, Inc.
 - e. Oatey.
 - f. Plastic Oddities; a division of Diverse Corporate Technologies.
 - g. Symmons Industries, Inc.
 - h. Watts Industries, Inc.; Water Products Div.
 - i. Whitehall Manufacturing; a div. of Acorn Engineering Company.
 - j. Zurn Plumbing Products Group; Light Commercial Operation.
3. Mounting: Recessed.
4. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
5. Faucet: Combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
6. Supply Shutoff Fittings: **NPS 1/2 (DN 15)** gate, globe, or ball valves and **NPS 1/2 (DN 15)** copper, water tubing.
7. Drain: **NPS 2 (DN 50)** standpipe and P-trap for direct waste connection to drainage piping.
8. Inlet Hoses: Two **60-inch- (1500-mm-)** long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
9. Drain Hose: One **48-inch- (1200-mm-)** long, rubber household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. IPS Corporation.
 - c. LSP Products Group, Inc.
 - d. Oatey.
 - e. Plastic Oddities; a division of Diverse Corporate Technologies.
3. Mounting: Recessed.
4. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
5. Faucet: Valved fitting complying with ASME A112.18.1. Include **NPS 1/2 (DN 15)** or smaller copper tube outlet.
6. Supply Shutoff Fitting: **NPS 1/2 (DN 15)** gate, globe, or ball valve and **NPS 1/2 (DN 15)** copper, water tubing.

2.7 HOSE STATIONS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:



- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ARCHON Industries, Inc.
2. Armstrong International, Inc.
3. Cooney Brothers, Inc.
4. DynaFluid Ltd.
5. Leonard Valve Company.
6. Strahman Valves, Inc.
7. T & S Brass and Bronze Works, Inc.
8. Insert manufacturer's name.

2.8 HOSE BIBBS

- A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Wheel handle.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.9 WALL HYDRANTS

- A. Nonfreeze Wall Hydrants:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Prier Products, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
4. Pressure Rating: 125 psig (860 kPa).
5. Operation: Loose key.



6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: **NPS 3/4 or NPS 1 (DN 20 or DN 25)**.
8. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
9. Box: Deep, flush mounting with cover.
10. Box and Cover Finish: Polished nickel bronze.
11. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
12. Nozzle and Wall-Plate Finish: Polished nickel bronze.
13. Operating Keys(s): One with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrowhead Brass Products, Inc.
 - b. Mansfield Plumbing Products LLC.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Prier Products, Inc.
 - e. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
3. Standard: ASSE 1019, Type A or Type B.
4. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
5. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
6. Pressure Rating: **125 psig (860 kPa)**.
7. Operation: Loose key.
8. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
9. Inlet: **NPS 1/2 or NPS 3/4 (DN 15 or DN 20)**.
10. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.10 GROUND HYDRANTS

2.11 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: **400-psig (2760-kPa)** minimum CWP.
3. Size: **NPS 3/4 (DN 20)**.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.



- B. Gate-Valve-Type, Hose-End Drain Valves:
 - 1. Standard: MSS SP-80 for gate valves.
 - 2. Pressure Rating: Class 125.
 - 3. Size: **NPS 3/4 (DN 20)**.
 - 4. Body: ASTM B 62 bronze.
 - 5. Inlet: **NPS 3/4 (DN 20)** threaded or solder joint.
 - 6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.
- C. Stop-and-Waste Drain Valves:
 - 1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
 - 2. Pressure Rating: **200-psig (1380-kPa)** minimum CWP or Class 125.
 - 3. Size: **NPS 3/4 (DN 20)**.
 - 4. Body: Copper alloy or ASTM B 62 bronze.
 - 5. Drain: **NPS 1/8 (DN 6)** side outlet with cap.

2.12 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 3. Standard: ASSE 1010 or PDI-WH 201.
 - 4. Type: Copper tube with piston.
 - 5. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.13 AIR VENTS

- A. Bolted-Construction Automatic Air Vents:
 - 1. Body: Bronze.
 - 2. Pressure Rating: **125-psig (860-kPa)** minimum pressure rating at **140 deg F (60 deg C)**.
 - 3. Float: Replaceable, corrosion-resistant metal.
 - 4. Mechanism and Seat: Stainless steel.
 - 5. Size: **NPS 1/2 (DN 15)** minimum inlet.
 - 6. Inlet and Vent Outlet End Connections: Threaded.
- B. Welded-Construction Automatic Air Vents:
 - 1. Body: Stainless steel.
 - 2. Pressure Rating: **150-psig (1035-kPa)** minimum pressure rating.
 - 3. Float: Replaceable, corrosion-resistant metal.
 - 4. Mechanism and Seat: Stainless steel.



5. Size: **NPS 3/8 (DN 10)** minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.14 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
3. Standard: ASSE 1018.
4. Pressure Rating: **125 psig (860 kPa)** minimum.
5. Body: Bronze.
6. Inlet and Outlet Connections: **NPS 1/2 (DN 15)** threaded, union, or solder joint.
7. Gravity Drain Outlet Connection: **NPS 1/2 (DN 15)** threaded or solder joint.
8. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
3. Standard: ASSE 1044, lavatory P-trap with **NPS 3/8 (DN 10)** minimum, trap makeup connection.
4. Size: **NPS 1-1/4 (DN 32)** minimum.
5. Material: Chrome-plated, cast brass.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 3. Do not install bypass piping around backflow preventers.



- C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- D. Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.
- E. Install balancing valves in locations where they can easily be adjusted.
- F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install thermometers and water regulators if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- G. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- H. Install outlet boxes recessed in wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- I. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.
 - 1. Install shutoff valve on outlet if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- J. Install nonfreeze, nondraining-type post hydrants set in concrete or pavement.
- K. Install freeze-resistant yard hydrants with riser pipe set in concrete or pavement. Do not encase canister in concrete.
- L. Install water hammer arresters in water piping according to PDI-WH 201.
- M. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.
- N. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- O. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- P. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."



3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Pressure vacuum breakers.
 2. Intermediate atmospheric-vent backflow preventers.
 3. Reduced-pressure-principle backflow preventers.
 4. Double-check backflow-prevention assemblies.
 5. Carbonated-beverage-machine backflow preventers.
 6. Dual-check-valve backflow preventers.
 7. Reduced-pressure-detector, fire-protection backflow-preventer assemblies.
 8. Double-check, detector-assembly backflow preventers.
 9. Water pressure-reducing valves.
 10. Calibrated balancing valves.
 11. Primary, thermostatic, water mixing valves.
 12. Manifold, thermostatic, water-mixing-valve assemblies.
 13. Photographic-process, thermostatic, water-mixing-valve assemblies.
 14. Primary water tempering valves.
 15. Outlet boxes.
 16. Hose stations.
 17. Supply-type, trap-seal primer valves.
 18. Trap-seal primer systems.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer double-check backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION



SECTION 221316
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
 - 3. Encasement for underground metal piping.
- B. Related Sections include the following:
 - 1. Division 22 Section "Sanitary Sewerage Pumps."

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).
 - 2. Sanitary Sewer, Force-Main Piping: 100 psig (690 kPa).

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. LEED Submittal:
 - 1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.
- C. Shop Drawings:
 - 1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
 - 2. Sovent Drainage System: Include plans, elevations, sections, and details.
- D. Field quality-control inspection and test reports.



1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - a. Available Manufacturers:
 - 1) ANACO.
 - 2) Fernco, Inc.
 - 3) Ideal Div.; Stant Corp.
 - 4) Mission Rubber Co.
 - 5) Tyler Pipe; Soil Pipe Div.
 - 2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - a. Available Manufacturers:
 - 1) ANACO.
 - 2) Clamp-All Corp.



- 3) Ideal Div.; Stant Corp.
- 4) Mission Rubber Co.
- 5) Tyler Pipe; Soil Pipe Div.
3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
 - a. Available Manufacturers:
 - 1) MG Piping Products Co.
- D. Rigid, Unshielded Couplings: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
 1. Available Manufacturers:
 - a. ANACO.

2.5 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.
- B. Drainage Fittings: ASME B16.12, threaded, cast-iron drainage pattern.
- C. Pressure Fittings:
 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125.
- D. Grooved-Joint Systems:
 1. Available Manufacturers:
 - a. Anvil International.
 - b. Star Pipe Products; Star Fittings Div.
 - c. Victaulic Company.
 - d. Ward Manufacturing, Inc.
 2. Grooved-End, Steel-Piping Fittings: ASTM A 47/A 47M, malleable-iron casting; ASTM A 106, galvanized-steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 3. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.6 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.



1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.
- C. Grooved-Joint Systems:
1. Available Manufacturers:
 - a. Victaulic Company.
 2. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
 3. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- D. Flanges: ASME 16.1, Class 125, cast iron.

2.7 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- B. Hard Copper Tube: **ASTM B 88, Types L and M (ASTM B 88M, Types B and C)**, water tube, drawn temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- C. Soft Copper Tube: **ASTM B 88, Type L (ASTM B 88M, Type B)**, water tube, annealed temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2.8 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- B. Solvent Cement and Adhesive Primer:
1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.9 SPECIAL PIPE FITTINGS

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
1. Available Manufacturers:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco, Inc.



- c. Logan Clay Products Company (The).
- d. Mission Rubber Co.
- e. NDS, Inc.
- f. Plastic Oddities, Inc.
- 2. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Mission Rubber Co.
- C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Available Manufacturers:
 - a. ANACO.
- D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.; DMD Div.
 - c. EBAA Iron Sales, Inc.
 - d. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - e. JCM Industries, Inc.
 - f. Romac Industries, Inc.
 - g. Smith-Blair, Inc.
 - h. Viking Johnson.
 - 2. Center-Sleeve Material: Manufacturer's standard.
 - 3. Gasket Material: Natural or synthetic rubber.
 - 4. Metal Component Finish: Corrosion-resistant coating or material.
- E. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.
 - 1. Available Manufacturers:
 - a. EBAA Iron Sales, Inc.
- F. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 - 1. Available Manufacturers:
 - a. EBAA Iron Sales, Inc.
 - b. Romac Industries, Inc.



- c. Star Pipe Products; Star Fittings Div.
- G. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 - 1. Available Manufacturers:
 - a. SIGMA Corp.

2.10 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch (0.10-mm) or LLDPE film of 0.008-inch (0.20-mm) minimum thickness.
- B. Form: Sheet or tube.
- C. Color: Black or natural.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel and rigid, unshielded couplings; and hubless-coupling joints.
 - 3. Steel pipe, drainage fittings, and threaded joints.
 - 4. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
 - 5. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 6. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard, and heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Steel pipe, drainage fittings, and threaded joints.
 - 4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Steel pipe, drainage fittings, and threaded joints.
 - 4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
 - 5. Copper DWV tube, copper drainage fittings, and soldered joints.
 - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 (DN 65 and DN 90): Hard copper tube, Type M (Type C); copper pressure fittings; and soldered joints.



6. Dissimilar Pipe-Material Couplings: Flexible, Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- E. Aboveground, vent piping **NPS 5 (DN 125)** and larger shall be any of the following:
 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 3. Steel pipe, drainage fittings, and threaded joints.
 4. Dissimilar Pipe-Material Couplings: Flexible, Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
 - F. Underground, soil, waste, and vent piping **NPS 4 (DN 100)** and smaller shall be any of the following:
 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel heavy-duty shielded, cast-iron and rigid, unshielded couplings; and hubless-coupling joints.
 3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
 4. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 5. Dissimilar Pipe-Material Couplings: Flexible, Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
 - G. Underground, soil and waste piping **NPS 5 (DN 125)** and larger shall be any of the following:
 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel and heavy-duty shielded, cast-iron couplings; and hubless-coupling joints.
 3. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
 4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
 - H. Aboveground sanitary-sewage force mains **NPS 1-1/2 and NPS 2 (DN 40 and DN 50)** shall be any of the following:
 1. Hard copper tube, **Type L (Type B)**; copper pressure fittings; and soldered joints.
 2. Steel pipe, pressure fittings, and threaded joints.
 - I. Aboveground sanitary-sewage force mains **NPS 2-1/2 to NPS 6 (DN 65 to DN 150)** shall be any of the following:
 1. Hard copper tube, **Type L (Type B)**; copper pressure fittings; and soldered joints.
 2. Steel pipe, pressure fittings, and threaded joints.
 3. Grooved-end steel pipe, grooved-joint system fittings and couplings, and grooved joints.
 - J. Underground sanitary-sewage force mains **NPS 4 (DN 100)** and smaller shall be any of the following:
 1. Hard copper tube, **Type L (Type B)**; wrought-copper pressure fittings; and soldered joints.
 2. Steel pipe, pressure fittings, and threaded joints.
 - a. Include grooved-joint system fittings and couplings and grooved joints where indicated.
 3. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile-iron fittings; glands, gaskets, and bolts; and mechanical joints.
 - a. Include grooved-joint system fittings and couplings and grooved joints where indicated.



4. Push-on-joint, ductile-iron pipe; push-on-joint ductile-iron fittings; gaskets; and gasketed joints.
 - a. Include grooved-joint system fittings and couplings and grooved joints where indicated.
 5. Pressure pipe couplings, if dissimilar pipe materials or piping with small difference in OD must be joined.
- K. Underground sanitary-sewage force mains **NPS 5 (DN 125)** and larger shall be any of the following:
1. Steel pipe, pressure fittings, and threaded joints.
 2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile-iron fittings; glands, gaskets, and bolts; and mechanical-joint joints.
 3. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron fittings; gaskets; and gasketed joints.
 4. Pressure pipe couplings, if dissimilar pipe materials or piping with small difference in OD must be joined.

3.3 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- F. Install underground, steel, force-main piping. Install encasement on piping according to ASTM A 674 or AWWA C105.
- G. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside the building between wall and floor penetrations and connection to sanitary sewer piping outside the building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- H. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- I. Install underground, ductile-iron, special pipe fittings according to AWWA C600.
 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- J. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- K. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.



- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- M. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- N. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- O. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping **NPS 3 (DN 80)** and smaller; 1 percent downward in direction of flow for piping **NPS 4 (DN 100)** and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- P. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Solvent Drainage System: Comply with ASSE 1043 and solvent fitting manufacturer's written installation instructions.
 - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- Q. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- R. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.
- S. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- T. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- U. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.



- D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- F. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- G. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Install gate or full-port ball valve for piping **NPS 2 (DN 50)** and smaller.
 - 2. Install gate valve for piping **NPS 2-1/2 (DN 65)** and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
 - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
 - 2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
 - 3. Install backwater valves in accessible locations.
 - 4. Backwater valve are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:
 - a. **100 Feet (30 m)** and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than **100 Feet (30 m)**: MSS Type 43, adjustable roller hangers.
 - c. Longer Than **100 Feet (30 m)**, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs **100 Feet (30 m)** or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with **3/8-inch (10-mm)** minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:



1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
 4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
 5. NPS 8 to NPS 12 (DN 200 to DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
- G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
 6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
 7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
 8. NPS 8 to NPS 12 (DN 200 to DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.
- I. Install supports for vertical steel piping every 15 feet (4.5 m).
- J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 2 (DN 50): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 2. NPS 3 (DN 80): 96 inches (2400 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 (DN 100): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 4. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
- K. Install supports for vertical stainless-steel piping every 10 feet (3 m).
- L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
- M. Install supports for vertical copper tubing every 10 feet (3 m).
- N. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
 2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
 3. NPS 4 and 5 (DN 100 and 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
 4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
 5. NPS 8 to NPS 12 (DN 200 to DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.



- O. Install supports for vertical PVC piping every **48 inches (1200 mm)**.
- P. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections **NPS 2-1/2 (DN 65)** and larger.
- D. Connect force-main piping to the following:
 - 1. Sanitary Sewer: To exterior force main or sanitary manhole.
 - 2. Sewage Pumps: To sewage pump discharge.

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than **10-foot head of water (30 kPa)**. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.



4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 4. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION



SECTION 221319
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Backwater valves.
 - 2. Cleanouts.
 - 3. Floor drains.
 - 4. Trench drains.
 - 5. Channel drainage systems.
 - 6. Air-admittance valves.
 - 7. Roof flashing assemblies.
 - 8. Through-penetration firestop assemblies.
 - 9. Miscellaneous sanitary drainage piping specialties.
 - 10. Flashing materials.
 - 11. FOG disposal systems.
 - 12. Grease interceptors.
 - 13. Grease removal devices.
 - 14. Oil interceptors.
 - 15. Solids interceptors.
- B. Related Sections include the following:
 - 1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
 - 2. Division 22 Section "Plumbing Fixtures" for hair interceptors.
 - 3. Division 22 Section "Healthcare Plumbing Fixtures" for plaster sink interceptors.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.



1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
 - 1. Backwater valves.
 - 2. Cleanouts.
 - 3. Floor drains.
 - 4. Trench drains.
 - 5. Channel drainage systems.
 - 6. Air-admittance valves.
 - 7. Roof flashing assemblies.
 - 8. Through-penetration firestop assemblies.
 - 9. Miscellaneous sanitary drainage piping specialties.
 - 10. Flashing materials.
- B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.



1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

- A. Horizontal, Cast-Iron Backwater Valves:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 4. Standard: ASME A112.14.1.
 - 5. Size: Same as connected piping.
 - 6. Body: Cast iron.
 - 7. Cover: Cast iron with bolted or threaded access check valve.
 - 8. End Connections: Hub and spigot or hubless.
 - 9. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
 - 10. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.
- B. Drain-Outlet Backwater Valves:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 3. Size: Same as floor drain outlet.
 - 4. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
 - 5. Check Valve: Removable ball float.
 - 6. Inlet: Threaded.
 - 7. Outlet: Threaded or spigot.



2.2 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - g. Josam Company; Blucher-Josam Div.
4. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
5. Size: Same as connected drainage piping
6. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch Hubless, cast-iron soil pipe test tee as required to match connected piping.
7. Closure: Countersunk, plug.
8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
9. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Light Commercial Operation.
 - h. Zurn Plumbing Products Group; Specification Drainage Operation.
4. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.
5. Size: Same as connected branch.
6. Type: Cast-iron soil pipe with cast-iron ferrule.
7. Body or Ferrule: Cast iron.
8. Clamping Device: Required.
9. Outlet Connection: Spigot.



10. Closure: Brass plug with tapered threads.
11. Adjustable Housing Material: Cast iron with set-screws or other device.
12. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
13. Frame and Cover Shape: Round.
14. Top Loading Classification: Extra Heavy Duty.
15. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.
16. Standard: ASME A112.3.1.
17. Size: Same as connected branch.
18. Housing: Stainless steel.
19. Closure: Stainless steel with seal.
20. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
4. Standard: ASME A112.36.2M. Include wall access.
5. Size: Same as connected drainage piping.
6. Body: Hub-and-spigot, cast-iron soil pipe T-branch, Hubless, cast-iron soil pipe test tee as required to match connected piping.
7. Closure: Countersunk or raised-head, plug.
8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
9. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
10. Wall Access: Round, wall-installation frame and cover.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Commercial Enameling Co.
 - b. Josam Company; Josam Div.
 - c. MIFAB, Inc.



- d. Prier Products, Inc.
- e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- f. Tyler Pipe; Wade Div.
- g. Watts Drainage Products Inc.
- h. Zurn Plumbing Products Group; Light Commercial Operation.
- i. Zurn Plumbing Products Group; Specification Drainage Operation.
4. Standard: ASME A112.6.3.
5. Pattern: Floor drain.
6. Body Material: Gray iron.
7. Seepage Flange: Required.
8. Anchor Flange: Required.
9. Clamping Device: Required.
10. Outlet: Bottom.
11. Coating on Interior and Exposed Exterior Surfaces: Not required.
12. Sediment Bucket: Not required unless noted on drawings..
13. Top or Strainer Material: Nickel bronze.
14. Top of Body and Strainer Finish: Polished bronze.
15. Top Shape: Square.
16. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
17. Trap Material: Cast iron.
18. Trap Pattern: Deep-seal P-trap.
19. Trap Features: Trap-seal primer valve drain connection.

2.4 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ayrlett, LLC.
 - b. Durgo, Inc.
 - c. Oatey.
 - d. ProSet Systems Inc.
 - e. RectorSeal.
 - f. Studor, Inc.
3. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
4. Housing: Plastic.
5. Operation: Mechanical sealing diaphragm.
6. Size: Same as connected fixture or branch vent piping.

B. Wall Box:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Durgo, Inc.
 - b. Oatey.
 - c. RectorSeal.



- d. Studor, Inc.
- 3. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.
- 4. Size: About 9 inches wide by 8 inches high by 4 inches deep (230 mm wide by 200 mm high by 100 mm deep).

2.5 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch- (2.4-mm-) thick, lead flashing collar and skirt extending at least 10 inches (250 mm) from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

- 1. Open-Top Vent Cap: Without cap.
- 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
- 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.6 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ProSet Systems Inc.
- 3. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
- 4. Size: Same as connected soil, waste, or vent stack.
- 5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
- 6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
- 7. Special Coating: Corrosion resistant on interior of fittings.

2.7 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

- 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser



- section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.
- B. Deep-Seal Traps:
1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
 2. Size: Same as connected waste piping.
 - a. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
 - b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings:
1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.
- D. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 2. Body: Bronze or cast iron.
 3. Inlet: Opening in top of body.
 4. Outlet: Larger than inlet.
 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- E. Sleeve Flashing Device:
1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches (51 mm) above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
 2. Size: As required for close fit to riser or stack piping.
- F. Stack Flashing Fittings:
1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
 2. Size: Same as connected stack vent or vent stack.
- G. Vent Caps:
1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
 2. Size: Same as connected stack vent or vent stack.
- H. Expansion Joints:
1. Standard: ASME A112.21.2M.
 2. Body: Cast iron with bronze sleeve, packing, and gland.
 3. End Connections: Matching connected piping.
 4. Size: Same as connected soil, waste, or vent piping.



2.8 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
 - 2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
 - 3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.
- B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
 - 2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm thickness).
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.9 OIL INTERCEPTORS

- A. Oil Interceptors:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings Jensen Precast or a comparable product.
 - a. .>
 - 4. Type: Factory-fabricated interceptor for separating and removing light oil from wastewater.
 - 5. Body Material: Pre-cast concrete.

2.10 MOTORS

- A. General requirements for motors are specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to **NPS 4 (DN 100)**. Use **NPS 4 (DN 100)** for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of **50 feet (15 m)** for piping **NPS 4 (DN 100)** and smaller and **100 feet (30 m)** for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, **30 Inches (750 mm)** or Less: Equivalent to 1 percent slope, but not less than **1/4-inch (6.35-mm)** total depression.
 - b. Radius, **30 to 60 Inches (750 to 1500 mm)**: Equivalent to 1 percent slope.
 - c. Radius, **60 Inches (1500 mm)** or Larger: Equivalent to 1 percent slope, but not greater than **1-inch (25-mm)** total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
- H. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.
- I. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.



- J. Assemble FRP channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
- K. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
- L. Install fixture air-admittance valves on fixture drain piping.
- M. Install stack air-admittance valves at top of stack vent and vent stack piping.
- N. Install air-admittance-valve wall boxes recessed in wall.
- O. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- P. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
- Q. Assemble open drain fittings and install with top of hub **1 inch (25 mm)** above floor.
- R. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- S. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- T. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- U. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- V. Install vent caps on each vent pipe passing through roof.
- W. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain **1-inch (25-mm)** clearance between vent pipe and roof substrate.
- X. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- Y. Install frost-proof vent caps on each vent pipe passing through roof. Maintain **1-inch (25-mm)** clearance between vent pipe and roof substrate.
- Z. Assemble components of FOG disposal systems and install on floor. Install trap, vent, fresh-air inlet, and flow-control fitting according to authorities having jurisdiction. Install shelf fastened to reinforcement in wall construction and adjacent to unit, unless otherwise indicated. Install culture bottle, culture metering pump, timer, and control on shelf. Install tubing between culture bottle, metering pump, and chamber.
- AA. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
 - 1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.



2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
 3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
 4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- BB. Install grease removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction. Install control panel adjacent to unit, unless otherwise indicated.
- CC. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing. Coordinate oil-interceptor storage tank and gravity drain with Division 23 Section "Facility Fuel-Oil Piping."
- DD. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.
- EE. Install wood-blocking reinforcement for wall-mounting-type specialties.
- FF. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- GG. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. FOG Disposal Systems: Connect inlet and outlet to unit, connect flow-control fitting and fresh-air inlet piping to unit inlet piping, and connect vent piping between trap and media chamber. Connect electrical power.
- D. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.
- E. Grease Removal Devices: Connect controls, electrical power, factory-furnished accessories, and inlet, outlet, and vent piping to unit.
- F. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.
- G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."



3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets **6.0-lb/sq. ft. (30-kg/sq. m)**, **0.0938-inch (2.4-mm)** thickness or thicker. Solder joints of lead sheets **4.0-lb/sq. ft. (20-kg/sq. m)**, **0.0625-inch (1.6-mm)** thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of **10 inches (250 mm)**, and skirt or flange extending at least **8 inches (200 mm)** around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least **8 inches (200 mm)** around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least **8 inches (200 mm)** around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. FOG disposal systems.
 - 2. Grease interceptors.
 - 3. Grease removal devices.
 - 4. Oil interceptors.
 - 5. Solids interceptors.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.



2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION



SECTION 221423
STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following storm drainage piping specialties:
 - 1. Backwater valves.
 - 2. Cleanouts.
 - 3. Trench drains.
 - 4. Channel drainage systems.
 - 5. Through-penetration firestop assemblies.
 - 6. Roof drains.
 - 7. Miscellaneous storm drainage piping specialties.
 - 8. Flashing materials.
- B. Related Sections include the following:
 - 1. Division 22 Section "Sanitary Waste Piping Specialties" for backwater valves, floor drains, trench drains and channel drainage systems connected to sanitary sewer, air admittance valves, FOG disposal systems, grease interceptors and removal devices, oil interceptors, and solid interceptors.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PUR: Polyurethane plastic.
- H. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

- A. Coordinate size and location of roof penetrations.



PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
4. Standard: ASME A112.14.1.
5. Size: Same as connected piping.
6. Body: Cast iron.
7. Cover: Cast iron with bolted or threaded access check valve.
8. End Connections: Hub and spigot or hubless.
9. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
10. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Size: Same as floor drain outlet.
4. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
5. Check Valve: Removable ball float.
6. Inlet: Threaded.
7. Outlet: Threaded or spigot.

C. Horizontal, Plastic Backwater Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:



- a. Canplas LLC.
- b. IPS Corporation.
- c. NDS Inc.
- d. Oatey.
- e. Plastic Oddities; a division of Diverse Corporate Technologies.
- f. Sioux Chief Manufacturing Company, Inc.
- g. Zurn Plumbing Products Group; Light Commercial Operation.
3. Size: Same as connected piping.
4. Body: PVC.
5. Cover: Same material as body with threaded access to check valve.
6. Check Valve: Removable swing check.
7. End Connections: Socket type.

2.2 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
4. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
5. Size: Same as connected drainage piping
6. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
7. Closure: Countersunk or raised-head, plug.
8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
9. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.



- e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Zurn Plumbing Products Group; Light Commercial Operation.
 - h. Zurn Plumbing Products Group; Specification Drainage Operation.
 - i. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
4. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.
 5. Size: Same as connected branch.
 6. Type: Cast-iron soil pipe with cast-iron ferrule.
 7. Body or Ferrule: Cast iron.
 8. Clamping Device: Required.
 9. Outlet Connection: Spigot.
 10. Closure: Brass plug with straight threads and gasket.
 11. Adjustable Housing Material: Cast iron with.
 12. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
 13. Frame and Cover Shape: Round.
 14. Top Loading Classification: Extra Heavy- Duty.
 15. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.
 16. Standard: ASME A112.3.1.
 17. Size: Same as connected branch.
 18. Housing: Stainless steel.
 19. Closure: Stainless steel with seal.
 20. Riser: Stainless-steel drainage pipe fitting to cleanout.
- C. Cast-Iron Wall Cleanouts:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 4. Standard: ASME A112.36.2M. Include wall access.
 5. Size: Same as connected drainage piping.
 6. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 7. Closure: Countersunk or raised-head, plug.
 8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 9. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
 10. Wall Access: Round, wall-installation frame and cover.



2.3 TRENCH DRAINS

A. Trench Drains:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
4. Standard: ASME A112.6.3 for trench drains.
5. Material: Ductile or gray iron.
6. Flange: Anchor.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Grate Material: Ductile iron or gray iron.
10. Grate Finish: See drain schedule in drawings.
11. Dimensions of Frame and Grate: See drain schedule and manufacturer's specifications.
12. Top Loading Classification: Extra Heavy-Duty.
13. Trap Material: Cast iron.
14. Trap Pattern: Not required.

2.4 CHANNEL DRAINAGE SYSTEMS

A. Stainless-Steel Channel Drainage Systems:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Blucher-Josam Div.
 - b. MultiDrain Systems.
 - c. Zurn Plumbing Products Group; Flo-Thru Operation.
4. Type: Modular system of stainless-steel channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
 - a. Standard: ASME A112.3.1, for trench drains.
 - b. Channel Sections: Interlocking-joint, stainless-steel with level invert.
 - 1) Dimensions: **5.8 inches (147 mm)** wide. Include number of units required to form total lengths indicated.



- c. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channels.
 - 1) Material: Stainless steel.
 - 2) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
 - d. Covers: Solid stainless steel, of width and thickness that fit recesses in channels, and of lengths indicated.
 - e. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
 - f. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.
5. Type: Modular system of stainless-steel channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
- a. Channel Sections: Interlocking-joint, stainless steel with level invert.
 - 1) Dimensions: **6 inches (152 mm)** wide. Include number of units required to form total lengths indicated.
 - b. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channels.
 - 1) Material: Stainless steel.
 - 2) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
 - c. Covers: Solid stainless steel, of width and thickness that fit recesses in channels, and of lengths indicated.
 - d. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
 - e. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.5 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

2.6 ROOF DRAINS

A. Metal Roof Drains:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Tyler Pipe; Wade Div.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Light Commercial Operation.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
- 4. Standard: ASME A112.21.2M.
- 5. Body Material: Cast iron.
- 6. Dimensions of Body: See drain schedule in drawings.
- 7. Outlet: Bottom.



8. Dome Material: Cast iron.

2.7 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected piping.

B. Downspout Boots:

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 (DN 100) outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout.
3. Description: ASTM A 74, Service class, hub-and-spigot, cast-iron soil pipe.
4. Size: Same as or larger than connected downspout.

C. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

2.8 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm) thickness.
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.
- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.
- G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.



3. Locate at minimum intervals of **50 feet (15 m)** for piping **NPS 4 (DN 100)** and smaller and **100 feet (30 m)** for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
 - D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
 - E. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
 - F. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.
 - G. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
 - H. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.
 1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 2. Position roof drains for easy access and maintenance.
 - I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
 - J. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
 - K. Install manufactured, gray-iron downspout boots at grade with top **12 inches (305 mm)** above grade. Secure to building wall.
 - L. Install cast-iron soil pipe downspout boots at grade with top of hub **12 inches (305 mm)** above grade.
 - M. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
 - N. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:



1. Lead Sheets: Burn joints of lead sheets **6.0-lb/sq. ft. (30-kg/sq. m)**, **0.0938-inch (2.4-mm)** thickness or thicker. Solder joints of lead sheets **4.0-lb/sq. ft. (20-kg/sq. m)**, **0.0625-inch (1.6-mm)** thickness or thinner.
 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of **10 inches (250 mm)**, and skirt or flange extending at least **8 inches (200 mm)** around pipe.
 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least **8 inches (200 mm)** around sleeve.
 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least **8 inches (200 mm)** around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shapes.
- 3.4 PROTECTION**
- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
 - B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

MIAMI-DADE PUBLIC LIBRARY SYSTEM
VOLUME II
PROJECT MANUAL
DIVISION 23- HEATING VENTILATING AND AIR CONDITIONING

South Dade Regional Library Interior Renovations

C23-MDPLS-01-ESP



230500	Common Work Results for HVAC
230513	Common Motor Requirements for HVAC Equipment
230529	Hangers and Supports for HVAC Piping and Equipment
230548	Vibration Controls for HVAC Piping and Equipment
230553	Identification for HVAC Piping and Equipment
230593	Testing, Adjusting, and Balancing for HVAC
230700	HVAC Insulation
230800	Commissioning of HVAC
230900	Instrumentation and Control for HVAC
232300	Refrigerant Piping
233113	Metal Ducts
233116	Nonmetal Ducts
233300	Air Duct Accessories
233713	Diffusers, Registers, and Grilles



SECTION 230500
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
 2. Dielectric fittings.
 3. Mechanical sleeve seals.
 4. Sleeves.
 5. Escutcheons.
 6. Grout.
 7. HVAC demolition.
 8. Equipment installation requirements common to equipment sections.
 9. Concrete bases.
 10. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.



PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 300-psig (2070-kPa) minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Stainless steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.



2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, black steel, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.



3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors when exposed.
- M. Install sleeves for pipes passing through concrete and masonry walls, ~~gypsum board partitions,~~ and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble



mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.



2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping **NPS 2 (DN 50)** and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping **NPS 2-1/2 (DN 65)** and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
1. Construct concrete bases of dimensions indicated, but not less than **4 inches (100 mm)** larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch (450-mm)** centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.



4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.9 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION



SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:



1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
 2. Split phase.
 3. Capacitor start, inductor run.
 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION



SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Equipment supports.
- B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
- C. See Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.
- D. See Division 23 Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
- E. See Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
- F. See Division 23 Section(s) "Metal Ducts" and "Nonmetal Ducts" for duct hangers and supports.

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Furnish supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Furnish equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Metal framing systems. Include Product Data for components.
 - 3. Equipment supports.
- C. Welding certificates.



1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Available Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Carpenter & Paterson, Inc.
 - 3. Empire Industries, Inc.
 - 4. ERICO/Michigan Hanger Co.
 - 5. Globe Pipe Hanger Products, Inc.
 - 6. Grinnell Corp.
 - 7. GS Metals Corp.
 - 8. National Pipe Hanger Corporation.
 - 9. PHD Manufacturing, Inc.
 - 10. PHS Industries, Inc.
 - 11. Piping Technology & Products, Inc.
 - 12. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Available Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 - 3. GS Metals Corp.
 - 4. Power-Strut Div.; Tyco International, Ltd.



5. Thomas & Betts Corporation.
 6. Tolco Inc.
 7. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: **100-psig- (690-kPa-)** minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Available Manufacturers:
1. Carpenter & Paterson, Inc.
 2. ERICO/Michigan Hanger Co.
 3. PHS Industries, Inc.
 4. Pipe Shields, Inc.
 5. Rilco Manufacturing Company, Inc.
 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend **2 inches (50 mm)** beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Available Manufacturers:
- a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Available Manufacturers:
- a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: **5000-psi (34.5-MPa)**, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, **NPS 1/2 to NPS 30 (DN 15 to DN 750)**.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of **120 to 450 deg F (49 to 232 deg C)** pipes, **NPS 4 to NPS 16 (DN 100 to DN 400)**, requiring up to **4 inches (100 mm)** of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, **NPS 3/4 to NPS 24 (DN 20 to DN 600)**, requiring clamp flexibility and up to **4 inches (100 mm)** of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, **NPS 1/2 to NPS 8 (DN 15 to DN 200)**.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes, **NPS 1/2 to NPS 30 (DN 15 to DN 750)**.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes, **NPS 4 to NPS 36 (DN 100 to DN 900)**, with steel pipe base stanchion support and cast-iron floor flange.
 - 7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, **NPS 1 to NPS 30 (DN 25 to DN 750)**, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 - 8. Complete Pipe Rolls (MSS Type 44): For support of pipes, **NPS 2 to NPS 42 (DN 50 to DN 1050)**, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, **NPS 3/4 to NPS 20 (DN 20 to DN 500)**.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, **NPS 3/4 to NPS 20 (DN 20 to DN 500)**, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to **6 inches (150 mm)** for heavy loads.
 2. Steel Clevises (MSS Type 14): For **120 to 450 deg F (49 to 232 deg C)** piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): **750 lb (340 kg)**.
 - b. Medium (MSS Type 32): **1500 lb (680 kg)**.
 - c. Heavy (MSS Type 33): **3000 lb (1360 kg)**.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed **1-1/4 inches (32 mm)**.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.



- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, **NPS 2-1/2 (DN 65)** and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
- b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
- c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. **NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.**
 - b. **NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.**
 - c. **NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.**
 - d. **NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.**
 - e. **NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.**
5. Pipes **NPS 8 (DN 200)** and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.



3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION



SECTION 230548

VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Isolation pads.
 2. Isolation mounts.
 3. Restrained elastomeric isolation mounts.
 4. Freestanding and restrained spring isolators.
 5. Housed spring mounts.
 6. Elastomeric hangers.
 7. Spring hangers.
 8. Spring hangers with vertical-limit stops.
 9. Pipe riser resilient supports.
 10. Resilient pipe guides.
 11. Restraining braces and cables.

1.2 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
1. Basic Wind Speed: 150mph.
 2. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.
- E. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent



testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. California Dynamics Corporation.
 - 4. Isolation Technology, Inc.
 - 5. Kinetics Noise Control.
 - 6. Mason Industries.
 - 7. Vibration Eliminator Co., Inc.
 - 8. Vibration Isolation.
 - 9. Vibration Mountings & Controls, Inc.
- D. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material: Oil- and water-resistant [neoprene] [rubber] [hermetically sealed compressed fiberglass].
- E. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - 1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- F. Restrained Mounts: All-directional mountings with seismic restraint.
 - 1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- G. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.



3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- H. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- I. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 2. Base: Factory drilled for bolting to structure.
 3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.
- J. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- K. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.



7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- L. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- M. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.
- N. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.



3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.
 - 8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION



SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.
 4. Duct labels.

1.2 SUBMITTAL

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
1. Material and Thickness: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 4. Fasteners: Stainless-steel rivets or self-tapping screws.
 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
 2. Letter Color: Black.
 3. Background Color: White.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number



and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, **1/8 inch (3.2 mm)** thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to **160 deg F (71 deg C)**.
- E. Minimum Label Size: Length and width vary for required label content, but not less than **2-1/2 by 3/4 inch (64 by 19 mm)**.
- F. Minimum Letter Size: **1/4 inch (6.4 mm)** for name of units if viewing distance is less than **24 inches (600 mm)**, **1/2 inch (13 mm)** for viewing distances up to **72 inches (1830 mm)**, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least **1-1/2 inches (38 mm)** high.

2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, **1/8 inch (3.2 mm)** thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Blue.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to **160 deg F (71 deg C)**.
- E. Minimum Label Size: Length and width vary for required label content, but not less than **2-1/2 by 3/4 inch (64 by 19 mm)**.
- F. Minimum Letter Size: **1/4 inch (6.4 mm)** for name of units if viewing distance is less than **24 inches (600 mm)**, **1/2 inch (13 mm)** for viewing distances up to **72 inches (1830 mm)**, and



proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least **1-1/2 inches (38 mm)** high.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of **50 feet (15 m)** along each run. Reduce intervals to **25 feet (7.6 m)** in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Chilled-Water Piping:
 - a. Background Color: Black.
 - b. Letter Color: White.
 - 2. Condenser-Water Piping:
 - a. Background Color: Black.
 - b. Letter Color: White.
 - 3. Heating Water Piping:
 - a. Background Color: Black.
 - b. Letter Color: White.
 - 4. Refrigerant Piping:
 - a. Background Color: Black.



- b. Letter Color: White.

3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
 - 1. Blue: For cold-air supply ducts.
 - 2. Yellow: For hot-air supply ducts.
 - 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of **50 feet (15 m)** in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION



SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
 - 2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

- A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- B. Certified TAB reports.

1.4 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect and Owner.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."



PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts and Nonmetal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.



- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.



- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 6. Obtain approval from Architect and Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.



2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 3. Measure total system airflow. Adjust to within indicated airflow.
 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 8. Record final fan-performance data.

- C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Balance variable-air-volume systems the same as described for constant-volume air systems.
 2. Set terminal units and supply fan at full-airflow condition.
 3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 4. Readjust fan airflow for final maximum readings.
 5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
 6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
 7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
 8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
- D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
 2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
 3. Set terminal units at full-airflow condition.
 4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 5. Adjust terminal units for minimum airflow.
 6. Measure static pressure at the sensor.
 7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
1. Open all manual valves for maximum flow.



2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect and Commissioning Authority and comply with requirements in Division 23 Section "Hydronic Pumps."
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
- C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- D. Set calibrated balancing valves, if installed, at calculated presettings.
- E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 1. Determine the balancing station with the highest percentage over indicated flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.



3. Record settings and mark balancing devices.

- H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- J. Check settings and operation of each safety valve. Record settings.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.11 PROCEDURES FOR CHILLERS

- A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
 - 1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
 - 2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
 - 3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
 - 4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
 - 5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
 - 6. Capacity: Calculate in tons of cooling.
 - 7. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.12 PROCEDURES FOR COOLING TOWERS

- A. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:
 - 1. Measure condenser-water flow to each cell of the cooling tower.



2. Measure entering- and leaving-water temperatures.
3. Measure wet- and dry-bulb temperatures of entering air.
4. Measure wet- and dry-bulb temperatures of leaving air.
5. Measure condenser-water flow rate recirculating through the cooling tower.
6. Measure cooling-tower spray pump discharge pressure.
7. Adjust water level and feed rate of makeup water system.
8. Measure flow through bypass.

3.13 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.14 PROCEDURES FOR BOILERS

- A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.
- B. Steam Boilers: Measure and record entering-water temperature and flow and leaving-steam pressure, temperature, and flow.

3.15 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
 1. Entering- and leaving-water temperature.
 2. Water flow rate.
 3. Water pressure drop.
 4. Dry-bulb temperature of entering and leaving air.
 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 6. Airflow.
 7. Air pressure drop.
- B. Measure, adjust, and record the following data for each electric heating coil:
 1. Nameplate data.
 2. Airflow.
 3. Entering- and leaving-air temperature at full load.
 4. Voltage and amperage input of each phase at full load and at each incremental stage.
 5. Calculated kilowatt at full load.
 6. Fuse or circuit-breaker rating for overload protection.
- C. Measure, adjust, and record the following data for each steam coil:
 1. Dry-bulb temperature of entering and leaving air.
 2. Airflow.
 3. Air pressure drop.
 4. Inlet steam pressure.
- D. Measure, adjust, and record the following data for each refrigerant coil:
 1. Dry-bulb temperature of entering and leaving air.
 2. Wet-bulb temperature of entering and leaving air.
 3. Airflow.
 4. Air pressure drop.
 5. Refrigerant suction pressure and temperature.



3.16 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Check the refrigerant charge.
 - 4. Check the condition of filters.
 - 5. Check the condition of coils.
 - 6. Check the operation of the drain pan and condensate-drain trap.
 - 7. Check bearings and other lubricated parts for proper lubrication.
 - 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.
 - 3. Drain pans are clean.
 - 4. Fans are clean.
 - 5. Bearings and other parts are properly lubricated.
 - 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
 - 1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 - 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 - 3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 - 4. Balance each air outlet.

3.17 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
 - 3. Heating-Water Flow Rate: Plus or minus 10 percent.
 - 4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.18 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.



- B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.19 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB contractor.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 - 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.



- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.

3.20 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION



**SECTION 230700
HVAC INSULATION**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
 - a. Cellular glass.
 - b. Flexible elastomeric.
 - c. Mineral fiber.
 - d. Polyolefin.
 - e. Polystyrene.
2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied jackets.
10. Tapes.
11. Securements.
12. Corner angles.

B. Related Sections:

1. Division 21 Section "Fire-Suppression Systems Insulation."
2. Division 22 Section "Plumbing Insulation."
3. Division 23 Section "Metal Ducts" for duct liners.
4. Division 33 Section "Underground Hydronic Energy Distribution" for loose-fill pipe insulation in underground piping outside the building.
5. Division 33 Section "Underground Steam and Condensate Distribution Piping" for loose-fill pipe insulation in underground piping outside the building.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

C. Field quality-control reports.



1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cell-U-Foam Corporation; Ultra-CUF.
 - b. Pittsburgh Corning Corporation; Foamglas Super K.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
 - 6. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
 - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type II with factory-applied vinyl jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.



1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; All-Service Duct Wrap.
- I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.
- J. Mineral-Fiber, Preformed Pipe Insulation:
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000 Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 3. Type II, 1200 deg F (649 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- K. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Knauf Insulation; Permawick Pipe Insulation.
 - b. Owens Corning; VaporWick Pipe Insulation.
- L. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II

or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; CrimpWrap.
 - b. Johns Manville; MicroFlex.
 - c. Knauf Insulation; Pipe and Tank Insulation.
 - d. Manson Insulation Inc.; AK Flex.
 - e. Owens Corning; Fiberglas Pipe and Tank Insulation.
- M. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armacell LLC; Tubolit.
 - b. Nomaco Inc.; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.
 - c. RBX Corporation; Therma-cell.
- N. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F (0.038 W/m x K) after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The); Styrofoam.
 - b. Knauf Insulation; Knauf Polystyrene.

2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; FlameChek.
 - b. Johns Manville; Firetemp Wrap.
 - c. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
 - d. Thermal Ceramics; FireMaster Duct Wrap.
 - e. 3M; Fire Barrier Wrap Products.
 - f. Unifrax Corporation; FyreWrap.
 - g. Vesuvius; PYROSCAT FP FASTR Duct Wrap.

2.3 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Insulco, Division of MFS, Inc.; SmoothKote.
 - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
 - c. Rock Wool Manufacturing Company; Delta One Shot.



2.4 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of **minus 75 to plus 300 deg F (minus 59 to plus 149 deg C)**.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-96.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-33.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA Inc.; Aero seal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
 - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of **minus 20 to plus 140 deg F (29 to plus 60 deg C)**.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-96.
 - b. Foster Products Corporation, H. B. Fuller Company; 97-13.
- F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.



2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Speedline Vinyl Adhesive.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96, Procedure B, **0.013 perm (0.009 metric perm)** at **43-mil (1.09-mm)** dry film thickness.
 3. Service Temperature Range: **Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C)**.
 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-10.
 - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
 - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
 - d. Marathon Industries, Inc.; 550.
 - e. Mon-Eco Industries, Inc.; 55-50.
 - f. Vimasco Corporation; WC-1/WC-5.
 2. Water-Vapor Permeance: ASTM F 1249, **3 perms (2 metric perms)** at **0.0625-inch (1.6-mm)** dry film thickness.
 3. Service Temperature Range: **Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C)**.
 4. Solids Content: 63 percent by volume and 73 percent by weight.
 5. Color: White.

2.6 SEALANTS

- A. Joint Sealants:



1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-76.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 - f. Vimasco Corporation; 750.
 2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-70.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
 3. Materials shall be compatible with insulation materials, jackets, and substrates.
 4. Permanently flexible, elastomeric sealant.
 5. Service Temperature Range: **Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).**
 6. Color: White or gray.
 7. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: **Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).**
 5. Color: Aluminum.
 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; CP-76.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: **Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).**
 5. Color: White.
 6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
 5. PVDC Jacket for Indoor Applications: **4-mil- (0.10-mm-)** thick, white PVDC biaxially oriented barrier film with a permeance at **0.02 perms (0.013 metric perms)** when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 6. PVDC Jacket for Outdoor Applications: **6-mil- (0.15-mm-)** thick, white PVDC biaxially oriented barrier film with a permeance at **0.01 perms (0.007 metric perms)** when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 8. Vinyl Jacket: White vinyl with a permeance of **1.3 perms (0.86 metric perms)** when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately **1 oz./sq. yd. (34 g/sq. m)** with a thread count of **10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm)**, in a Leno weave, for duct, equipment, and pipe.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.

2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.



- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: Color-code jackets based on system. Color as selected by Architect.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
 5. Factory-fabricated tank heads and tank side panels.
- D. Aluminum Jacket: Comply with **ASTM B 209 (ASTM B 209M)**, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
 2. Sheet and roll stock ready for shop or field sizing.
 3. Finish and thickness are indicated in field-applied jacket schedules.
 4. Moisture Barrier for Indoor Applications: **1-mil- (0.025-mm-)** thick, heat-bonded polyethylene and kraft paper.
 5. Moisture Barrier for Outdoor Applications: **3-mil- (0.075-mm-)** thick, heat-bonded polyethylene and kraft paper.
 6. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- E. Self-Adhesive Outdoor Jacket: **60-mil- (1.5-mm-)** thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Polyguard; Alumaguard 60.
- F. PVDC Jacket for Indoor Applications: **4-mil- (0.10-mm-)** thick, white PVDC biaxially oriented barrier film with a permeance at **0.02 perms (0.013 metric perms)** when tested according to



ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The), Saran 540 Vapor Retarder Film.
- G. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms (0.007 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The), Saran 560 Vapor Retarder Film.
- H. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.10 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width: 3 inches (75 mm).
 3. Thickness: 11.5 mils (0.29 mm).
 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches (75 mm).
 3. Thickness: 6.5 mils (0.16 mm).
 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.



- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 2. Width: 2 inches (50 mm).
 3. Thickness: 6 mils (0.15 mm).
 4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
 2. Width: 2 inches (50 mm).
 3. Thickness: 3.7 mils (0.093 mm).
 4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.
- E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
 2. Width: 3 inches (75 mm).
 3. Film Thickness: 4 mils (0.10 mm).
 4. Adhesive Thickness: 1.5 mils (0.04 mm).
 5. Elongation at Break: 145 percent.
 6. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.
- F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The); Saran 560 Vapor Retarder Tape.
 2. Width: 3 inches (75 mm).
 3. Film Thickness: 6 mils (0.15 mm).
 4. Adhesive Thickness: 1.5 mils (0.04 mm).
 5. Elongation at Break: 145 percent.
 6. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.

2.11 SECUREMENTS

- A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal.



1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
- B. Insulation Pins and Hangers:
 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - c. Spindle: Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
 - c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
 - c. Spindle: Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.



4. Insulation-Retaining Washers: Self-locking washers formed from **0.016-inch- (0.41-mm-)** thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than **1-1/2 inches (38 mm)** in diameter.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from **0.016-inch- (0.41-mm-)** thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than **1-1/2 inches (38 mm)** in diameter.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
 - 3) Insert manufacturer's name.
- C. Staples: Outward-clinching insulation staples, nominal **3/4-inch- (19-mm-)** wide, stainless steel or Monel.
- D. Wire: **0.062-inch (1.6-mm)** soft-annealed, stainless steel.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

2.12 CORNER ANGLES

- A. PVC Corner Angles: **30 mils (0.8 mm)** thick, minimum **1 by 1 inch (25 by 25 mm)**, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: **0.040 inch (1.0 mm)** thick, minimum **1 by 1 inch (25 by 25 mm)**, aluminum according to **ASTM B 209 (ASTM B 209M)**, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.



3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with **3-inch- (75-mm-)** wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced **4 inches (100 mm)** o.c.
 - 3. Overlap jacket longitudinal seams at least **1-1/2 inches (38 mm)**. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **2 inches (50 mm)** o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.



- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least **4 inches (100 mm)** beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least **2 inches (50 mm)** below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least **2 inches (50 mm)**.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least **2 inches (50 mm)**.
 - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least **2 inches (50 mm)**.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - c. On tanks and vessels, maximum anchor-pin spacing is **3 inches (75 mm)** from insulation end joints, and **16 inches (400 mm)** o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.
 - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately **6 inches (150 mm)** from each end. Install wire or cable between two circumferential girdles **12 inches (300 mm)** o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of **48 inches (1200 mm)** o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least **3 inches (75 mm)**.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.



- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
 - 1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 - 2. Seal longitudinal seams and end joints.
- C. Insulation Installation on Pumps:
 - 1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on **6-inch (150-mm)** centers, starting at corners. Install **3/8-inch- (10-mm-)** diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
 - 2. Fabricate boxes from stainless steel, at least **0.050 inch (1.3 mm)** thick.
 - 3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for



- above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least **2 inches (50 mm)** over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 CELLULAR-GLASS INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at **6 inches (150 mm)** o.c.
 4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.



3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:



1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at **6 inches (150 mm)** o.c.
 4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least **1 inch (25 mm)**, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.
- E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions **18 inches (450 mm)** and smaller, place pins along longitudinal centerline of duct. Space **3 inches (75 mm)** maximum from insulation end joints, and **16 inches (400 mm)** o.c.
 - b. On duct sides with dimensions larger than **18 inches (450 mm)**, place pins **16 inches (400 mm)** o.c. each way, and **3 inches (75 mm)** maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

- d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing **2 inches (50 mm)** from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with **1/2-inch (13-mm)** outward-clinching staples, **1 inch (25 mm)** o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below **50 deg F (10 deg C)** at **18-foot (5.5-m)** intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than **3 inches (75 mm)**.
 5. Overlap unfaced blankets a minimum of **2 inches (50 mm)** on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of **18 inches (450 mm)** o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with **6-inch- (150-mm-)** wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced **6 inches (150 mm)** o.c.
- F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions **18 inches (450 mm)** and smaller, place pins along longitudinal centerline of duct. Space **3 inches (75 mm)** maximum from insulation end joints, and **16 inches (400 mm)** o.c.
 - b. On duct sides with dimensions larger than **18 inches (450 mm)**, space pins **16 inches (400 mm)** o.c. each way, and **3 inches (75 mm)** maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing **2 inches (50 mm)** from 1 edge and 1 end of insulation segment.

Secure laps to adjacent insulation section with **1/2-inch (13-mm)** outward-clinching staples, **1 inch (25 mm)** o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below **50 deg F (10 deg C)** at **18-foot (5.5-m)** intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than **3 inches (75 mm)**.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with **6-inch- (150-mm-)** wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced **6 inches (150 mm)** o.c.

3.9 POLYOLEFIN INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
 1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of polyolefin pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.10 POLYSTYRENE INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:



1. Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed **1-1/2-inch (38-mm)** thickness.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed section of polystyrene insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with **1-1/2-inch (38-mm)** laps at longitudinal seams and **3-inch- (75-mm-)** wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with **1-inch (25-mm)** overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with **2-inch (50-mm)** overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands **12 inches (300 mm)** o.c. and at end joints.

D. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.



2. Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of **2 inches (50 mm)** over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of **33-1/2 inches (850 mm)** or less. The **33-1/2-inch- (850-mm-)** circumference limit allows for **2-inch- (50-mm-)** overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.12 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.13 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.14 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
 2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the



"Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.15 BOILER BREECHING INSULATION SCHEDULE

- A. Round, Exposed Breeching and Connector: High-temperature mineral-fiber blanket, **3 inches (75 mm)** thick and **3-lb/cu. ft. (48-kg/cu. m)** nominal density.
- B. Round, Concealed Breeching and Connector Insulation: High-temperature mineral-fiber blanket, **3 inches (75 mm)** thick and **3-lb/cu. ft. (48-kg/cu. m)** nominal density.

3.16 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 1. Indoor, concealed supply and outdoor air.
 2. Indoor, exposed supply and outdoor air.
 3. Indoor, concealed return located in nonconditioned space.
 4. Indoor, exposed return located in nonconditioned space.
 5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
 6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
 7. Indoor, concealed oven and warewash exhaust.
 8. Indoor, exposed oven and warewash exhaust.
 9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 11. Outdoor, concealed supply and return.
 12. Outdoor, exposed supply and return.
- B. Items Not Insulated:
 1. Fibrous-glass ducts.
 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 3. Factory-insulated flexible ducts.
 4. Factory-insulated plenums and casings.
 5. Flexible connectors.
 6. Vibration-control devices.
 7. Factory-insulated access panels and doors.

3.17 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, **1-1/2 inches (38 mm)** thick and **0.75-lb/cu. ft. (12-kg/cu. m)** nominal density.
- B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, **1-1/2 inches (38 mm)** thick and **0.75-lb/cu. ft. (12-kg/cu. m)** nominal density.



- C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber board, **2 inches (50 mm)** thick and nominal density.
- D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber board, **1-1/2 inches (38 mm)** thick and **0.75-lb/cu. ft. (12-kg/cu. m)** nominal density.
- E. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.
- F. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, **2 inches (50 mm)** thick and **0.75-lb/cu. ft. (12-kg/cu. m)** nominal density.
- G. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, **2 inches (50 mm)** thick and **0.75-lb/cu. ft. (12-kg/cu. m)** nominal density.
- H. Exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber board, **2 inches (50 mm)** thick and **0.75-lb/cu. ft. (12-kg/cu. m)** nominal density.
- I. Exposed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber board, **2 inches (50 mm)** thick and **0.75-lb/cu. ft. (12-kg/cu. m)** nominal density.
- J. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.

3.18 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, **2 inches (50 mm)** thick and **1.5-lb/cu. ft. (24-kg/cu. m)** nominal density.
- C. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, **2 inches (50 mm)** thick and **1.5-lb/cu. ft. (24-kg/cu. m)** nominal density.
- D. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, **2 inches (50 mm)** thick and **1.5-lb/cu. ft. (24-kg/cu. m)** nominal density.
- E. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, **2 inches (50 mm)** thick and **1.5-lb/cu. ft. (24-kg/cu. m)** nominal density.
- F. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, **2 inches (50 mm)** thick and **1.5-lb/cu. ft. (24-kg/cu. m)** nominal density.
- G. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, **2 inches (50 mm)** thick and **1.5-lb/cu. ft. (24-kg/cu. m)** nominal density.
- H. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, **2 inches (50 mm)** thick and **1.5-lb/cu. ft. (24-kg/cu. m)** nominal density.
- I. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, **2 inches (50 mm)** thick and **1.5-lb/cu. ft. (24-kg/cu. m)** nominal density.

3.19 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
- C. Heat-Exchanger (Water-to-Water for Heating Service) Insulation: Mineral-fiber pipe and tank, **2 inches (50 mm)** thick.



- D. Dual-service heating and cooling pump insulation shall be one of the following:
 - 1. Cellular Glass: **3 inches (75 mm)** thick.
- E. Heating-Hot-Water Pump Insulation: Mineral-Fiber Board: **2 inches (50 mm)** thick and **3-lb/cu. ft. (48-kg/cu. m)** nominal density.
- F. Chilled-water expansion/compression tank insulation shall be the following:
 - 1. Cellular Glass: **1-1/2 inches (38 mm)** thick.
- G. Dual-service heating and cooling expansion/compression tank insulation shall be the following:
 - 1. Cellular Glass: **1-1/2 inches (38 mm)** thick.
- H. Heating-Hot-Water Expansion/Compression Tank Insulation: Mineral-Fiber Pipe and Tank: **1 inch (25 mm)** thick.
- I. Chilled-water air-separator insulation shall be the following:
 - 1. Cellular Glass: **2 inches (50 mm)** thick.
- J. Dual-service heating and cooling air-separator insulation shall be the following:
 - 1. Cellular Glass: **2 inches (50 mm)** thick.
- K. Heating-Hot-Water Air-Separator Insulation: Mineral-Fiber Pipe and Tank: **2 inches (50 mm)** thick.

3.20 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.21 INDOOR PIPING INSULATION SCHEDULE

- A. Chilled Water and Brine, above **40 Deg F (5 Deg C)**: Insulation shall be the following:
 - 1. Cellular Glass: **2 inches (50 mm)** thick.
- B. Heating-Hot-Water Supply and Return, **200 Deg F (93 Deg C)** and below: Insulation shall be the following:
 - 1. Cellular Glass: **2 inches (50 mm)** thick.
- C. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, **1 inch (25 mm)** thick.
- D. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric, **1 inch (25 mm)** thick.
- E. Dual-Service Heating and Cooling, **40 to 200 Deg F (5 to 93 Deg C)**: Insulation shall be the following:
 - 1. Cellular Glass: **2 inches (50 mm)** thick.
- F. Condensate drain Piping: Flexible elastomeric, **1 inch (25 mm)** thick.



3.22 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Chilled Water and Brine: Insulation shall be the following:
 - 1. Cellular Glass: **3 inches (75 mm)** thick.
- B. Heating-Hot-Water Supply and Return, **200 Deg F (93 Deg C)** and below: Insulation shall be the following:
 - 1. Cellular Glass: **3 inches (75 mm)** thick.
- C. Refrigerant Suction and Hot-Gas Piping: Insulation shall be the following:
 - 1. Cellular Glass: **2 inches (50 mm)** thick.
- D. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be the following:
 - 1. Flexible Elastomeric: **2 inches (50 mm)** thick.
- E. Dual-Service Heating and Cooling: Insulation shall be the following:
 - 1. Cellular Glass: **3 inches (75 mm)** thick.

3.23 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Loose-fill insulation, for belowground piping, is specified in Division 33 piping distribution Sections.
- B. Chilled Water, All Sizes: Cellular glass, **2 inches (50 mm)** thick.
- C. Heating-Hot-Water Supply and Return, All Sizes, **200 Deg F (93 Deg C)** and below: Cellular glass, **3 inches (75 mm)** thick.
- D. Dual-Service Heating and Cooling, All Sizes, **40 to 200 Deg F (4 to 93 Deg C)**: Cellular glass, **3 inches (75 mm)** thick.

3.24 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed:
 - 1. Aluminum, Smooth: **0.016 inch (0.41 mm)** thick.
- D. Ducts and Plenums, Exposed:
 - 1. None.
- E. Equipment, Concealed:
 - 1. None.
- F. Equipment, Exposed, up to **48 Inches (1200 mm)** in Diameter or with Flat Surfaces up to **72 Inches (1800 mm)**:
 - 1. None.
- G. Equipment, Exposed, Larger Than **48 Inches (1200 mm)** in Diameter or with Flat Surfaces Larger Than **72 Inches (1800 mm)**:
 - 1. None.
- H. Piping, Concealed:



- 1. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.
- I. Piping, Exposed:
 - 1. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.

3.25 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Concealed:
 - 1. None.
- D. Ducts and Plenums, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
 - 1. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.
- E. Ducts and Plenums, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
 - 1. Aluminum, Smooth with 1-1/4-Inch- (32-mm-) Deep Corrugations: thick.
- F. Equipment, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
 - 1. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.
- G. Equipment, Exposed, Larger Than 48 Inches (1200 mm) in Diameter or with Flat Surfaces Larger Than 72 Inches (1800 mm):
 - 1. Aluminum, Smooth with 1-1/4-Inch- (32-mm-) Deep Corrugations: thick.
- H. Piping, Concealed:
 - 1. Aluminum, Smooth: 0.016 inch (0.41 mm) thick.
- I. Piping, Exposed:
 - 1. PVC: 20 mils (0.5 mm) thick.

3.26 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION



**SECTION 230800
COMMISSIONING OF HVAC**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.2 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.
- D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.3 ALLOWANCES

- A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by the "Schedule of Allowances" Article in Division 01 Section "Allowances."

1.4 UNIT PRICES

- A. Commissioning testing allowance may be adjusted up or down by the "List of Unit Prices" Article in Division 01 Section "Unit Prices" when actual man-hours are computed at the end of commissioning testing.

1.5 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing review and coordination meeting.
- D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.6 CxA'S RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.



- B. Direct commissioning testing.
- C. Verify testing, adjusting, and balancing of Work are complete.
- D. Provide test data, inspection reports, and certificates in Systems Manual.

1.7 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA for inclusion in the commissioning plan:
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
 - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
 - 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
 - 4. Certificate of readiness, signed by the Contractor, certifying that HVAC&R systems, assemblies, equipment, components, and associated controls are ready for testing.
 - 5. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
 - 6. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
 - 7. Test and inspection reports and certificates.
 - 8. Corrective action documents.
 - 9. Verification of testing, adjusting, and balancing reports.

1.8 SUBMITTALS

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

- A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.



- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 TESTING AND BALANCING VERIFICATION

- A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.
- B. Notify the CxA at least 10 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.
- C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.
 - 1. The CxA will notify testing and balancing Contractor 15 days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
 - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA along with the HVAC&R Contractor, testing and balancing Contractor, and HVAC&R Instrumentation and Control Contractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.



- I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in Division 23 boiler Sections. Provide submittals, test data, inspector record, and boiler certification to the CxA.
- B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.
- C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 23 piping Sections. HVAC&R Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:
 - 1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
 - 2. Description of equipment for flushing operations.
 - 3. Minimum flushing water velocity.
 - 4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
- D. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.
- E. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.
- F. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION



SECTION 230900
INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. See Division 23 Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.2 SUBMITTALS

- A. Product Data: For each control device indicated.
- B. Shop Drawings:
 - 1. Schematic flow diagrams.
 - 2. Power, signal, and control wiring diagrams.
 - 3. Details of control panel faces.
 - 4. Damper schedule.
 - 5. Valve schedule.
 - 6. DDC System Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
 - 7. Control System Software: Schematic diagrams, written descriptions, and points list.
- C. Software and firmware operational documentation.
- D. Field quality-control test reports.
- E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

- A. Manufacturers:
 - 1. Andover Controls Corporation.
 - 2. Johnson Controls, Inc.; Controls Group.
 - 3. Siemens Building Technologies, Inc.
 - 4. Trane; Worldwide Applied Systems Group.



5. Carrier Inc.
- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.
- C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3 DDC EQUIPMENT

- A. Operator Workstation: PC-based microcomputer with minimum configuration as follows:
 1. Motherboard: With 8 integrated USB 2.0 ports, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
 2. Processor: **Intel Pentium 4**, 3.2 GHz.
 3. Random-Access Memory: 2.0 GB.
 4. Graphics: Video adapter, minimum **1600 x 1200** pixels, 128-MB video memory, with TV out.
 5. Monitor: **19 inches (480 mm)** LCD color.
 6. Keyboard: QWERTY, 105 keys in ergonomic shape.
 7. Hard-Disk Drive: **500 GB**.
 8. CD-ROM Read/Write Drive: **48x24x48**.
 9. Mouse: Three button, optical.
 10. Uninterruptible Power Supply: **[2]** 1.0 kVa.
 11. Operating System: **Microsoft Windows XP Professional** with high-speed Internet access.
 12. Printer: Color, ink-jet type as follows:
 - a. Print Head: **4800 x 1200** dpi optimized color resolution.
 - b. Paper Handling: Minimum of **100** sheets.
 - c. Print Speed: Minimum of **17** ppm in black and **12** ppm in color.
 - d. Application Software.
- B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
 1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 - d. Software applications, scheduling, and alarm processing.



- e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
- C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 3. Local operator interface provides for download from or upload to operator workstation.
- D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
 3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
 4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation **with three-position (on-off-auto) override switches and status lights**.
 5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) **with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer**.
 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
 7. Universal I/Os: Provide software selectable binary or analog outputs.
- E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.
 2. Maximum response time of 10 nanoseconds.
 3. Minimum transverse-mode noise attenuation of 65 dB.
 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.



2.4 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
 - 1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and **72-hour** battery backup.
 - 2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. **Perform scheduling with real-time clock.** Perform automatic system diagnostics; monitor system and report failures.
 - 3. Enclosure: Dustproof rated for operation at **32 to 120 deg F (0 to 50 deg C)**.

2.5 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range **minus 10 to plus 70 deg F (minus 23 to plus 21 deg C)**, and single- or double-pole contacts.
- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
 - 1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
- D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

2.6 TIME CLOCKS

- A. Manufacturers:
 - 1. ATC-Diversified Electronics.
 - 2. Grasslin Controls Corporation.
 - 3. Paragon Electric Co., Inc.
 - 4. Precision Multiple Controls, Inc.
 - 5. SSAC Inc.; ABB USA.
 - 6. TCS/Basys Controls.
 - 7. Theben AG - Lumilite Control Technology, Inc.
 - 8. Time Mark Corporation.
- B. Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.
- C. Solid-state, programmable time control with **8** separate programs each with up to 100 on-off operations; 1-second resolution; lithium battery backup; keyboard interface and manual override; individual on-off-auto switches for each program; 365-day calendar with 20 programmable



holidays; choice of fail-safe operation for each program; system fault alarm; and communications package allowing networking of time controls and programming from PC.

2.7 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
 - 1. **[Available]**Manufacturers:
 - a. BEC Controls Corporation.
 - b. Ebtron, Inc.
 - c. Heat-Timer Corporation.
 - d. I.T.M. Instruments Inc.
 - e. MAMAC Systems, Inc.
 - f. RDF Corporation.
 - 2. Accuracy: Plus or minus **0.5 deg F (0.3 deg C)** at calibration point.
 - 3. Wire: Twisted, shielded-pair cable.
 - 4. Insertion Elements in Ducts: Single point, **8 inches (200 mm)** long; use where not affected by temperature stratification or where ducts are smaller than **9 sq. ft. (0.84 sq. m)**.
 - 5. Averaging Elements in Ducts: **36 inches (915 mm) long, flexible**; use where prone to temperature stratification or where ducts are larger than **10 sq. ft. (1 sq. m)**.
 - 6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of **2-1/2 inches (64 mm)**.
 - 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: **Exposed**.
 - b. Set-Point Indication: **Exposed**.
 - c. Thermometer: **Exposed**.
 - d. Color: White
 - e. Orientation: **Horizontal**.
 - 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 - 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- C. RTDs and Transmitters:
 - 1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. MAMAC Systems, Inc.
 - c. RDF Corporation.
 - 2. Accuracy: Plus or minus 0.2 percent at calibration point.
 - 3. Wire: Twisted, shielded-pair cable.
 - 4. Insertion Elements in Ducts: Single point, **8 inches (200 mm)** long; use where not affected by temperature stratification or where ducts are smaller than **9 sq. ft. (0.84 sq. m)**.
 - 5. Averaging Elements in Ducts: **18 inches (460 mm) long, rigid**; use where prone to temperature stratification or where ducts are larger than **9 sq. ft. (0.84 sq. m)**; length as required.



6. Insertion Elements for Liquids: Brass socket with minimum insertion length of **2-1/2 inches (64 mm)**.
 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: **Exposed**.
 - b. Set-Point Indication: **Exposed**.
 - c. Thermometer: **Exposed**.
 - d. Color: White
 - e. Orientation: **Horizontal**.
 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
 9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- D. Humidity Sensors: Bulk polymer sensor element.
1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.
 - f. Vaisala.
 2. Accuracy: **5** percent full range with linear output.
 3. Room Sensor Range: 20 to 80 percent relative humidity.
 4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: **Exposed**.
 - b. Set-Point Indication: **Exposed**.
 - c. Thermometer: **Exposed**.
 - d. Color: White
 - e. Orientation: **Horizontal**.
 5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
 6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of **32 to 120 deg F (0 to 50 deg C)**.
 7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
- E. Pressure Transmitters/Transducers:
1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.



- f. Vaisala.
- 2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
 - b. Output: 4 to 20 mA.
 - c. Building Static-Pressure Range: 0- to 0.25-inch wg (0 to 62 Pa).
 - d. Duct Static-Pressure Range: 0- to 5-inch wg (0 to 1240 Pa).
- 3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure; linear output 4 to 20 mA.
- 4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure and tested to 300-psig (2070-kPa); linear output 4 to 20 mA.
- 5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
- 6. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.
- F. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - 1. Set-Point Adjustment: **Exposed**.
 - 2. Set-Point Indication: **Exposed**.
 - 3. Thermometer: **Exposed**.
 - 4. Color: White
 - 5. Orientation: **Horizontal**.
- G. Room sensor accessories include the following:
 - 1. Insulating Bases: For sensors located on exterior walls.
 - 2. Guards: **Locking, solid metal, ventilated**.
 - 3. Adjusting Key: As required for calibration and cover screws.

2.8 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa).
- B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig (55 to 414 kPa), piped across pump.
- C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.



- G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
 - 1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. I.T.M. Instruments Inc.

2.9 GAS DETECTION EQUIPMENT

- A. Manufacturers:
 - 1. B. W. Technologies.
 - 2. CEA Instruments, Inc.
 - 3. Ebtron, Inc.
 - 4. Gems Sensors Inc.
 - 5. Greystone Energy Systems Inc.
 - 6. Honeywell International Inc.; Home & Building Control.
 - 7. INTEC Controls, Inc.
 - 8. I.T.M. Instruments Inc.
 - 9. MSA Canada Inc.
 - 10. QEL/Quatrosense Environmental Limited.
 - 11. Sauter Controls Corporation.
 - 12. Sensidyne, Inc.
 - 13. TSI Incorporated.
 - 14. Vaisala.
 - 15. Vulcain Inc.
- B. Carbon Monoxide Detectors: Single or multichannel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of 32 to 104 deg F (0 to 40 deg C); with 2 factory-calibrated alarm levels at 50 and 100 ppm.
- C. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F (minus 5 to plus 55 deg C) and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output, for wall mounting.
- D. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

2.10 THERMOSTATS

- A. Manufacturers:
 - 1. Erie Controls.
 - 2. Danfoss Inc.; Air-Conditioning and Refrigeration Div.
 - 3. Heat-Timer Corporation.
 - 4. Sauter Controls Corporation.
 - 5. tekmar Control Systems, Inc.



6. Theben AG - Lumilite Control Technology, Inc.
- B. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
 1. Automatic switching from heating to cooling.
 2. Preferential rate control to minimize overshoot and deviation from set point.
 3. Set up for four separate temperatures per day.
 4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
 5. Short-cycle protection.
 6. Programming based on **every day of week**.
 7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
 8. Battery replacement without program loss.
 9. Thermostat display features include the following:
 - a. Time of day.
 - b. Actual room temperature.
 - c. Programmed temperature.
 - d. Programmed time.
 - e. Duration of timed override.
 - f. Day of week.
 - g. System mode indications include "heating," "off," "fan auto," and "fan on."
- C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, **55 to 85 deg F (13 to 30 deg C)** set-point range, and **2 deg F (1 deg C)** maximum differential.
- D. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, **55 to 85 deg F (13 to 30 deg C)** set-point range, and **2 deg F (1 deg C)** maximum differential.
 1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
 2. Selector Switch: Integral, manual on-off-auto.
- E. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
 1. Bulbs in water lines with separate wells of same material as bulb.
 2. Bulbs in air ducts with flanges and shields.
 3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
 4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
 5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
 6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.



- F. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than **75 deg F (24 deg C)** above normal maximum operating temperature, and the following:
 - 1. Reset: Manual.
 - 2. Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.
 - G. Room Thermostat Cover Construction: Manufacturer's standard locking covers.
 - 1. Set-Point Adjustment: **Exposed**.
 - 2. Set-Point Indication: **Exposed**.
 - 3. Thermometer: **Exposed**.
 - 4. Color: White
 - 5. Orientation: **Horizontal**.
 - H. Room thermostat accessories include the following:
 - 1. Insulating Bases: For thermostats located on exterior walls.
 - 2. Thermostat Guards: **Locking, solid metal, ventilated**.
 - 3. Adjusting Key: As required for calibration and cover screws.
 - 4. Set-Point Adjustment: **1/2-inch- (13-mm-)** diameter, adjustment knob.
 - I. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.
 - J. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
 - K. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- [**or automatic-**]reset switch that trips if temperature sensed across any **12 inches (300 mm)** of bulb length is equal to or below set point.
 - 1. Bulb Length: Minimum **20 feet (6 m)**.
 - 2. Quantity: One thermostat for every **20 sq. ft. (2 sq. m)** of coil surface.
 - L. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- [**or automatic-**]reset switch that trips if temperature sensed across any **12 inches (300 mm)** of bulb length is equal to or above set point.
 - 1. Bulb Length: Minimum **20 feet (6 m)**.
 - 2. Quantity: One thermostat for every **20 sq. ft. (2 sq. m)** of coil surface.
 - M. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of **25 psig (172 kPa)**, and cast housing with position indicator and adjusting knob.
- 2.11 HUMIDISTATS**
- A. Manufacturers:
 - 1. MAMAC Systems, Inc.
 - 2. ROTRONIC Instrument Corp.
 - B. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.



2.12 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 3. Nonspring-Return Motors for Valves Larger Than **NPS 2-1/2 (DN 65)**: Size for running torque of **150 in. x lbf (16.9 N x m)** and breakaway torque of **300 in. x lbf (33.9 N x m)**.
 4. Spring-Return Motors for Valves Larger Than **NPS 2-1/2 (DN 65)**: Size for running and breakaway torque of **150 in. x lbf (16.9 N x m)**.
 5. Nonspring-Return Motors for Dampers Larger Than **25 Sq. Ft. (2.3 sq. m)**: Size for running torque of **150 in. x lbf (16.9 N x m)** and breakaway torque of **300 in. x lbf (33.9 N x m)**.
 6. Spring-Return Motors for Dampers Larger Than **25 Sq. Ft. (2.3 sq. m)**: Size for running and breakaway torque of **150 in. x lbf (16.9 N x m)**.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers:
 - a. Belimo Aircontrols (USA), Inc.
 2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
 3. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: **7 inch-lb/sq. ft. (86.8 kg-cm/sq. m)** of damper.
 - b. Opposed-Blade Damper with Edge Seals: **5 inch-lb/sq. ft. (62 kg-cm/sq. m)** of damper.
 - c. Parallel-Blade Damper without Edge Seals: **4 inch-lb/sq. ft (49.6 kg-cm/sq. m)** of damper.
 - d. Opposed-Blade Damper without Edge Seals: **3 inch-lb/sq. ft. (37.2 kg-cm/sq. m)** of damper.
 - e. Dampers with **2- to 3-Inch wg (500 to 750 Pa)** of Pressure Drop or Face Velocities of **1000 to 2500 fpm (5 to 13 m/s)**: Increase running torque by 1.5.
 - f. Dampers with **3- to 4-Inch wg (750 to 1000 Pa)** of Pressure Drop or Face Velocities of **2500 to 3000 fpm (13 to 15 m/s)**: Increase running torque by 2.0.
 4. Coupling: V-bolt and V-shaped, toothed cradle.
 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
 7. Power Requirements (Two-Position Spring Return): **24-V ac**.
 8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
 9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.



10. Temperature Rating: **Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C).**
11. Temperature Rating (Smoke Dampers): **Minus 22 to plus 250 deg F (Minus 30 to plus 121 deg C).**
12. Run Time: **12 seconds open, 5 seconds closed.**

2.13 CONTROL VALVES

- A. Manufacturers:
 1. Danfoss Inc.; Air Conditioning & Refrigeration Div.
 2. Erie Controls.
 3. Hayward Industrial Products, Inc.
 4. Magnatrol Valve Corporation.
 5. Neles-Jamesbury.
 6. Parker Hannifin Corporation; Skinner Valve Division.
 7. Pneuline Controls.
 8. Sauter Controls Corporation.
- B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- C. Hydronic system globe valves shall have the following characteristics:
 1. **NPS 2 (DN 50)** and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
 2. **NPS 2-1/2 (DN 65)** and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
 3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
 - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
 - b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
 4. Sizing: **3-psig (21-kPa)** maximum pressure drop at design flow rate or the following:
 - a. Two Position: Line size.
 - b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
 - c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
 5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
 6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.
- D. Butterfly Valves: **200-psig (1380-kPa)** maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
 1. Body Style: **Grooved.**



2. Disc Type: **Epoxy-coated ductile iron**.
3. Sizing: **1-psig (7-kPa)** maximum pressure drop at design flow rate.
- E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
 1. Rating: Class 125 for service at **125 psig (860 kPa)** and **250 deg F (121 deg C)** operating conditions.
 2. Sizing: **3-psig (21-kPa)** maximum pressure drop at design flow rate, to close against pump shutoff head.
 3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
- F. Self-Contained Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
 1. Rating: Class 125 for service at **125 psig (860 kPa)** and **250 deg F (121 deg C)** operating conditions.
 2. Thermostatic Operator: **Liquid-filled integral** sensor with **integral** adjustable dial.

2.14 DAMPERS

- A. Manufacturers:
 1. Air Balance Inc.
 2. Don Park Inc.; Autodamp Div.
 3. TAMCO (T. A. Morrison & Co. Inc.).
 4. United Enertech Corp.
 5. Vent Products Company, Inc.
- B. Dampers: AMCA-rated, **opposed**-blade design; **0.108-inch- (2.8-mm-)** minimum thick, galvanized-steel or **0.125-inch- (3.2-mm-)** minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than **0.064-inch- (1.6-mm-)** thick galvanized steel with maximum blade width of **8 inches (200 mm)** and length of **48 inches (1220 mm)**.
 1. Secure blades to **1/2-inch- (13-mm-)** diameter, zinc-plated axles using zinc-plated hardware, with **nylon** blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
 2. Operating Temperature Range: From **minus 40 to plus 200 deg F (minus 40 to plus 93 deg C)**.
 3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
 4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than **10 cfm per sq. ft. (50 L/s per sq. m)** of damper area, at differential pressure of **4-inch wg (1000 Pa)** when damper is held by torque of **50 in. x lbf (5.6 N x m)**; when tested according to AMCA 500D.

2.15 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices **48 inches (1220 mm)** above the floor.
 - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- B. Install guards on thermostats in the following locations:
 - 1. Entrances.
 - 2. Public areas.
 - 3. Where indicated.
- C. Install automatic dampers according to Division 23 Section "Air Duct Accessories."
- D. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- E. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."
- F. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."
- G. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."
- H. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.
- I. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."
 - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 - 2. Install exposed cable in raceway.
 - 3. Install concealed cable in raceway.
 - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 - 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.



- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, **test, and adjust** field-assembled components and equipment installation, including connections, **and to assist in field testing**. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 - 6. Test each system for compliance with sequence of operation.
 - 7. Test software and hardware interlocks.
- C. DDC Verification:
 - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 - 2. Check instruments for proper location and accessibility.
 - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 - 4. Check instrument tubing for proper fittings, slope, material, and support.
 - 5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 - 6. Check temperature instruments and material and length of sensing elements.
 - 7. Check control valves. Verify that they are in correct direction.
 - 8. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
 - 9. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."



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END OF SECTION



SECTION 232300
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-22:
 - 1. Suction Lines for Air-Conditioning Applications: 185 psig (1276 kPa).

1.3 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M).
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.

3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
4. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.2 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 3. Operator: Rising stem and hand wheel.
 4. Seat: Nylon.
 5. End Connections: Socket, union, or flanged.
 6. Working Pressure Rating: 500 psig (3450 kPa).
 7. Maximum Operating Temperature: 275 deg F (135 deg C).
- B. Packed-Angle Valves:
 1. Body and Bonnet: Forged brass or cast bronze.
 2. Packing: Molded stem, back seating, and replaceable under pressure.
 3. Operator: Rising stem.
 4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
 5. Seal Cap: Forged-brass or valox hex cap.
 6. End Connections: Socket, union, threaded, or flanged.
 7. Working Pressure Rating: 500 psig (3450 kPa).
 8. Maximum Operating Temperature: 275 deg F (135 deg C).
- C. Check Valves:
 1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
 2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
 3. Piston: Removable polytetrafluoroethylene seat.
 4. Closing Spring: Stainless steel.
 5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
 6. End Connections: Socket, union, threaded, or flanged.
 7. Maximum Opening Pressure: 0.50 psig (3.4 kPa).
 8. Working Pressure Rating: 500 psig (3450 kPa).
 9. Maximum Operating Temperature: 275 deg F (135 deg C).
- D. Service Valves:
 1. Body: Forged brass with brass cap including key end to remove core.
 2. Core: Removable ball-type check valve with stainless-steel spring.
 3. Seat: Polytetrafluoroethylene.
 4. End Connections: Copper spring.
 5. Working Pressure Rating: 500 psig (3450 kPa).



- E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
 - 1. Body and Bonnet: Plated steel.
 - 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Working Pressure Rating: 400 psig (2760 kPa).
 - 6. Maximum Operating Temperature: 240 deg F (116 deg C).
 - 7. Manual operator.
- F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - 1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 - 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Seat Disc: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Working Pressure Rating: 400 psig (2760 kPa).
 - 6. Maximum Operating Temperature: 240 deg F (116 deg C).
- G. Thermostatic Expansion Valves: Comply with ARI 750.
 - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Packing and Gaskets: Non-asbestos.
 - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 - 5. Suction Temperature: 40 deg F (4.4 deg C).
 - 6. Reverse-flow option (for heat-pump applications).
 - 7. End Connections: Socket, flare, or threaded union.
 - 8. Working Pressure Rating: 450 psig (3100 kPa).
- H. Straight-Type Strainers:
 - 1. Body: Welded steel with corrosion-resistant coating.
 - 2. Screen: 100-mesh stainless steel.
 - 3. End Connections: Socket or flare.
 - 4. Working Pressure Rating: 500 psig (3450 kPa).
 - 5. Maximum Operating Temperature: 275 deg F (135 deg C).
- I. Angle-Type Strainers:
 - 1. Body: Forged brass or cast bronze.
 - 2. Drain Plug: Brass hex plug.
 - 3. Screen: 100-mesh monel.
 - 4. End Connections: Socket or flare.
 - 5. Working Pressure Rating: 500 psig (3450 kPa).
 - 6. Maximum Operating Temperature: 275 deg F (135 deg C).
- J. Moisture/Liquid Indicators:



1. Body: Forged brass.
 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 3. Indicator: Color coded to show moisture content in ppm.
 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 5. End Connections: Socket or flare.
 6. Working Pressure Rating: 500 psig (3450 kPa).
 7. Maximum Operating Temperature: 240 deg F (116 deg C).
- K. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Designed for reverse flow (for heat-pump applications).
 4. End Connections: Socket.
 5. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
 6. Working Pressure Rating: 500 psig (3450 kPa).
 7. Maximum Operating Temperature: 240 deg F (116 deg C).
- L. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Designed for reverse flow (for heat-pump applications).
 4. End Connections: Socket.
 5. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
 6. Maximum Pressure Loss: 2 psig (14 kPa).
 7. Working Pressure Rating: 500 psig (3450 kPa).
 8. Maximum Operating Temperature: 240 deg F (116 deg C).
- M. Liquid Accumulators: Comply with ARI 495.
1. Body: Welded steel with corrosion-resistant coating.
 2. End Connections: Socket or threaded.
 3. Working Pressure Rating: 500 psig (3450 kPa).
 4. Maximum Operating Temperature: 275 deg F (135 deg C).

2.3 REFRIGERANTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Atofina Chemicals, Inc.
 2. DuPont Company; Fluorochemicals Div.



3. Honeywell, Inc.; Genetron Refrigerants.
 4. INEOS Fluor Americas LLC.
- C. ASHRAE 34, R-22: Monochlorodifluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Suction Lines **NPS 1-1/2 (DN 40)** and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Suction Lines **NPS 4 (DN 100)** and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, **L (B)**, drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Safety-Relief-Valve Discharge Piping: Copper, Type **K, L**, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:
 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.

2. Install horizontal suction lines with a uniform slope downward to compressor.
 3. Install traps and double risers to entrain oil in vertical runs.
 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.
- R. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."
- S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- T. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- U. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.
- V. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.3 PIPE JOINT CONSTRUCTION

- A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
 2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.
 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
 4. Spring hangers to support vertical runs.
 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
 2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
 3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).

4. **NPS 1-1/4 (DN 32)**: Maximum span, **96 inches (2400 mm)**; minimum rod size, **3/8 inch (9.5 mm)**.
5. **NPS 1-1/2 (DN 40)**: Maximum span, **96 inches (2400 mm)**; minimum rod size, **3/8 inch (9.5 mm)**.
6. **NPS 2 (DN 50)**: Maximum span, **96 inches (2400 mm)**; minimum rod size, **3/8 inch (9.5 mm)**.
7. **NPS 2-1/2 (DN 65)**: Maximum span, **108 inches (2700 mm)**; minimum rod size, **3/8 inch (9.5 mm)**.
8. **NPS 3 (DN 80)**: Maximum span, **10 feet (3 m)**; minimum rod size, **3/8 inch (9.5 mm)**.
9. **NPS 4 (DN 100)**: Maximum span, **12 feet (3.7 m)**; minimum rod size, **1/2 inch (13 mm)**.

D. Support multifloor vertical runs at least at each floor.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.6 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to **500 micrometers (67 Pa)**. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to **2 psig (14 kPa)**.
4. Charge system with a new filter-dryer core in charging line.

3.7 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.



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2. Verify that compressor oil level is correct.
 3. Open compressor suction and discharge valves.
 4. Open refrigerant valves except bypass valves that are used for other purposes.
 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION



SECTION 233113
METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
3. Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
4. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Duct-Cleaning Test Report for Prerequisite EQ 1: Documentation of work performed for compliance with ASHRAE 62.1-2004, Section 7.2.4 - "Ventilation System Start-Up."

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.



10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.

E. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."



- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGill AirFlow LLC.
 - b. SEMCO Incorporated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than **60 Inches (1524 mm)** in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger Than **90 inches (2286 mm)** in diameter with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: **G60 (Z180)**.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.



- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- G. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning.
 - 3. Maximum Thermal Conductivity:
 - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F (0.033 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - 4. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - 5. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Insulation Pins and Washers:
 - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
 - 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of **2500 fpm (12.7 m/s)**.
 7. Secure liner with mechanical fasteners **4 inches (100 mm)** from corners and at intervals not exceeding **12 inches (300 mm)** transversely; at **3 inches (75 mm)** from transverse joints and at intervals not exceeding **18 inches (450 mm)** longitudinally.
 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than **2500 fpm (12.7 m/s)** or where indicated.
 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: **3/32-inch (2.4-mm)** diameter, with an overall open area of 23 percent.
 10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: **4 inches (102 mm)**.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: **10-inch wg (2500 Pa)**, positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: **Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C)**.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.



10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
 6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:



1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.7 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.; a division of Cooper Industries.
 2. Hilti Corp.
 3. Kinetics Noise Control.
 4. Mason Industries.
 5. Unistrut Corporation; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.



- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of **1 inch (25 mm)**, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least **1-1/2 inches (38 mm)**.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

- A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
- B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of **20 feet (6 m)** in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of **1-1/2 inches (38 mm)** from bottom of duct.
- C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes **2-Inch wg (500 Pa)** and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than **2-Inch wg (500 Pa)**: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes **2-Inch wg (500 Pa)** and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than **2-Inch wg (500 Pa)**: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than **4 inches (100 mm)** thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than **4 inches (100 mm)** thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," **Table 4-1 (Table 4-1M)**, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within **24 inches (610 mm)** of each elbow and within **48 inches (1200 mm)** of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of **16 feet (5 m)**.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.



3.7 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits as required by the Owner or the Owner's consultants:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - 6. Supply-air ducts, dampers, actuators, and turning vanes.
 - 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 - 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 - 6. Provide drainage and cleanup for wash-down procedures.
 - 7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.



3.8 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

- 1. Underground Ducts: Concrete-encased, stainless steel.

- B. Supply Ducts:

- 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive **2-inch wg (500 Pa)**.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive **3-inch wg (750 Pa)**.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive **3-inch wg (750 Pa)**.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- 4. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive **2-inch wg (500 Pa)**.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.

- C. Return Ducts:

- 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative **2-inch wg (500 Pa)**.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative **3-inch wg (750 Pa)**.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative **2-inch wg (500 Pa)**.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.

- D. Exhaust Ducts:

- 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative **1-inch wg (250 Pa)**.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.



- c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
 - a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
 - b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
 - c. Welded seams and joints.
 - d. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
 - e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - f. SMACNA Leakage Class: 3.
 4. Ducts Connected to Dishwasher Hoods:
 - a. Type 304, stainless-steel sheet.
 - b. Exposed to View: No. 4 finish.
 - c. Concealed: No. 2D finish.
 - d. Welded seams and flanged joints with watertight EPDM gaskets.
 - e. Pressure Class: Positive or negative 3-inch wg (750 Pa).
 - f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - g. SMACNA Leakage Class: 3.
 5. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:
 - a. Type 316, stainless-steel sheet.
 - 1) Exposed to View: No. 4 finish.
 - 2) Concealed: No. 2B finish.
 - b. PVC-coated, galvanized sheet steel with thicker coating on duct interior.
 - c. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
 - d. Minimum SMACNA Seal Class: A.
 - e. SMACNA Leakage Class: 3.
 6. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.



- d. SMACNA Leakage Class for Round and Flat Oval: 3.
- F. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel.
 2. PVC-Coated Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Galvanized.
 3. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Galvanized.
 4. Aluminum Ducts: Aluminum.
- G. Liner:
1. Supply Air Ducts: Fibrous glass, Type I, 1-inches (38 mm) thick.
 2. Return Air Ducts: Fibrous glass, Type I, 1-inches (38 mm) thick.
 3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch (25 mm) thick.
 4. Supply Fan Plenums: Fibrous glass, Type II, 1-1/2 inches (38 mm) thick.
 5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches (51 mm) thick.
 6. Transfer Ducts: Fibrous glass, Type I, 1-1/2 inches (38 mm) thick.
- H. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm (5 m/s) or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm (7.6 m/s) or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.



- 1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
- b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Standing seam.
- I. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
 - c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION



**SECTION 233116
NONMETAL DUCTS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fibrous-glass ducts and fittings.
 - 2. Phenolic-foam ducts and fittings.
- B. Related Sections:
 - 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for nonmetal ducts.
 - 2. Division 23 Section "Metal Ducts" for single- and double-wall, rectangular and round ducts.
 - 3. Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
 - 4. Division 23 Section "Air Duct Accessories" for dampers, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Duct layout indicating sizes and pressure classes.
 - 3. Elevation of top of ducts.
 - 4. Dimensions of main duct runs from building grid lines.
 - 5. Fittings.
 - 6. Reinforcement and spacing.
 - 7. Seam and joint construction.
 - 8. Penetrations through fire-rated and other partitions.
 - 9. Equipment installation based on equipment being used on Project.
 - 10. Hangers and supports, including methods for duct and building attachment and vibration isolation.
- C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which duct will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Penetrations of smoke barriers and fire-rated construction.
 - 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.



- d. Sprinklers.
- e. Access panels.
- f. Perimeter moldings.

1.3 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."
- C. NFPA Compliance:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 FIBROUS-GLASS DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, :
 - 1. CertainTeed Corporation; Insulation Group.
 - 2. Johns Manville.
 - 3. Knauf Insulation.
 - 4. Owens Corning.
- B. Fibrous-Glass Duct Materials: Resin-bonded fiberglass, faced on the outside surface with fire-resistant FSK vapor retarder and with a smooth fiberglass mat finish on the air-side surface.
 - 1. Duct Board: Factory molded into rectangular boards.
 - 2. Round Duct: Factory molded into straight round duct and smooth fittings.
 - 3. Temperature Limits: 40 to 250 deg F (5 to 121 deg C) inside ducts; 150 deg F (66 deg C) ambient temperature surrounding ducts.
 - 4. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F (0.035 W/m x K) at 75 deg F (24 deg C) mean temperature.
 - 5. Moisture Absorption: Not exceeding 5 percent by weight at 120 deg F (49 deg C) and 95 percent relative humidity for 96 hours when tested according to ASTM C 1104/C 1104M.
 - 6. Permeability: 0.02 perms (1.15 ng/Pa x s x sq. m) maximum when tested according to ASTM E 96/E 96M, Procedure A.
 - 7. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL, and registered by the EPA for use in HVAC systems.
 - 8. Noise-Reduction Coefficient: 0.65 minimum when tested according to ASTM C 423, Mounting A.
 - 9. Required Markings: EI rating, UL label, and other markings required by UL 181 on each full sheet of duct board.
- C. Closure Materials:
 - 1. Pressure-Sensitive Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-P," the manufacturer's name, and a date code.
 - a. Tape: Aluminum foil-scrim tape imprinted with listing information.
 - b. Minimum Tape Width: 2-1/2 inches (64 mm); 3 inches (76 mm) for duct board thicker than 1 inch (25 mm).
 - c. Staples: 1/2-inch (13-mm) outward clinching, 2 inches (51 mm) o.c. in tabs, one tab per joint.



- d. Water resistant.
- e. Mold and mildew resistant.
- 2. Heat-Activated Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-H," the manufacturer's name, and a date code.
 - a. Tape: Aluminum foil-scrim tape imprinted with listing information.
 - b. Minimum Tape Width: **3 inches (76 mm)**.
 - c. Heat-Sensitive Imprint: Printed indicator on tape to show proper heating during application has been achieved.
 - d. Water resistant.
 - e. Mold and mildew resistant.
- 3. Two-Part Tape Sealing System: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-M," the manufacturer's name, and a date code.
 - a. Tape: Woven glass fiber impregnated with mineral gypsum.
 - b. Minimum Tape Width: **3 inches (76 mm)**.
 - c. Sealant: Modified styrene acrylic.
 - d. Water resistant.
 - e. Mold and mildew resistant.
 - f. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Fabrication:

- 1. Select joints, seams, transitions, elbows, and branch connections and fabricate according to SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 2, "Specifications and Closure," and Chapter 4, "Fittings and Connections."
- 2. Fabricate 90-degree mitered elbows to include turning vanes.
- 3. Reinforcements: Comply with requirements in SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 5, "Reinforcement" for channel- and tie-rod reinforcement materials, spacing, and fabrication.
- 4. Preformed Round Duct: Comply with NAIMA AH116, "Fibrous Glass Duct Construction Standards," Section VII, "Preformed Round Duct."

2.2 PHENOLIC-FOAM DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Knauf Insulation.
- B. Duct Panel: CFC-free phenolic-foam bonded on both sides with factory-applied **0.001-inch-(0.025-mm-)** thick, aluminum foil reinforced with fiberglass scrim.
 - 1. Maximum Temperature: **158 deg F (70 deg C)** inside ducts or ambient temperature surrounding ducts.
 - 2. Maximum Thermal Conductivity: **0.13 Btu x in./h x sq. ft. x deg F (0.019 W/m x K)** at **75 deg F (24 deg C)** mean temperature.
 - 3. Permeability: **0.0002 perms (0.0115 ng/Pa x s x sq. m)** maximum when tested according to ASTM E 96/E 96M, Procedure A.
 - 4. Antimicrobial Agent: Compound shall be tested for efficacy by an NRTL, and registered by the EPA for use in HVAC systems.
 - 5. Noise-Reduction Coefficient: 0.65 minimum when tested according to ASTM C 423, Mounting A.
 - 6. Required Markings: UL label and other markings required by UL 181 on each full sheet of duct panel; UL ratings for closure materials.



C. Closure Materials:

1. V-Groove Adhesive: Silicone.
 - a. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Pressure-Sensitive Tape: Comply with UL 181A; imprinted by the manufacturer with the coding "181A-P," the manufacturer's name, and a date code.
 - a. Tape: Aluminum foil tape imprinted with listing information.
 - b. Minimum Tape Width: 3 inches (76 mm).
 - c. Water resistant.
 - d. Mold and mildew resistant.
3. Polymeric Sealing System:
 - a. Structural Membrane: Woven glass fiber.
 - b. Minimum Tape Width: 3 inches (76 mm).
 - c. Sealant: Water based.
 - d. Color: White.
 - e. Water resistant.
 - f. Mold and mildew resistant.
 - g. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Fabrication:

1. Fabricate joints, seams, transitions, reinforcement, elbows, branch connections, access doors and panels, and damage repairs according to Knauf Insulation's "Knauf KoolDuct System Design Guide," Section 4, "Duct Construction," and Section 5, "Ductwork System General."
2. Fabricate 90-degree mitered elbows to include turning vanes.

2.3 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables: ASTM A 603, galvanized steel with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Install ducts with fewest possible joints.
- B. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.



- C. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- D. Install ducts with a clearance of **1 inch (25 mm)**, plus allowance for insulation thickness.
- E. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges. Overlap openings on four sides by at least **1-1/2 inches (38 mm)**.
- F. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- G. Protect duct interiors from the moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."
- H. Install fibrous-glass ducts and fittings to comply with SMACNA's "Fibrous Glass Duct Construction Standards."
- I. Install foam ducts and fittings to comply with Knauf Insulation's "Knauf KoolDuct System Design Guide."

3.2 HANGER AND SUPPORT INSTALLATION

- A. Install hangers and supports for fibrous-glass ducts and fittings to comply with SMACNA's "Fibrous Glass Duct Construction Standards," Chapter 6, "Hangers and Supports."
- B. Install hangers and supports for phenolic-foam ducts and fittings to comply with Knauf Insulation's "Knauf KoolDuct System Design Guide," Section 5, "Ductwork System General."
- C. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than **4 inches (100 mm)** thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than **4 inches (100 mm)** thick.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch duct as recommended by duct manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:



1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits as required by the Owner or the Owner's consultants:
1. Air outlets and inlets (registers, grilles, and diffusers).
 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 4. Coils and related components.
 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 6. Supply-air ducts, dampers, actuators, and turning vanes.
 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
1. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 2. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of ducts or duct accessories.
 3. Clean fibrous-glass duct with HEPA vacuuming equipment; do not permit duct to get wet. Replace fibrous-glass duct that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 4. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 5. Provide drainage and cleanup for wash-down procedures.
 6. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.4 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.5 DUCT SCHEDULE

- A. Indoor Ducts and Fittings: Non-Metal ducts shall be used for air conditioning in residential units only.
1. Fibrous-Glass Rectangular Ducts and Fittings:
 - a. Minimum Flexural Rigidity: EI-475.
 - b. Minimum Board Thickness: **1 inch (25 mm)**.
 2. Fibrous-Glass Round Ducts and Fittings:
 - a. Minimum Thickness: **1 inch (25 mm)**.



3. Phenolic-Foam Rectangular Ducts and Fittings:
 - a. Minimum Panel Thickness: 7/8 inch (22 mm).
 - b. Aluminum Cladding: Minimum 0.025 inch (0.635 mm) thick.
- B. Outdoor Duct and Fittings:
 1. Phenolic-Foam Rectangular Ducts and Fittings:
 - a. Minimum Panel Thickness: 7/8 inch (22 mm).
 - b. Aluminum Cladding: Minimum 0.032 inch (0.813 mm) thick.
 - c. Polymeric Sealing System: Coat ducts, including gang-nail couplings, grip flanges, and couplings.

END OF SECTION



SECTION 233300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Backdraft and pressure relief dampers.
 2. Manual volume dampers.
 3. Control dampers.
 4. Fire dampers.
 5. Smoke dampers.
 6. Flange connectors.
 7. Turning vanes.
 8. Duct-mounted access doors.
 9. Flexible connectors.
 10. Flexible ducts.
 11. Duct accessory hardware.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
 - e. Wiring Diagrams: For power, signal, and control wiring.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G60 (Z180).



2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 2 finish for exposed ducts.
- D. Aluminum Sheets: Comply with **ASTM B 209 (ASTM B 209M)**, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with **ASTM B 221 (ASTM B 221M)**, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, **1/4-inch (6-mm)** minimum diameter for lengths **36 inches (900 mm)** or less; **3/8-inch (10-mm)** minimum diameter for lengths longer than **36 inches (900 mm)**.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Air Balance Inc.; a division of Mestek, Inc.
 2. American Warming and Ventilating; a division of Mestek, Inc.
 3. Cesco Products; a division of Mestek, Inc.
 4. Duro Dyne Inc.
 5. Greenheck Fan Corporation.
 6. Lloyd Industries, Inc.
 7. Nailor Industries Inc.
 8. NCA Manufacturing, Inc.
 9. Pottorff; a division of PCI Industries, Inc.
 10. Ruskin Company.
 11. SEMCO Incorporated.
 12. Vent Products Company, Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: **2000 fpm (10 m/s)**.
- D. Maximum System Pressure: **2-inch wg (0.5 kPa)**.
- E. Frame: **0.052-inch- (1.3-mm-)** thick, galvanized sheet steel, with welded corners and mounting flange.
- F. Blades: Multiple single-piece blades, center-pivoted, maximum **6-inch (150-mm)** width, **0.025-inch- (0.6-mm-)** thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Neoprene, mechanically locked.
- I. Blade Axles:
 1. Material: Stainless steel.
 2. Diameter: **0.20 inch (5 mm)**.
- J. Tie Bars and Brackets: Aluminum.
- K. Return Spring: Adjustable tension.
- L. Bearings: Steel ball or synthetic pivot bushings.



M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20-gage (1.0-mm) minimum.
 - b. Sleeve Length: 6 inches (152 mm) minimum.
6. Screen Mounting: Rear mounted.
7. Screen Material: Aluminum.
8. Screen Type: Bird.
9. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements,:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Pottorff; a division of PCI Industries, Inc.
 - h. Ruskin Company.
 - i. Trox USA Inc.
 - j. Vent Products Company, Inc.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:
 - a. Hat-shaped, stainless-steel channels, 0.064-inch (1.62-mm) minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Stainless-steel, 0.064 inch (1.62 mm) thick.
6. Blade Axles: Stainless steel.
7. Bearings:
 - a. Stainless-steel sleeve.
 - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.



- c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Pottorff; a division of PCI Industries, Inc.
 - h. Ruskin Company.
 - i. Trox USA Inc.
 - j. Vent Products Company, Inc.
 2. Standard leakage rating, with linkage outside airstream.
 3. Suitable for horizontal or vertical applications.
 4. Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
 - e. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
 6. Blade Axles: Stainless steel.
 7. Bearings:
 - a. Stainless-steel sleeve.
 - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 8. Tie Bars and Brackets: Aluminum.
- C. Jackshaft:
1. Size: 1-inch (25-mm) diameter.
 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- D. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
 2. Include center hole to suit damper operating-rod size.
 3. Include elevated platform for insulated duct mounting.

2.4 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Arrow United Industries; a division of Mestek, Inc.
 3. Cesco Products; a division of Mestek, Inc.
 4. Duro Dyne Inc.
 5. Flexmaster U.S.A., Inc.
 6. Greenheck Fan Corporation.
 7. Lloyd Industries, Inc.
 8. M&I Air Systems Engineering; Division of M&I Heat Transfer Products Ltd.
 9. McGill AirFlow LLC.
 10. METALAIRE, Inc.



11. Metal Form Manufacturing, Inc.
12. Nailor Industries Inc.
13. NCA Manufacturing, Inc.
14. Ruskin Company.
15. Vent Products Company, Inc.
16. Young Regulator Company.

B. Frames:

1. Hat shaped.
2. Stainless-steel channels, 0.064 inch (1.62 mm) thick.
3. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 8 inches (200 mm).
2. Parallel- and opposed-blade design.
3. Stainless steel.
4. 0.064 inch (1.62 mm) thick.
5. Blade Edging: Closed-cell neoprene edging.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch- (13-mm-) diameter; stainless steel nonferrous metal; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

E. Bearings:

1. Stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.5 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. NCA Manufacturing, Inc.
9. PHL, Inc.
10. Pottorff; a division of PCI Industries, Inc.
11. Prefco; Perfect Air Control, Inc.
12. Ruskin Company.
13. Vent Products Company, Inc.
14. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.



- C. Closing rating in ducts up to **4-inch wg (1-kPa)** static pressure class and minimum **4000-fpm (20-m/s)** velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, **0.034-inch- (0.85-mm-)** thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: **0.052 or 0.138 inch (1.3 or 3.5 mm)** thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, **0.034-inch- (0.85-mm-)** thick, galvanized sheet steel. In place of interlocking blades, use full-length, **0.034-inch- (0.85-mm-)** thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, **165 deg F (74 deg C)** rated, fusible links.
- K. Heat-Responsive Device: Electric resettable link and switch package, factory installed, **165 deg F (74 deg C)** rated.

2.6 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Cesco Products; a division of Mestek, Inc.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. PHL, Inc.
 - 6. Ruskin Company.
- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Smoke Detector: Integral, factory wired for single-point connection.
- D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, **0.034-inch- (0.85-mm-)** thick galvanized steel; with mitered and interlocking corners.
- E. Blades: Roll-formed, horizontal, interlocking, **0.034-inch- (0.85-mm-)** thick, galvanized sheet steel. In place of interlocking blades, use full-length, **0.034-inch- (0.85-mm-)** thick, galvanized-steel blade connectors.
- F. Leakage: Class I.
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Mounting Sleeve: Factory-installed, **0.052-inch- (1.3-mm-)** thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- I. Damper Motors: Modulating action.



- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." Division 26 Sections.
 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
 7. Electrical Connection: 115 V, single phase, 60 Hz.
- K. Accessories:
1. Auxiliary switches for position indication.
 2. , damper mounted.

2.7 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ductmate Industries, Inc.
 2. Nexus PDQ; Division of Shilco Holdings Inc.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. METALAIRE, Inc.
 4. SEMCO Incorporated.
 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.



1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vaness and Vane Runners," and 2-4, "Vane Support in Elbows."
- E. Vane Construction: Double wall.
- F. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.9 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Cesco Products; a division of Mestek, Inc.
 3. Ductmate Industries, Inc.
 4. Flexmaster U.S.A., Inc.
 5. Greenheck Fan Corporation.
 6. McGill AirFlow LLC.
 7. Nailor Industries Inc.
 8. Pottorff; a division of PCI Industries, Inc.
 9. Ventfabrics, Inc.
 10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.
- C. Pressure Relief Access Door:
 1. Door and Frame Material: Galvanized sheet steel.



2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 10-inch wg (2500 Pa).
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.10 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Ductmate Industries, Inc.
 2. Flame Gard, Inc.
 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch (1.1-mm) stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F (1093 deg C).
- F. Minimum Pressure Rating: 10-inch wg (2500 Pa), positive or negative.

2.11 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Ventfabrics, Inc.
 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
 2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
 3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.



1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
 2. Minimum Tensile Strength: 500 lbf/inch (88 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
 3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).
- G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.12 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
- C. Noninsulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.
1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
- D. Noninsulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.
1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
- E. Noninsulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire.
1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).



- F. Noninsulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil.
 - 1. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
 - 2. Maximum Air Velocity: 5000 fpm (25 m/s).
 - 3. Temperature Range: Minus 100 to plus 435 deg F (Minus 73 to plus 224 deg C).
- G. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 - 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 - 3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2004.
- H. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
 - 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 - 3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
 - 4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1-2004.
- I. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 - 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 - 3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2004.
- J. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 - 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 - 3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2004.
- K. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
 - 2. Maximum Air Velocity: 5000 fpm (25 m/s).
 - 3. Temperature Range: Minus 20 to plus 250 deg F (Minus 29 to plus 121 deg C).
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2004.
- L. Flexible Duct Connectors:
 - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.
 - 2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.13 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.



- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream and downstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-foot (15-m) spacing.
 - 8. Upstream and downstream from turning vanes.
 - 9. Control devices requiring inspection.
 - 10. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
 - 2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
 - 3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).



4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
 5. Body Access: 25 by 14 inches (635 by 355 mm).
 6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).
- K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
 - L. Install flexible connectors to connect ducts to equipment.
 - M. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
 - N. Connect terminal units to supply ducts with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.
 - O. Connect diffusers or light troffer boots to ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.
 - P. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
 - Q. Install duct test holes where required for testing and balancing purposes.
 - R. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.

END OF SECTION



SECTION 233713
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Round ceiling diffusers.
 2. Rectangular and square ceiling diffusers.
 3. Perforated diffusers.
 4. Louver face diffusers.
 5. Linear bar diffusers.
 6. Linear slot diffusers.
 7. Adjustable bar registers and grilles.
 8. Fixed face registers and grilles.
 9. Linear bar grilles.
- B. Related Sections:
1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Round Ceiling Diffuser:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. METALAIRE, Inc.
 - b. Titus.
 - c. Tuttle & Bailey.
 - d. Air Guide Inc.
 3. Devices shall be specifically designed for variable-air-volume flows.
 4. Material: Aluminum.
 5. Finish: Baked enamel, color selected by Architect.
 6. Face Style: Four cone.
 7. Mounting: Duct connection.
 8. Pattern: Fully adjustable.
 9. Dampers: Radial opposed blade.



10. Accessories:
 - a. Equalizing grid.
 - b. Plaster ring.
 - c. Safety chain.
 - d. Wire guard.
 - e. Sectorizing baffles.
 - f. Operating rod extension.
- B. Rectangular and Square Ceiling Diffusers:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. METALAIRE, Inc.
 - b. Titus.
 - c. Tuttle & Bailey.
 3. Devices shall be specifically designed for variable-air-volume flows.
 4. Material: Aluminum.
 5. Finish: Baked enamel, color selected by Architect.
 6. Face Size: As shown on plans.
 7. Face Style: Four cone.
 8. Mounting: Surface.
 9. Pattern: Adjustable.
 10. Dampers: Radial opposed blade.
 11. Accessories:
 - a. Equalizing grid.
 - b. Plaster ring.
 - c. Safety chain.
 - d. Wire guard.
 - e. Sectorizing baffles.
 - f. Operating rod extension.
- C. Perforated Diffuser:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. METALAIRE, Inc.
 - b. Titus.
 - c. Tuttle & Bailey.
 3. Devices shall be specifically designed for variable-air-volume flows.
 4. Material: Steel backpan and pattern controllers, with aluminum face.
 5. Finish: Baked enamel, color selected by Architect.
 6. Face Size: AS shown on plan.
 7. Duct Inlet: Round.
 8. Face Style: Flush.
 9. Mounting: T-bar.
 10. Pattern Controller: Four louvered deflector patches.
 11. Dampers: Butterfly.
 12. Accessories:
 - a. Equalizing grid.
 - b. Plaster ring.



- c. Safety chain.
- d. Wire guard.
- e. Sectorizing baffles.
- f. Operating rod extension.

D. Louver Face Diffuser:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. METALAIRE, Inc.
 - b. Titus.
 - c. Tuttle & Bailey.
- 3. Devices shall be specifically designed for variable-air-volume flows.
- 4. Material: Aluminum.
- 5. Finish: Baked enamel, color selected by Architect.
- 6. Face Size: As shown on plan.
- 7. Mounting: Surface.
- 8. Pattern: Four-way
- 9. Dampers: Radial opposed blade.
- 10. Accessories:
 - a. Square to round neck adaptor.
 - b. Adjustable pattern vanes.
 - c. Throw reducing vanes.
 - d. Equalizing grid.
 - e. Plaster ring.
 - f. Safety chain.
 - g. Wire guard.
 - h. Sectorizing baffles.
 - i. Operating rod extension.

2.2 CEILING LINEAR SLOT OUTLETS

A. Linear Bar Diffuser:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. METALAIRE, Inc.
 - b. Titus.
 - c. Tuttle & Bailey.
- 3. Devices shall be specifically designed for variable-air-volume flows.
- 4. Material: Aluminum.
- 5. Finish: Baked enamel, color selected by Architect.
- 6. Narrow Core Spacing Arrangement: 1/8-inch- (3-mm-) thick blades spaced 1/4 inch (6 mm) apart, zero-degree deflection.
- 7. Wide Core Spacing Arrangement: 1/8-inch- (3-mm-) thick blades spaced 1/2 inch (13 mm) apart, zero-degree deflection.
- 8. Wide Core Spacing Arrangement: 3/16-inch- (5-mm-) thick blades spaced 1/2 inch (13 mm) apart, zero [30]-degree deflection.
- 9. Pencil-Proof Core Spacing Arrangement: 3/16-inch- (5-mm-) thick blades spaced 7/16 inch (11 mm) apart, zero-degree deflection.



10. Two-Way Deflection Vanes: Extruded construction fixed louvers with removable core.
11. Frame: 1-1/4 inches (32 mm) wide.
12. Mounting: Concealed bracket.
13. Damper Type: Adjustable opposed-blade assembly.

B. Linear Slot Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. METALAIRE, Inc.
 - b. Titus.
 - c. Tuttle & Bailey.
3. Devices shall be specifically designed for variable-air-volume flows.
4. Material - Shell: [Aluminum], noninsulated.
5. Material - Pattern Controller and Tees: Aluminum.
6. Finish - Face and Shell: Baked enamel, black.
7. Finish - Pattern Controller: Baked enamel, black.
8. Finish - Tees: Baked enamel, color selected by Architect.
9. Slot Width: 1 inch (25 mm).
10. Number of Slots: One.
11. Length: 48 inches (1200 mm).

2.3 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. METALAIRE, Inc.
 - b. Titus.
 - c. Tuttle & Bailey.
3. Material: Aluminum.
4. Finish: Baked enamel, color selected by Architect.
5. Face Blade Arrangement: Vertical spaced 3/4 inch (19 mm) apart.
6. Core Construction: Integral.
7. Rear-Blade Arrangement: Horizontal spaced 3/4 inch (19 mm) apart.
8. Frame: 1-1/4 inches (32 mm) wide.
9. Mounting: Concealed.
10. Damper Type: Adjustable opposed blade.
11. Accessories:
 - a. Front-blade gang operator.
 - b. Filter.

B. Adjustable Bar Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. METALAIRE, Inc.
 - b. Titus.



- c. Tuttle & Bailey.
 3. Material: Aluminum.
 4. Finish: Baked enamel, color selected by Architect.
 5. Face Blade Arrangement: Vertical spaced 3/4 inch (19 mm) apart.
 6. Core Construction: Integral.
 7. Rear-Blade Arrangement: Horizontal spaced 3/4 inch (19 mm) apart.
 8. Frame: 1-1/4 inches (32 mm) wide.
 9. Mounting: Concealed.
 - C. Fixed Face Register:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Titus.
 - b. Tuttle & Bailey.
 3. Material: Aluminum.
 4. Finish: Baked enamel, color selected by Architect.
 5. Core Construction: Integral.
 6. Frame: 1-1/4 inches (32 mm) wide.
 7. Mounting: Concealed.
 8. Damper Type: Adjustable opposed blade.
 9. Accessory: Filter.
 - D. Fixed Face Grille:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Titus.
 - b. Tuttle & Bailey.
 3. Material: Aluminum.
 4. Finish: Baked enamel, color selected by Architect.
 5. Core Construction: Integral.
 6. Frame: 1-1/4 inches (32 mm) wide.
 7. Mounting: Concealed.
 8. Accessory: Filter.
 - E. Linear Bar Grille:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Titus.
 - b. Tuttle & Bailey.
 3. Material: Aluminum.
 4. Finish: Baked enamel, color selected by Architect.
 5. Distribution plenum.
 - a. Internal insulation.
 - b. Inlet damper.
 6. Frame: 1-1/4 inches (32 mm) wide.
 7. Mounting: Concealed.



- 8. Damper Type: Adjustable opposed blade.

2.4 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

MIAMI-DADE PUBLIC LIBRARY SYSTEM
VOLUME II
PROJECT MANUAL
DIVISION 26- ELECTRICAL

South Dade Regional Library Interior Renovations

C23-MDPLS-01-ESP



260500	Common Work Results for Electrical
260519	Low-Voltage Electrical Power Conductors and Cables
260523	Control-Voltage Electrical Power Cables
260526	Grounding and Bonding for Electrical Systems
260529	Hangers and Supports for Electrical Systems
260533	Raceway and Boxes for Electrical Systems
260553	Identification for Electrical Systems
260923	Lighting Control Devices
260933	Central Dimming Controls
260936	Modular Dimming Controls
262416	Panelboards
262726	Wiring Devices
262813	Fuses
262816	Enclosed Switches and Circuit Breakers
265100	Interior Lighting
265110	Lighting Fixtures Schedule



SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For sleeve seals.

1.5 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.



- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 3. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 4. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 5. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.



- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors **2 inches (50 mm)** above finished floor level.
- G. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for **1-inch (25-mm)** annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION



SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.
- B. Related Sections include the following:
 - 1. Division 26 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.
 - 2. Division 26 Section "Undercarpet Electrical Power Cables" for flat cables for undercarpet installations.
 - 3. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.



1.6 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- B. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, XHHW and SO.
- D. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, metal-clad cable, Type MC and Type USE with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.



4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 2. Pressure Plates: Carbon steel. Include two for each sealing element.
 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Metal-clad cable, Type MC.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.
- F. Feeders in Cable Tray: Type THHN-THWN, single conductors in raceway.
- G. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- J. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.
- K. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway.
- L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- M. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- N. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least **6 inches (150 mm)** of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve rectangle perimeter less than **50 inches (1270 mm)** and no side greater than **16 inches (400 mm)**, thickness shall be **0.052 inch (1.3 mm)**.
 - 2. For sleeve rectangle perimeter equal to, or greater than, **50 inches (1270 mm)** and 1 or more sides equal to, or greater than, **16 inches (400 mm)**, thickness shall be **0.138 inch (3.5 mm)**.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors **2 inches (50 mm)** above finished floor level.
- H. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and cable unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.



- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.
 - a. Emergency systems feeders.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- D. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- E. Remove and replace malfunctioning units and retest as specified above.



**MIAMI-DADE COUNTY, FLORIDA
PROJECT: C23-MDPLS-01-ESP**

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END OF SECTION



SECTION 260523
CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. UTP cabling.
 - 2. 50/125-micrometer, multimode optical fiber cabling.
 - 3. RS-232 cabling.
 - 4. RS-485 cabling.
 - 5. Low-voltage control cabling.
 - 6. Control-circuit conductors.
 - 7. Identification products.

1.2 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- F. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- G. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- H. RCDD: Registered Communications Distribution Designer.
- I. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.
- J. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.
- K. UTP: Unshielded twisted pair.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - 1. Vertical and horizontal offsets and transitions.
 - 2. Clearances for access above and to side of cable trays.
 - 3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
 - 4. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.



- C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Maintenance Data: For wire and cable to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight.
 - 2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 - 3. Test each pair of UTP cable for open and short circuits.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install UTP and optical fiber cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- B. Cable Trays:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cable Management Solutions, Inc.
 - b. Cablofil Inc.
 - c. Cooper B-Line, Inc.



- d. Cope - Tyco/Allied Tube & Conduit.
- e. GS Metals Corp.
2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.
 - a. Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - b. Trough or Ventilated Cable Trays: Nominally 6 inches (150 mm) wide.
 - c. Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
 - d. Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - e. Solid-Bottom or Nonventilated Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with solid covers.
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
 1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

- A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry."

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. CommScope, Inc.
 2. Genesis Cable Products; Honeywell International, Inc.
 3. Mohawk; a division of Belden CDT.
 4. Nordex/CDT; a subsidiary of Cable Design Technologies.
 5. 3M.
 6. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. Description: 100-ohm, four-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket.
 1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 3. Comply with TIA/EIA-568-B.2, Category 6.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or Type CMG; or Type MPP, Type CMP, Type MPR, Type CMR, Type MP, or Type MPG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR; or Type MPP, Type CMP, or Type MPR; complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX; or Type MPP, Type CMP, Type MPR, Type CMR, Type MP, Type MPG, Type CM, or Type CMG.
 - e. Multipurpose: Type MP or Type MPG; or Type MPP or Type MPR.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.



- g. Multipurpose, Riser Rated: Type MPR or Type MPP, complying with UL 1666.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hubbell Premise Wiring.
 - 2. KRONE Incorporated.
 - 3. Leviton Voice & Data Division.
 - 4. Panduit Corp.
 - 5. Siemon Co. (The).
 - 6. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.
- C. Connecting Blocks: 110 style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare; integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Corning Cable Systems.
 - 2. General Cable Technologies Corporation.
 - 3. Mohawk; a division of Belden CDT.
 - 4. Optical Connectivity Solutions Division; Emerson Network Power.
 - 5. 3M.
 - 6. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. Description: Multimode, 50/125-micrometer, 24-fiber, nonconductive, tight buffer, optical fiber cable.
 - 1. Comply with ICEA S-83-596 for mechanical properties.
 - 2. Comply with TIA/EIA-568-B.3 for performance specifications.
 - 3. Comply with TIA/EIA-492AAAA-B for detailed specifications.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or Type OFCG.
 - e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR; or Type OFNR, Type OFCP, or Type OFNP; complying with UL 1666.
 - 5. Conductive cable shall be steel-armored type.
 - 6. Maximum Attenuation: 3.5 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 - 7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
- C. Jacket:
 - 1. Jacket Color: Aqua for 50/125-micrometer cable.
 - 2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
 - 3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).



2.6 OPTICAL FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Corning Cable Systems.
 - 2. Dynacom Corporation.
 - 3. Hubbell Premise Wiring.
 - 4. Nordex/CDT; a subsidiary of Cable Design Technologies.
 - 5. Optical Connectivity Solutions Division; Emerson Network Power.
 - 6. Siemon Co. (The).
- B. Cable Connecting Hardware: Comply with the Fiber Optic Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - 1. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss not more than 0.75 dB.
 - 2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 RS-232 CABLE

- A. Standard Cable: NFPA 70, Type CM.
 - 1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - 2. Polypropylene insulation.
 - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - 4. PVC jacket.
 - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 - 6. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - 2. Plastic insulation.
 - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - 4. Plastic jacket.
 - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 - 6. Flame Resistance: Comply with NFPA 262.

2.8 RS-485 CABLE

- A. Standard Cable: NFPA 70, Type CM or Type CMG.
 - 1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - 2. PVC insulation.
 - 3. Unshielded.
 - 4. PVC jacket.
 - 5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - 2. Fluorinated ethylene propylene insulation.
 - 3. Unshielded.
 - 4. Fluorinated ethylene propylene jacket.



5. Flame Resistance: NFPA 262, Flame Test.

2.9 LOW-VOLTAGE CONTROL CABLE

- A. Paired Cable: NFPA 70, Type CMG.
 1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with NFPA 262.
- C. Paired Cable: NFPA 70, Type CMG.
 1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
 2. PVC insulation.
 3. Unshielded.
 4. PVC jacket.
 5. Flame Resistance: Comply with UL 1581.
- D. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
 2. Fluorinated ethylene propylene insulation.
 3. Unshielded.
 4. Plastic jacket.
 5. Flame Resistance: NFPA 262, Flame Test.

2.10 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.11 IDENTIFICATION PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Brady Corporation.
 2. HellermannTyton.
 3. Kroy LLC.
 4. Panduit Corp.
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."



2.12 SOURCE QUALITY CONTROL

- A. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.
- C. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- D. Install manufactured conduit sweeps and long-radius elbows if possible.
- E. Pathway Installation in Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard if entering room from overhead.
 - 4. Extend conduits **3 inches (75 mm)** above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- F. Backboards: Install backboards with **96-inch (2440-mm)** dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 4. Cables may not be spliced. Secure and support cables at intervals not exceeding **30 inches (760 mm)** and not more than **6 inches (150 mm)** from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - 6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - 7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.



8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
 1. Comply with TIA/EIA-568-B.2.
 2. Install 110-style IDC termination hardware unless otherwise indicated.
 3. Do not untwist UTP cables more than **1/2 inch (12 mm)** from the point of termination to maintain cable geometry.
- D. Installation of Control-Circuit Conductors:
 1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- E. Optical Fiber Cable Installation:
 1. Comply with TIA/EIA-568-B.3.
 2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- F. Open-Cable Installation:
 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend copper cable not in a wireway or pathway a minimum of **8 inches (200 mm)** above ceilings by cable supports not more than **60 inches (1525 mm)** apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- G. Installation of Cable Routed Exposed under Raised Floors:
 1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable **72 inches (1830 mm)** long shall be neatly coiled not less than **12 inches (305 mm)** in diameter below each feed point.
- H. Separation from EMI Sources:
 1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of **5 inches (127 mm)**.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of **12 inches (305 mm)**.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of **24 inches (600 mm)**.
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of **2-1/2 inches (64 mm)**.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of **6 inches (150 mm)**.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of **12 inches (305 mm)**.
 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.



- b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
- c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- 5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
- 6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables.

3.4 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits, No 14 AWG.
 - 2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified



- in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
 - D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
 - E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
 - F. Prepare test and inspection reports.

END OF SECTION



SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.
 - 1. Overhead-lines grounding.
 - 2. Underground distribution grounding.
 - 3. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding arrangements and connections for separately derived systems.
 - 5. Grounding for sensitive electronic equipment.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control test reports.
 - 1. Instructions for periodic testing and inspection of grounding features at test wells based on NETA MTS.
 - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
 - b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with UL 467 for grounding and bonding materials and equipment.



PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Bare Grounding Conductor and Conductor Protector for Wood Poles:
 - 1. No. 4 AWG minimum, soft-drawn copper.
 - 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.
- D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm) in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.
- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
 - 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
 - 2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.



- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least **24 inches (600 mm)** below grade.
 - 2. Duct-Bank Grounding Conductor: Bury **12 inches (300 mm)** above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus on insulated spacers **1 inch (25 mm)**, minimum, from wall **6 inches (150 mm)** above finished floor, unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
- E. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING OVERHEAD LINES

- A. Comply with IEEE C2 grounding requirements.
- B. Install 2 parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.
- C. Drive ground rods until tops are **12 inches (300 mm)** below finished grade in undisturbed earth.
- D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.
- E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.
- F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.
- G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so **4 inches (100 mm)** will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from **2 inches (50 mm)** above to **6 inches (150 mm)** below concrete. Seal floor opening with waterproof, nonshrink grout.



- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than **6 inches (150 mm)** from the foundation.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.



- G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- H. Metal and Wood Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service

- entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than **60 feet (18 m)** apart.
- I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 2. Bury ground ring not less than **24 inches (600 mm)** from building foundation.
- J. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of **20 feet (6 m)** of bare copper conductor not smaller than No. 4 AWG.
1. If concrete foundation is less than **20 feet (6 m)** long, coil excess conductor within base of foundation.
 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- C. Perform the following tests and inspections and prepare test reports:
 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and



their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

- D. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 Insert value ohms.
 - 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
 - 5. Substations and Pad-Mounted Equipment: 5 ohms.
 - 6. Manhole Grounds: 10 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION



SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Nonmetallic slotted channel systems. Include Product Data for components.
 - 4. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."



- B. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with **9/16-inch- (14-mm-)** diameter holes at a maximum of **8 inches (200 mm)** o.c., in at least 1 surface.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 - d. Seasafe, Inc.
 - 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 - 3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 - 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in



riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be **1/4 inch (6 mm)** in diameter.



- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.



3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION



SECTION 260533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
 - 2. For handholes and boxes for underground wiring, including the following:
 - a. Duct entry provisions, including locations and duct sizes.
 - b. Frame and cover design.
 - c. Grounding details.
 - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e. Joint details.
- C. Samples for Initial Selection: For wireways, nonmetallic wireways and surface raceways with factory-applied texture and color finishes.
- D. Samples for Verification: For each type of exposed finish required for wireways, nonmetallic wireways and surface raceways, prepared on Samples of size indicated below.
- E. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:



1. Structural members in the paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
- F. Qualification Data: For professional engineer and testing agency.
- G. Source quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AFC Cable Systems, Inc.
 2. Alflex Inc.
 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 5. Electri-Flex Co.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Aluminum Rigid Conduit: ANSI C80.5.
- D. IMC: ANSI C80.6.
- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- F. EMT: ANSI C80.3.
- G. FMC: Zinc-coated steel or aluminum.
- H. LFMC: Flexible steel conduit with PVC jacket.
- I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 2. Fittings for EMT: set-screw or compression type.
 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:



1. AFC Cable Systems, Inc.
 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 3. Arnco Corporation.
 4. CANTEX Inc.
 5. CertainTeed Corp.; Pipe & Plastics Group.
- B. ENT: NEMA TC 13.
- C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- D. LFNC: UL 1660.
- E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- F. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Arnco Corporation.
 2. Endot Industries Inc.
 3. IPEX Inc.
 4. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Comply with UL 2024; flexible type, approved for plenum, riser and general-use installation.

2.4 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cooper B-Line, Inc.
 2. Hoffman.
 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type.
- E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Hoffman.
 2. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.



- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.6 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Prime coating, ready for field painting.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Butler Manufacturing Company; Walker Division.
 - b. Enduro Systems, Inc.; Composite Products Division.
 - c. Hubbell Incorporated; Wiring Device-Kellems Division.
 - d. Lamson & Sessions; Carlon Electrical Products.
 - e. Panduit Corp.

2.7 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- E. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.
- F. Nonmetallic Floor Boxes: Nonadjustable, round.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
- I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- J. Cabinets:



1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Description: Comply with SCTE 77.
1. Color of Frame and Cover: Gray.
 2. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 5. Cover Legend: Molded lettering as indicated for each service.
 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation.
 - d. NewBasis.
- C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of fiberglass.



1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Carson Industries LLC.
 - b. Christy Concrete Products.
 - c. Nordic Fiberglass, Inc.

2.9 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.10 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Advance Products & Systems, Inc.
 2. Calpico, Inc.
 3. Metraflex Co.
 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 2. Pressure Plates: Carbon steel. Include two for each sealing element.
 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.11 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 1. Tests of materials shall be performed by a independent testing agency.
 2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 1. Exposed Conduit: Rigid steel conduit RNC, Type EPC-80-PVC.
 2. Concealed Conduit, Aboveground: Rigid steel conduit RNC, Type EPC-40-PVC.



3. Underground Conduit: RNC, Schedule 40-PVC, direct buried. Provide Schedule 80 PVC at penetrations.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
 6. Application of Handholes and Boxes for Underground Wiring:
 - a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
 - b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
 - c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with **3000-lbf (13 345-N)** vertical loading.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT or RNC.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. ~~Mechanical rooms.~~
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT or RNC, Type EPC-40-PVC.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: EMT with compression type fittings or PVC
 7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.
 8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway.
 9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway.
 10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: **1/2-inch (16-mm)** trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- E. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.



- B. Keep raceways at least **6 inches (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of four 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than **1-inch (27-mm)** trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than **200-lb (90-kg)** tensile strength. Leave at least **12 inches (300 mm)** of slack at each end of pull wire.
- L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
 - 1. **3/4-Inch (19-mm)** Trade Size and Smaller: Install raceways in maximum lengths of **50 feet (15 m)**.
 - 2. **1-Inch (25-mm)** Trade Size and Larger: Install raceways in maximum lengths of **75 feet (23 m)**.
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
 - 3. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

- a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
4. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- N. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- P. Set metal floor boxes level and flush with finished floor surface.
- Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
 2. Install backfill as specified in Division 31 Section "Earth Moving."
 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
 5. Warning Tapes: Provide warning tapes approximately 24 inches (600 mm) o.c. Align tapes along the width and along the centerline of conduit.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes and boxes with bottom below the frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.



- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION



SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Identification for raceways.
 2. Identification of power and control cables.
 3. Identification for conductors.
 4. Underground-line warning tape.
 5. Warning labels and signs.
 6. Instruction signs.
 7. Equipment identification labels.
 8. Miscellaneous identification products.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
1. Black letters on an orange field.
 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, **2 inches (50 mm)** long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Write-On Tags: Polyester tag, **0.010 inch (0.25 mm)** thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
 1. Black letters on an orange field.
 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.



1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 FLOOR MARKING TAPE

- A. **2-inch- (50-mm-)** wide, **5-mil (0.125-mm)** pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.
- C. Tag: Type I:
 1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 2. Thickness: **4 mils (0.1 mm)**.
 3. Weight: **18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m)**.
 4. **3-Inch (75-mm)** Tensile According to ASTM D 882: **30 lbf (133.4 N)**, and **2500 psi (17.2 MPa)**.
- D. Tag: Type ID:
 1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
 2. Overall Thickness: **5 mils (0.125 mm)**.
 3. Foil Core Thickness: **0.35 mil (0.00889 mm)**.
 4. Weight: **28 lb/1000 sq. ft. (13.7 kg/100 sq. m)**.
 5. **3-Inch (75-mm)** Tensile According to ASTM D 882: **70 lbf (311.3 N)**, and **4600 psi (31.7 MPa)**.

2.7 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:



1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
 3. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Metal-Backed, Butyrate Warning Signs:
1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
 3. Nominal size, 10 by 14 inches (250 by 360 mm).
- E. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.8 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.9 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.
- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at **50-foot (15-m)** maximum intervals in straight runs, and at **25-foot (7.6-m)** maximum intervals in congested areas.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at **6 to 8 inches (150 to 200 mm)** below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds **16 inches (400 mm)** overall.
- G. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at **10-foot (3-m)** maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
 - 3. UPS.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.



- 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 1. Limit use of underground-line warning tape to direct-buried cables.
 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.



1. Labeling Instructions:
 - a. Indoor Equipment: Adhesive film label. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on **1-1/2-inch- (38-mm-)** high label; where two lines of text are required, use labels **2 inches (50 mm)** high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION



SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Time switches.
 - 2. Outdoor and indoor photoelectric switches.
 - 3. Indoor occupancy sensors.
 - 4. Outdoor motion sensors.
 - 5. Lighting contactors.
 - 6. Emergency shunt relays.
- B. Related Sections include the following:
 - 1. Division 26 Sections "Central Dimming Controls" for architectural dimming system equipment.
 - 2. Division 26 Section "Network Lighting Controls" for low-voltage, manual and programmable lighting control systems.
 - 3. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.
 - 4. Division 26 Section "Theatrical Lighting" for theatrical lighting controls.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.



PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Grasslin Controls Corporation; a GE Industrial Systems Company.
 2. Leviton Mfg. Company Inc.
 3. Lightolier Controls; a Genlyte Company.
 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 5. Square D; Schneider Electric.
- B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
1. Contact Configuration: SPST.
 2. Contact Rating: 20-A ballast load, 120/240-V ac.
 3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
 4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
 5. Astronomic Time: All channels.
 6. Battery Backup: For schedules and time clock.
- C. Electromechanical-Dial Time Switches: Type complying with UL 917.
1. Contact Configuration: SPST.
 2. Contact Rating: 20-A ballast load, 120/240-V ac, 22k.
 3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
 4. Astronomic time dial.
 5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
 6. Skip-a-day mode.
 7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Intermatic, Inc.
 2. Lithonia Lighting; Acuity Lighting Group, Inc.
 3. Paragon Electric Co.; Invensys Climate Controls.
 4. Square D; Schneider Electric.
 5. Touch-Plate, Inc.
- B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 2. Time Delay: 15-second minimum, to prevent false operation.
 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.



4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.
- C. Description: Solid state, with SPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.
1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range.
 2. Time Delay: 30-second minimum, to prevent false operation.
 3. Lightning Arrester: Air-gap type.
 4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.3 INDOOR PHOTOELECTRIC SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Eaton Electrical Inc; Cutler-Hammer Products.
 2. Lithonia Lighting; Acuity Lighting Group, Inc.
 3. MicroLite Lighting Control Systems.
 4. Paragon Electric Co.; Invensys Climate Controls.
 5. Square D; Schneider Electric.

2.4 OUTDOOR MOTION SENSORS (PIR)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Bryant Electric; a Hubbell Company.
 2. Hubbell Lighting.
 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 4. Paragon Electric Co.; Invensys Climate Controls.
 5. RAB Lighting, Inc.
- B. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C), rated as raintight according to UL 773A.
1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 2. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
 - b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 3. Bypass Switch: Override the on function in case of sensor failure.
 4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc (11 to 215 lx); keep lighting off during daylight hours.
- C. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
- D. Detection Coverage: Up to 35 feet (11 m), with a field of view of 90 degrees.
- E. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.



- F. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - 2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.5 LIGHTING CONTACTORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 2. GE Industrial Systems; Total Lighting Control.
 - 3. Grasslin Controls Corporation; a GE Industrial Systems Company.
 - 4. Hubbell Lighting.
 - 5. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 6. Square D; Schneider Electric.
- B. Description: Electrically operated and mechanically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Enclosure: Comply with NEMA 250.
 - 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.6 EMERGENCY SHUNT RELAY

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Lighting Control and Design, Inc.
 - 2. Coil Rating: 120 V.

2.7 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."



PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be **1/2 inch (13 mm)**.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls."
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."



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END OF SECTION



SECTION 260933
CENTRAL DIMMING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes microprocessor-based central dimming controls with the following components:
 - 1. Master-control stations.
 - 2. Wall stations.
 - 3. Dimmer cabinets.
 - 4. Manual switches and plates for controlling dimmers.

1.2 SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Central dimming controls.
 - 2. Dimmer panels.
 - 3. Device plates, plate color, and material.
 - 4. Ballasts and lamp combinations compatible with dimmer controls.
- B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on Project. Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
 - 1. Include elevation views of front panels of control and indicating devices and control stations.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
 - 3. Operation and maintenance data.
- C. Warranty.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain central dimming controls from a single source with total responsibility for compatibility of lighting control system components specified in this Section, in Division 26 Section "Network Lighting Controls," and in Division 26 Section "Lighting Control Devices."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of central dimming controls that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Damage from transient voltage surges.
 - 2. Warranty Period: Cost to repair or replace any parts for two years from date of Substantial Completion.



3. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Leviton Mfg. Company Inc.
 2. Leviton NSI Division.
 3. Lightolier; a Genlyte Group.
 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 5. Lutron Electronics, Inc.

2.2 GENERAL SYSTEM REQUIREMENTS

- A. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.
- B. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state dimmers and control panels.
 1. Alternative Line-Voltage Surge Suppression: Comply with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" for Category A locations.
- C. Dimmers and Dimmer Modules: Comply with UL 508.
 1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
 2. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

2.3 SYSTEM DESCRIPTION

- A. Description: Microprocessor-based, solid-state controls consisting of control stations and a separately mounted dimmer cabinet.
 1. Operation: Change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a slider is operated.
 2. System control shall include master station(s), wall stations, and dimmer panels.
 3. Each zone shall be configurable to control the following light sources:
 - a. Fluorescent lamps with electronic magnetic ballasts.
 - b. Line-voltage incandescent lamps.
 - c. Low-voltage incandescent lamps.
 - d. Cold cathode lamps.
 - e. Non-dimmed loads.
 - f. LED lamps.



4. Control of each zone shall interface with controls for the following accessory functions:
 - a. Curtains and drapes.
 - b. Blackout curtains.
 - c. Projector screens.
 - d. Motorized partitions.
 - e. Manually positioned partitions.
5. Memory: Retain preset scenes and fade settings through power failures for at least 90 days by retaining physical settings of controls or by an on-board, automatically recharged battery.

2.4 CONTROL NETWORK

- A. Dimmers shall receive signals from control stations that are linked to dimmer cabinet with a common network data cable.
- B. Functions of network control stations shall be set up at master station that include the number and arrangement of scene presets, zones, and fade times at wall stations.
 1. Control Voltage: 24- or 10-V dc.
 2. Comply with [USITT AMX 192] [USITT DMX 512] for data transmission.

2.5 MASTER-CONTROL STATIONS

- A. Functions and Features:
 1. Control adjustment of the lighting level for each scene of each zone, and adjustment of fade-time setting for each scene change from one preset scene to another. Controls shall use digital rocker switches with LCD graphic display of light level.
 2. Master channel shall raise and lower lighting level of all zones.
 3. Fade rate for each scene shall be adjustable from zero to 60 seconds.
 4. Fade override control for each scene.
 5. Recall each preset scene and allow adjustment of zone controls associated with that scene.
 6. Lockout switch to prevent changes when set.
 7. On and off scene controls for non-dim channel contactors.
 8. Emergency-control pushbutton to bypass all controls, turning all dimmers to full bright and turning on non-dim channel contactors.
 9. Master on and off switch; off position enables housekeeping controls.
 10. Housekeeping controls to turn on selected lighting fixtures for housekeeping functions.
 11. Pushbuttons for accessory functions.
 12. Enable and disable wall stations.
 13. Rear-illuminate all scene-select buttons.
 14. Show lighting-level setting and fade-rate setting graphically using LEDs or backlighted bar-graph indicator.
- B. Mounting: Single, flush wall box with manufacturer's standard faceplate with hinged transparent locking cover.

2.6 WALL STATIONS

- A. Functions and Features:



1. Wall stations shall function as a submaster to a master station, containing limited control of selected scenes of the master station.
 2. Controls to adjust the lighting level of each dimmer for each scene, and the fade time setting for each scene change from one preset scene to another.
 3. Numbered pushbuttons to select scenes.
 4. Off switch to turn master station off. Operating the off switch at any remote station shall automatically turn on selected housekeeping lighting.
 5. On switch turns all scenes of master station to full bright.
 6. Pushbutton controls for accessory functions.
- B. Mounting: Flush, wall box with manufacturer's standard faceplate.
- C. Hand-held Cordless Control: Scene-select and accessory function pushbuttons using infrared transmission.

2.7 DIMMER CABINETS

- A. Factory wired, with barriers to accommodate 120- and 277-V feeders and suitable to control designated lighting equipment or accessory functions.
- B. Ambient Conditions:
1. Temperature: 60 to 95 deg F (15 to 35 deg C).
 2. Relative Humidity: 10 to 90 percent, noncondensing.
 3. Filtered air supply.
- C. Dimmer Cabinet Assembly: NRTL listed and labeled.
- D. Cabinet Type: Plug in, modular, and accepting dimmers of each specified type in any plug-in position.
1. Integrated Fault-Current Rating: 10,000-A RMS symmetrical.
- E. Lighting Dimmers: Solid-state SCR dimmers.
1. Primary Protection: Magnetic or thermal-magnetic circuit breaker, also serving as the disconnecting means.
 2. Dimmer response to control signal shall follow the "Square Law Dimming Curve" specified in IESNA's "IESNA Lighting Handbook."
 3. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
 4. Dimmed circuits shall be filtered to provide a minimum 350-mic.sec. current-rise time at a 90-degree conduction angle and 50 percent of rated dimmer capacity. Rate of current rise shall not exceed 30 mA/mic.sec., measured from 10 to 90 percent of load-current waveform.
 5. Protect controls of each dimmer with a fuse and transient voltage surge suppression.
- F. Non-dim modules shall include relays with contacts rated to switch 20-A tungsten-filament load at 120-V ac and 20-A electronic ballast load at 277-V ac.
- G. Accessory function control modules shall be compatible with requirement of the accessory being controlled.
- H. Digital Control Network:
1. Dimmers shall receive digital signals from digital network control stations that are linked to the dimmer cabinet with a common network data cable.



2. Functions of digital network control stations shall be set up at the dimmer cabinet's electronic controls that include indicated number and arrangement of scene presets, channels, and fade times.
- I. Emergency Power Transfer Switch: Comply with UL 1008; factory prewired and pretested to automatically transfer load circuits from normal to emergency power supply when normal supply fails.
 1. Transfer from normal to emergency supply when normal-supply voltage drops to 55 percent or less.
 2. Retransfer immediately to normal on failure of emergency supply and after an adjustable time-delay of 10 to 90 seconds on restoration of normal supply while emergency supply is available.
 3. Integrated Fault-Current Rating: Same value as listed for the panel.
 4. Test Switch: Simulate failure of normal supply to test controls associated with transfer scheme.
 5. Fabricate and test dimmer boards to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

2.8 MANUAL SWITCHES AND PLATES

- A. Switches: Modular, momentary pushbutton, low-voltage type.
 1. Color: White unless otherwise indicated.
 2. Integral Pilot Light: Indicate when circuit is on. Use where indicated.
 3. Locator Light: Internal illumination.
 4. Wall Plates: Comply with requirements in Division 26 Section "Wiring Devices" for materials, finish, and color. Use multigang plates if more than one switch is indicated at a location.
 5. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.9 CONDUCTORS AND CABLES

- A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- D. Unshielded, Twisted-Pair Data Cable: Category 6. Comply with requirements in Division 27 Section "Communications Horizontal Cabling."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method:
 1. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."



2. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Division 27 Section "Communications Horizontal Cabling."
 3. Minimum conduit size shall be **1/2 inch (13 mm)**.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" for identifying components and power and control wiring.
- B. Label each dimmer module with a unique designation.
- C. Label each scene control button with approved scene description.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
1. Continuity tests of circuits.
 2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
 - a. Include testing of dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
 3. Emergency Power Transfer: Test listed functions.
- C. Remove and replace malfunctioning dimming control components and retest as specified above.
- D. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
- E. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain central dimming controls.
- B. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls."

END OF SECTION



SECTION 260936
MODULAR DIMMING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes manual modular dimming controls.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL DIMMING DEVICE REQUIREMENTS

- A. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.
- B. Dimmers and Dimmer Modules: Comply with UL 508.
 - 1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
 - 2. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

2.2 MANUAL MODULAR MULTISCENE DIMMING CONTROLS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or a comparable product by one of the following:
 - 1. Leviton Mfg. Company Inc.
 - 2. Lightolier Controls; a division of Lightolier; a Genlyte Group.
 - 3. Lutron Electronics, Inc.
- D. Description: Factory-fabricated equipment providing manual modular dimming control consisting of a wall-box-mounted, master-scene controller and indicated number of wall-box zone stations. Controls and dimmers shall be integrated for mounting in one-, two-, or three-gang wall box under a single wall plate. Each zone station shall be adjustable to indicated number of scenes, which shall be recorded on the zone controller.
- E. Operation: Automatically change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.
- F. Each manual modular multiscene dimming controller shall include a master control and remote controls.



- G. Each zone shall be configurable to control the following:
 - 1. Fluorescent lamps with electronic magnetic ballasts.
 - 2. Incandescent lamps.
 - 3. Low-voltage incandescent lamps.
- H. Memory: Retain preset scenes through power failures for at least seven days.
- I. Device Plates: Style, material, and color shall comply with Division 26 Section "Wiring Devices."
- J. Master-Scene Controller: Suitable for mounting in a single flush wall box.
 - 1. Switches: Master off, group dim, group bright, and selectors for each scene.
 - 2. LED indicator lights, one associated with each scene switch, and one for the master off switch.
- K. Fluorescent Zone Dimmer: Suitable for operating lighting fixtures and ballasts specified in Division 26 Section "Interior Lighting," and arranged to dim number of scenes indicated for the master-scene controller. Scene selection is at the master-scene controller for setting light levels of each zone associated with scene.
 - 1. Switch: Slider style for setting the light level for each scene.
 - 2. LED indicator lights, one associated with each scene.
 - 3. Electrical Rating: 2000 VA, 120 V.
- L. Incandescent Zone Dimmer: Suitable for operating incandescent lamps at line-voltage or low-voltage lamps connected to a transformer and arranged to dim number of scenes indicated for the master-scene controller. Scene selection shall be at the master-scene controller for setting light levels of each zone associated with scene.
 - 1. Switch: Slider style for setting the light level for each scene.
 - 2. LED indicator lights, one associated with each scene.
 - 3. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.

2.3 CONDUCTORS AND CABLES

- A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Class 2 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be **1/2 inch (13 mm)**.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.



- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.2 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" for identifying components and power and control wiring.
- B. Label each dimmer module with a unique designation.
- C. Label each scene control button with approved scene description.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Continuity tests of circuits.
 - 2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
 - a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
- C. Remove and replace malfunctioning modular dimming control components and retest as specified above.
- D. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
- E. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

END OF SECTION



SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Distribution panelboards.
 2. Lighting and appliance branch-circuit panelboards.
 3. Load centers.
 4. Electronic-grade panelboards.

1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 3. Detail bus configuration, current, and voltage ratings.
 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 5. Include evidence of NRTL listing for series rating of installed devices.
 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 7. Include wiring diagrams for power, signal, and control wiring.
 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
- C. Qualification Data: For qualified testing agency.
1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field Quality-Control Reports:
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.



- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding **minus 22 deg F (minus 30 deg C)** to **plus 104 deg F (plus 40 deg C)**.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.

1.7 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.



1.8 WARRANTY

1. Warranty Period: Five years from date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Keys: Two spares for each type of panelboard cabinet lock.
 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and surface-mounted cabinets.
 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Wash-Down Areas: NEMA 250, Type 4X, stainless steel Insert material.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 3. Finishes:
 - a. Panels and Trim: Steel galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
 4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses:
 1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
 5. Split Bus: Vertical buses divided into individual vertical sections.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 1. Material: Hard-drawn copper, 98 percent conductivity.



2. Main and Neutral Lugs: Mechanical type.
 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than **36 inches (914 mm)** high, provide two latches, keyed alike.
- D. Mains: Circuit breaker.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- G. Branch Overcurrent Protective Devices: Fused switches.
- H. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
 2. External Control-Power Source: 24-V control circuit.



2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only.
- D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- E. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
 - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
 - 2. External Control-Power Source: 24-V control circuit.
- F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 LOAD CENTERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Load Centers: Comply with UL 67.
- C. Mains: Circuit breaker.
- D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- E. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.5 ELECTRONIC-GRADE PANELBOARDS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Current Technology; a subsidiary of Danahar Corporation.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 4. Liebert Corporation.
 - 5. Siemens Energy & Automation, Inc.
 - 6. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1; with factory-installed, integral TVSS; labeled by an NRTL for compliance with UL 67 after installing TVSS.



- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- D. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
- E. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
- F. Buses:
 - 1. Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
 - 2. Copper equipment and isolated ground buses.
 - 3. Accessories:
 - 4. Peak Single-Impulse Surge Current Rating: 80 kA per mode/160 kA per phase.
 - 5. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
 - a. Line to Neutral: 70,000 A.
 - b. Line to Ground: 70,000 A.
 - c. Neutral to Ground: 50,000 A.
 - 6. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
 - 7. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120-V, three-phase, four-wire circuits shall be as follows:
 - a. Line to Neutral: 400 V for 208Y/120.
 - b. Line to Ground: 400 V for 208Y/120.
 - c. Neutral to Ground: 400 V for 208Y/120.
 - 8. Protection modes and UL 1449 SVR for 240/120-V, single-phase, three-wire circuits shall be as follows:
 - a. Line to Neutral: 400 V.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.
 - 9. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:
 - a. Line to Neutral: 400 V, 800 V from high leg.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.
 - 10. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:
 - a. Line to Line: 1000 V for 240 V.
 - b. Line to Ground: 800 V for 240 V.

2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.



2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 6. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Remote-mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Communication Capability: Universal-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
 - f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - h. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
 - i. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
 - j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - k. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
 - l. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
 - m. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - n. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."
 2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
 3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.



2.7 PANELBOARD SUPPRESSORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Current Technology; a subsidiary of Danahar Corporation.
 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 4. Liebert Corporation.
 5. Siemens Energy & Automation, Inc.
 6. Square D; a brand of Schneider Electric.
 7. Accessories:
 - a. Fuses rated at 200-kA interrupting capacity.
 - b. Fabrication using bolted compression lugs for internal wiring.
 8. Peak Single-Impulse Surge Current Rating: 80 kA per mode/160 kA per phase.
 9. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
 - a. Line to Neutral: 70,000 A.
 - b. Line to Ground: 70,000 A.
 - c. Neutral to Ground: 50,000 A.
 10. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
 11. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120-V, three-phase, four-wire circuits shall be as follows:
 - a. Line to Neutral: 400 V for 208Y/120.
 - b. Line to Ground: 400 V for 208Y/120.
 - c. Neutral to Ground: 400 V for 208Y/120.
 12. Protection modes and UL 1449 SVR for 240/120-V, single-phase, three-wire circuits shall be as follows:
 - a. Line to Neutral: 400 V.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.
 13. Protection modes and UL 1449 SVR for 240/120-V, three-phase, four-wire circuits with high leg shall be as follows:
 - a. Line to Neutral: 400 V, 800 V from high leg.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.
 14. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:
 - a. Line to Line: 1000 V for 240 V.
 - b. Line to Ground: 800 V for 240 V.

2.8 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407.



- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407.
- B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
 - 2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to panelboards.
 - 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- E. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- H. Install filler plates in unused spaces.
- I. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- K. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.



- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as indicated
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.



3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION



**SECTION 262726
WIRING DEVICES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Receptacles with integral surge suppression units.
 - 4. Wall-box motion sensors.
 - 5. Isolated-ground receptacles.
 - 6. Hospital-grade receptacles.
 - 7. Snap switches and wall-box dimmers.
 - 8. Solid-state fan speed controls.
 - 9. Wall-switch and exterior occupancy sensors.
 - 10. Communications outlets.
 - 11. Pendant cord-connector devices.
 - 12. Cord and plug sets.
 - 13. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.
- B. Related Sections include the following:
 - 1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.



1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.
 - 2. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
 - 3. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:



- a. Cooper; 8300 (duplex).
 - b. Hubbell; HBL8310 (single), HBL8300H (duplex).
 - c. Leviton; 8310 (single), 8300 (duplex).
 - d. Pass & Seymour; 9301-HG (single), 9300-HG (duplex).
- C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell; CR 5253IG.
 - b. Leviton; 5362-IG.
 - c. Pass & Seymour; IG6300.
 - 2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- D. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; TR8300.
 - b. Hubbell; HBL8300SG.
 - c. Leviton; 8300-SGG.
 - d. Pass & Seymour; 63H.
 - 2. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.
 - 2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; HGF20.
 - b. Hubbell; HGF8300.
 - c. Leviton; 6898-HG.
 - d. Pass & Seymour; 2091-SHG.
 - 3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
- C. Isolated-Ground, Duplex Convenience Receptacles:
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; IG5362BLS.
 - b. Hubbell; IG5362SA.
 - c. Leviton; 5380-IG.



2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- D. Hospital-Grade, Duplex Convenience Receptacles: Comply with UL 498 Supplement SD.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 8300BLS.
 - b. Hubbell; HBL8362SA.
 - c. Leviton; 8380.
 2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
- E. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; IG8300HGBLS.
 - b. Hubbell; IG8362SA.
 - c. Leviton; 8380-IG.
 2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Comply with UL 498 Supplement SD. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.4 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper Crouse-Hinds.
 - b. EGS/Appleton Electric.
 - c. Killark; a division of Hubbell Inc.

2.5 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; L520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell; IG2310.
 - b. Leviton; 2310-IG.
 2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw



terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.

2.7 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.8 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 2221PL for 120 V and 277 V.
 - b. Hubbell; HPL1221PL for 120 V and 277 V.
 - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - d. Pass & Seymour; PS20AC1-PLR for 120 V.
 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120/277 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
 2. Description: Single pole, with factory-supplied key in lieu of switch handle.



- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 1995.
 - b. Hubbell; HBL1557.
 - c. Leviton; 1257.
 - d. Pass & Seymour; 1251.
- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 1995L.
 - b. Hubbell; HBL1557L.
 - c. Leviton; 1257L.
 - d. Pass & Seymour; 1251L.

2.9 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
 - 1. 600 W; dimmers shall require no derating when ganged with other devices.
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.10 FAN SPEED CONTROLS

- A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
 - 1. Continuously adjustable slider, 5 A.
 - 2. Three-speed adjustable slider, 1.5 A.

2.11 OCCUPANCY SENSORS

- A. Wall-Switch Sensors:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 6111 for 120 V, 6117 for 277 V.
 - b. Hubbell; WS1277.
 - c. Leviton; ODS 10-ID.
 - d. Pass & Seymour; WS3000.
 - e. Watt Stopper (The); WS-200.
 - 2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).



B. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell; AT120 for 120 V, AT277 for 277 V.
 - b. Leviton; ODS 15-ID.
2. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

C. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; ATP1600WRP.
 - b. Leviton; ODWWV-IRW.
 - c. Pass & Seymour; WA1001.
 - d. Watt Stopper (The); CX-100.
3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

D. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell; ATD1600WRP.
 - b. Leviton; ODW12-MRW.
 - c. Watt Stopper (The); DT-200.
2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).

E. Wide-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell; ATP120HBRP.
 - b. Leviton; ODWHB-IRW.
 - c. Pass & Seymour; HS1001.
 - d. Watt Stopper (The); CX-100-3.
2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

F. Exterior Occupancy Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Leviton; PS200-10.
 - b. Watt Stopper (The); EW-100-120.
2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot (34-m) detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.12 COMMUNICATIONS OUTLETS

A. Telephone Outlet:



1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 3560-6.
 - b. Leviton; 40649.
2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 3562.
 - b. Leviton; 40595.
2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.13 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.14 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Round, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable.

2.15 POKE-THROUGH ASSEMBLIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Pass & Seymour/Legrand; Wiring Devices & Accessories.
3. Square D/ Schneider Electric.
4. Thomas & Betts Corporation.
5. Wiremold Company (The).

B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.

1. Service Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.



2. Size: Selected to fit nominal **3-inch (75-mm)** cored holes in floor and matched to floor thickness.
3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
4. Closure Plug: Arranged to close unused **3-inch (75-mm)** cored openings and reestablish fire rating of floor.
5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, 4-pair, Category 5e voice and data communication cables.

2.16 MULTIOUTLET ASSEMBLIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Hubbell Incorporated; Wiring Device-Kellems.
 2. Wiremold Company (The).
- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard finish.
- D. Wire: No. 12 AWG.

2.17 SERVICE POLES

- A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
 1. Poles: Nominal **2.5-inch- (65-mm-)** square cross section, with height adequate to extend from floor to at least **6 inches (150 mm)** above ceiling, and with separate channels for power wiring and voice and data communication cabling.
 2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
 3. Finishes: Manufacturer's standard painted finish and trim combination.
 4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
 5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.
 6. Voice and Data Communication Outlets: Two RJ-45 Category 5e jacks.

2.18 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Emergency Power System: Red.
 3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:



1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than **6 inches (152 mm)** in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
 2. Verify that dimmers used for fan speed control are listed for that application.



3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
 2. Test Instruments: Use instruments that comply with UL 1436.
 3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION



SECTION 262813
FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cartridge fuses rated 600-V ac and less for use in enclosed switches, enclosed controllers and motor-control centers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA FU 1 for cartridge fuses.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

- A. Service Entrance: Class J, fast acting.
- B. Feeders: Class L, fast acting.
- C. Motor Branch Circuits: Class RK1, time delay.
- D. Other Branch Circuits: Class RK1, time delay.
- E. Control Circuits: Class CC, time delay.

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION



SECTION 262816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Molded-case switches.
 - 7. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Qualification Data: For qualified testing agency.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.



- D. Field quality-control reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Manufacturer's field service report.
- F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than **minus 22 deg F (minus 30 deg C)** and not exceeding **104 deg F (40 deg C)**.
 - 2. Comply with NFPA 70E.

1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.



2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 6. Hookstick Handle: Allows use of a hookstick to operate the handle.
 7. Lugs: Mechanical type, suitable for number, size, and conductor material.
 8. Service-Rated Switches: Labeled for use as service equipment.
 9. Accessory Control Power Voltage: Remote mounted and powered; 24-V dc.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.



- B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 6. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 7. Accessory Control Power Voltage: Remote mounted and powered; 24-V dc.

2.3 RECEPTACLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 600-V ac, 60 A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 600-V ac, 60 A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
- E. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).



2.4 SHUNT TRIP SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Ferraz Shawmut, Inc.
 - 3. Littelfuse, Inc.
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer source of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- E. Accessories:
 - 1. Oiltight key switch for key-to-test function.
 - 2. Oiltight green ON pilot light.
 - 3. Isolated neutral lug; 100 percent rating.
 - 4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 - 5. Form C alarm contacts that change state when switch is tripped.
 - 6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
 - 7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.5 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I^2t response.



- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- I. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 5. Communication Capability: Universal-mounted communication module with functions and features compatible with power monitoring and control system, specified in Division 26 Section "Electrical Power Monitoring and Control."
 - 6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 8. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 9. Alarm Switch: One NC contact that operates only when circuit breaker has tripped.
 - 10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - 11. Zone-Selective Interlocking: Integral with ground-fault trip unit; for interlocking ground-fault protection function.
 - 12. Electrical Operator: Provide remote control for on, off, and reset operations.
 - 13. Accessory Control Power Voltage: Integrally mounted, self-powered; 24-V dc.

2.6 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Features and Accessories:
 - 1. Standard frame sizes and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings,



- push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
 7. Alarm Switch: One NC contact that operates only when switch has tripped.
 8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
 9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
 10. Electrical Operator: Provide remote control for on, off, and reset operations.
 11. Accessory Control Power Voltage: Integrally mounted, self-powered; 24-V dc.

2.7 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved metal or laminated-plastic nameplate.



3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

END OF SECTION



**SECTION 265100
INTERIOR LIGHTING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
1. Interior lighting fixtures, lamps, and ballasts.
 2. Emergency lighting units.
 3. Exit signs.
 4. Lighting fixture supports.
 5. Retrofit kits for fluorescent lighting fixtures.
- B. Related Sections include the following:
1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 2. Division 26 Section "Central Dimming Controls" for architectural dimming systems.
 3. Division 26 Section "Network Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
 4. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
 5. Division 26 Section "Theatrical Lighting" for theatrical lighting fixtures and their controls.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. CU: Coefficient of utilization.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.
- G. RCR: Room cavity ratio.

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
1. Physical description of lighting fixture including dimensions.
 2. Emergency lighting units including battery and charger.
 3. Ballast.
 4. Energy-efficiency data.
 5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Division 23 Section "Diffusers, Registers, and Grilles."



6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23 Section "Diffusers, Registers, and Grilles."
7. Life, output, and energy-efficiency data for lamps.
8. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
 - b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
 1. Wiring Diagrams: Power and control wiring.
- C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 1. Lighting fixtures.
 2. Suspended ceiling components.
 3. Structural members to which suspension systems for lighting fixtures will be attached.
 4. Other items in finished ceiling including the following:
 - a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Occupancy sensors.
 - f. Access panels.
 5. Perimeter moldings.
- D. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:
 1. Lamps: Specified units installed.
 2. Accessories: Cords and plugs.
- E. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- F. Qualification Data: For agencies providing photometric data for lighting fixtures.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.



- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.
- E. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.
- F. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.
 - 1. Obtain Architect's approval of fixtures for mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: one year from date of Substantial Completion. Full warranty shall apply throughout this time period.
 - 2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: one year from date of Substantial Completion. Full warranty shall apply throughout this time period.
- B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Electronic Ballasts: Five Insert number years from date of Substantial Completion.
 - 2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.
- C. Special Warranty for T5 and T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: One year(s) from date of Substantial Completion.



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
- B. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- I. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least **0.125 inch (3.175 mm)** minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.
- J. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.
- K. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 23 Section "Diffusers, Registers, and Grilles."
 - 1. Air Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.



2. Heat Removal Units: Air path leads through lamp cavity.
3. Combination Heat Removal and Air Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air supply units.
4. Dampers: Operable from outside fixture for control of return-air volume.
5. Static Fixture: Air supply slots are blanked off, and fixture appearance matches active units.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. Electronic Ballasts: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.
 1. Sound Rating: A, except B for T12/HO and T12/Slimline lamp ballasts.
 2. Total Harmonic Distortion Rating: Less than 10 percent.
 3. Transient Voltage Protection: IEEE C62.41, Category A or better.
 4. Operating Frequency: 20 kHz or higher.
 5. Lamp Current Crest Factor: 1.7 or less.
 6. BF: 0.85 or higher.
 7. Power Factor: 0.95 or higher.
 8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
- B. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:
 1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: A.
 4. Total Harmonic Distortion Rating: Less than 20 percent.
 5. Transient Voltage Protection: IEEE C62.41, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. BF: 0.95 or higher, unless otherwise indicated.
 9. Power Factor: 0.95 or higher.
- C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
 1. Ballast Manufacturer Certification: Indicated by label.
- D. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.
- E. Ballasts for Low-Temperature Environments:
 1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic or electromagnetic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
 2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.
- F. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.
- G. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.



1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

H. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 30 percent of rated lamp lumens.
2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.95 0.98 or higher.
10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
11. Ballast Case Temperature: 75 deg C, maximum.

B. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 Insert value percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 Insert value percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate 1 fluorescent lamp(s) continuously to provide Code required minimum lighting levels. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Night-Light Connection: Operate one fluorescent lamp continuously.
3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
4. Battery: Sealed, maintenance-free, nickel-cadmium type.



5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.
- B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.
1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Night-Light Connection: Operate one fluorescent lamp in a remote fixture continuously.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type.
 5. Housing: NEMA 250, Type 1 enclosure.
 6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.6 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: **Minus 22 deg F (Minus 30 deg C)** for single-lamp ballasts.
 3. Normal Ambient Operating Temperature: **104 deg F (40 deg C)**.
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
1. Lamp end-of-life detection and shutdown circuit.
 2. Sound Rating: A.
 3. Total Harmonic Distortion Rating: Less than 15 percent.
 4. Transient Voltage Protection: IEEE C62.41, Category A or better.
 5. Lamp Current Crest Factor: 1.5 or less.
 6. Power Factor: .90 or higher.
 7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.



8. Protection: Class P thermal cutout.
 9. Retain subparagraph and associated subparagraphs below for bi-level ballasts.
 10. Bi-Level Dimming Ballast: Ballast circuit and leads provide for remote control of the light output of the associated fixture between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 35 percent of rated lamp lumens.
 - c. Compatibility: Certified by ballast manufacturer for use with specific bi-level control system and lamp type indicated. Certified by lamp manufacturer that ballast operating modes are free from negative effect on lamp life and color-rendering capability.
 11. Continuous Dimming Ballast: Dimming range shall be from 100 to 35 percent of rated lamp lumens without flicker.
 - a. Ballast Input Watts: Reduced to a maximum of 50 percent of normal at lowest dimming setting.
 - b. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated. Certified by lamp manufacturer that ballast operating modes are free from negative effect on lamp life and color-rendering capability.
- C. Auxiliary Instant-On Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent light output.
- D. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter-starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 - a. Restrike Range: 105- to 130-V ac.
 - b. Maximum Voltage: 250-V peak or 150-V ac RMS.
 2. Minimum Starting Temperature: **Minus 40 deg F (Minus 40 deg C).**
 3. Open-circuit operation shall not reduce average lamp life.

2.7 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
1. Lamps for AC Operation: Fluorescent, 2 for each fixture, 20,000 hours of rated lamp life.
 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.



- e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is announced by an integral audible alarm and flashing red LED.
3. Master/Remote Sign Configurations:
- a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
 - b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.8 EMERGENCY LIGHTING UNITS

- A. Description: Self-contained units complying with UL 924.
1. Battery: Sealed, maintenance-free, lead-acid type.
 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
 7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
 8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is announced by an integral audible alarm and flashing red LED.

2.9 FLUORESCENT LAMPS

- A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.
- B. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours, unless otherwise indicated.



- C. T8 rapid-start low-mercury lamps, rated 17 W maximum, nominal length of **24 inches (610 mm)**, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours, unless otherwise indicated.
- D. T5 rapid-start low-mercury lamps, rated 28 W maximum, nominal length of **45.2 inches (1150 mm)**, 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3000 K, and average rated life of 20,000 hours, unless otherwise indicated.
- E. T5HO rapid-start, high-output low-mercury lamps, rated 54 W maximum, nominal length of **45.2 inches (1150 mm)**, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 Insert value K, and average rated life of 20,000 hours, unless otherwise indicated.
- F. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.
 - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 - 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 - 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 - 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 - 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 - 6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

2.10 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.
 - 1. Dual-Arc Tube Lamps: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
- B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.
- C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
- D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.11 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: **1/2-inch (13-mm)** steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, **1/2-inch (13-mm)** steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, **12 gage (2.68 mm)**.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, **12 gage (2.68 mm)**.
- F. Rod Hangers: **3/16-inch (5-mm)** minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.12 RETROFIT KITS FOR FLUORESCENT LIGHTING FIXTURES

- A. Comply with UL 1598 listing requirements.



1. Reflector Kit: UL 1598, Type I. Suitable for two- to four-lamp, surface-mounted or recessed lighting fixtures by improving reflectivity of fixture surfaces.
2. Ballast and Lamp Change Kit: UL 1598, Type II. Suitable for changing existing ballast, lamps, and sockets.

2.13 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

A. Fixture Type:

1. Voltage: 120 -V ac.
2. Mounting: Recessed, ceiling Pendant, Surface ceiling, Surface, wall Suspended
3. Ballast Type: Electronic instant start.
4. Ballast Type: , compatible with lamp type indicated.
5. Ballast Fuse: Factory installed, slow-blow type rated between 2.65 and 3.0 times the line current.
6. Trim and Hardware: Spring-loaded door latches.
7. Minimum CU for typical RCR shall be as follows (typical cavity reflectances are ceiling, 80 percent; wall, 50 percent; and floor, 20 percent): RCR 3 CU.
8. Submit Sample.
9. Provide lighting fixtures as needed for mockups.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than **6 inches (150 mm)** from lighting fixture corners.
 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two **3/4-inch (20-mm)** metal channels spanning and secured to ceiling tees.
- C. Suspended Lighting Fixture Support:
 1. Pendants and Rods: Where longer than **48 inches (1200 mm)**, brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
- E. Adjust aimable lighting fixtures to provide required light intensities.
- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.



**MIAMI-DADE COUNTY, FLORIDA
PROJECT: C23-MDPLS-01-ESP**

Miami-Dade Public Library System
101 West Flagler Street
Miami, Florida 33130-1523
T 305-375-BOOK
miamidade.gov

- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION



**SECTION 265110
LIGHTING FIXTURE SCHEDULE**

Type	MFG	Part
L1	Metalux	24CZ2-40-UNV-L935-A3/8-4/18GDIMCD1-U
L1E	Metalux	24CZ2-40-UNV-EL7W-L935-A3/8-5/18GDIM-CD1-U
L2	Metalux	22CZ2-39-UNV-L935-A3/8-4/18GDIMCD1-U
L2E	Metalux	22CZ2-39-UNV-EL7W-L935-A3/8-5/18GDIM-CD1-U
L3	Halo	HC415D010 HM40525935 41MDHWF
L3E	Halo	HC415D010IEM7 HM4052593541MDHWF IEM
L3A	Portfolio	LDA3B10R40-90-35-D010E3AAHSFWF HB26
L3AE	Portfolio	LDA3B10R40-90-35-D010-EM7-E3AAHSFWF HB26
L4	Camman Industries, Inc.	C1003-24-LN-35K-CLV-MV-WM-PMW-90CRI
L4E	Camman Industries, Inc.	C1003-24-LN-35K-CLV-MV-WM-PMWREM-90CRI
L5	Camman Industries, Inc.	C1003-48-LN-35K-CLV-MV-WM-PMW-90CRI
L5E	Camman Industries, Inc.	C1003-48-LN-35K-CLV-MV-WM-PMWIEM-90CRI
L6	Camman Industries, Inc.	P1003-48-LH-35K-CLV-MV-WM-PMWST-90CRI
L6E	Camman Industries, Inc.	P1003-48-LH-35K-CLV-MV-WM-PMWIEM-ST-90CRI
L7	Metalux	4SNX-45SL-LW-UNV-L935-CD1-U
L7E	Metalux	4SNX-45SL-LW-UNV-L935-CD1-EL7WFKO-U
L8	Camman Industries, Inc.	C1003-24-35K-LN-CLV-MV-WM-PMW-OTBD
L8E	Camman Industries, Inc.	C1003-24-35K-LN-CLV-MV-WM-PMWOTBD-IEM-90CRI



L9	io LED	CS0SL-8SCT-120-ID-UNV-W-SASTD1FCS-10V-STD
L9-1	Acclaim Lighting	ACA-242-1AAHN
L10	Camman Industries, Inc.	P1044-48-LD-35K-CLV-MV-WM-PWM-ACC
L11-3	Camman Industries, Inc.	P1044-72-LN-35K-CLV-MV-WM-PWM-ACC
L11-4	Camman Industries, Inc.	P1044-96-LN-35K-CLV-MV-WM-PWM-ACC
L11-6	Camman Industries, Inc.	P1044-144-LN-35K-CLV-MV-WM-PWM-ACC
L12-1	Kuzco Lighting	PD9117-WH/GD
L12-2	Kuzco Lighting	PD9117-WH/SV
L12-3	Kuzco Lighting	PD9117-WH/BU
L13-2	ALW	LPX2RMD-FN-S24-RW-N-N-WS-DMXSW-UNV-N-N
L13-3	ALW	LPX2RMD-FN-S36-RW-N-N-WS-DMXSW-UNV-N-N
L13-4	ALW	LPX2RMD-FN-S48-RW-N-N-WS-DMXSW-UNV-N-N
L13-4E	ALW	LPX2RMD-FN-S48-RW-N-N-WS-DMXSW-UNV-N-N
L14	Portfolio	LD2B15D010 EU2B15NFL2590352LBD1H HB26
L15	Isolite	UEL-EM-G-1C2M-MTEBR
L16	Camman Industries, Inc.	P1044-24-LD-35K-CLV-MV-WM-PWM-ACC
L16E	Camman Industries, Inc.	P1044-24-LD-35K-CLV-MV-WM-PWM-ACC
INV1	Isolite	E3MINI-250-LC-MB-FD
INV2	Isolite	E3MINI-550-LC-MB-FD



Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 24CZ2-40-UNV-L935-A3/8-4/18GDIM-CD1-U
 Notes:

Type:
L1
 LDI24-110942

Project		Catalog #		Type	
Prepared by		Notes		Date	



Metalux

Cruze ST 24CZ2

2' x 4' LED Specification Grade Troffer

Typical Applications

Office • Education • Healthcare • Hospitality • Retail

Interactive Menu

- Order Information page 2
- Photometric Data page 3
- Connected Systems page 5
- VividTune™ Color Tuning Solutions page 6
- Product Warranty

Product Certification



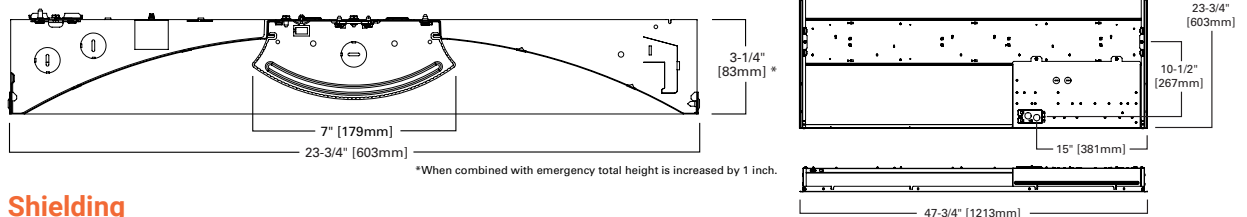
Product Features



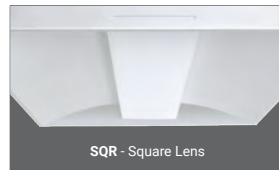
Top Product Features

- Latch-less design provides clean architectural look
- VividTune CCT tuning options from 3000K-5000K or 2700K-6500K
- Designers delight - ribbed, smooth and round perforated lens options
- High performance efficacy up to 167 lm/W
- Integrated sensor systems - occupancy, daylight and IoT connectivity
- Options to meet Buy American and other domestic preference requirements

Dimensional and Mounting Details

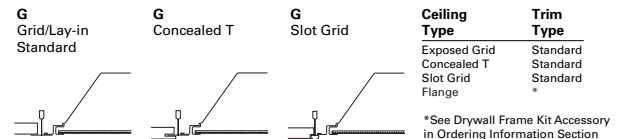


Shielding



See ordering information for more shielding options.

Ceiling Compatibility





Job Name:
South Dade Regional Library Specifications
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
24CZ2-40-UNV-L935-A3/8-4/18GDIM-
CD1-U

Notes:

Type:

L1

LDI24-110942

Metalux

24CZ2 LED

Order Information

SAMPLE ORDER NUMBER: 24CZ2-45HE-UNV-L835-CD1-U

Domestic Preferences	Rating	Series	Air	Lumen Output	Shielding	Voltage		
Domestic Preferences ⁽¹⁾	Rating	Series	Air	Lumen Level	Efficacy	Shielding	Voltage ⁽⁹⁾	
[Blank]=Standard BAA=Buy American Act TAA=Trade Agreements Act	[Blank]=Standard ATW-SW4=Chicago Rated	24CZ2=2x4 Cruze ST	[Blank]=Standard A=Air (Vented) ⁽¹⁷⁾	30=3000 Lumens 35=3500 Lumens 40=4000 Lumens 45=4500 Lumens 50=5000 Lumens 55=5500 Lumens 60=6000 Lumens 65=6500 Lumens 70=7000 Lumens 75=7500 Lumens	80=8000 Lumens ⁽⁴⁾ 85=8500 Lumens ⁽⁴⁾ 90=9000 Lumens ⁽⁴⁾ 95=9500 Lumens ⁽⁴⁾ 100=10000 Lumens ⁽⁴⁾ 110=11000 Lumens ⁽⁴⁾ 120=12000 Lumens ⁽⁴⁾ 130=13000 Lumens ⁽⁴⁾ 150=15000 Lumens ⁽⁴⁾ 170=17000 Lumens ⁽⁴⁾	[Blank]=Standard Efficacy ⁽⁵⁾ HE=High Efficacy ⁽⁷⁾ VHE=Very High Efficacy ^{(4),(6),(8)}	[Blank]=Ribbed Frosted Acrylic Lens (standard) S=Smooth Frosted Acrylic Lens RDP=Smooth Lens with Round Pattern Insert HRP=High-Efficiency Round Perf Inlay SQR=Square Lens	UNV=Universal Voltage 120-277 347V=347 Volt ⁽¹⁰⁾ 48V=48 Volt Low-Voltage (Class 2) ⁽²⁾
Notes (1) Only product configurations with these designated prefixes are built to be compliant with the Buy American Act of 1933 (BAA) or Trade Agreements Act of 1979 (TAA), respectively. Please refer to DOMESTIC PREFERENCES website for more information. Components shipped separately may be separately analyzed under domestic preference requirements.			Notes (2) Air version is intended for air return through plenum. See air return data table for air flow volumes. Air option not available with ATW-SW4.	Notes (3) Not available with white tuning and Standard Efficacy. (4) Available with CD or HCD drivers only. (5) 6500 lumens standard efficacy and 7500 lumens and higher are not available with WN driver. (6) Available up to 6500 lumens. (7) Available up to 7500 lumens. (8) Requires 2 CD-1 Drivers above 100VHE.		Notes (9) Products also available in non-US voltages and frequencies for international markets. (10) Some 347V versions require a transformer. Total wattage will increase by 2 watts if used. (C) Consult WaveLinX Low-Voltage or DLPV system pages for additional details and compatibility.		

Options	Emergency Options	CRI/CCT	Flex
Options	Emergency Options	CRI/CCT	Flex
GL=Single Element Fuse GM=Double Element Fuse	[Blank]=No emergency EL7W=7-watt 120V-277V emergency battery pack ⁽¹¹⁾ EL10W=10-watt 120V-277V emergency battery pack ⁽¹¹⁾ EL14W=14-watt 120V-277V emergency battery pack ⁽¹¹⁾ EL10WSD=10W emergency battery pack with self-diagnostic installed ^{(11),(13)} EL14WSD=14W emergency battery pack with self-diagnostic installed ^{(11),(13)} ELV7W=Low-voltage system, 7-watt emergency battery pack ⁽²⁾ ELV14W=Low-voltage system, 14-watt emergency battery pack ⁽²⁾ ETRD=Emergency Transfer Relay with dimming control ⁽¹²⁾ RRU=LVS Controls Emergency Transfer Relay with dimming control ⁽¹²⁾ UEL7W=UL924 Listed luminaire, 7-watt, 120V-277V emergency battery pack ⁽¹¹⁾ UEL14W=UL924 Listed luminaire, 14-watt 120V-277V emergency battery pack ⁽¹¹⁾ UEL10WSD=Bodine 10W emergency battery pack with self diagnostic installed ^{(11),(14)} UETRD=UL924 Listed luminaire, Emergency Transfer Relay with dimming control ⁽¹²⁾ URRU=UL924 Listed luminaire, LVS Controls Emergency Transfer Relay with dimming control ⁽¹²⁾	L830=80CRI, 3000K L835=80CRI, 3500K L840=80CRI, 4000K L850=80CRI, 5000K L930=90CRI, 3000K L935=90CRI, 3500K L940=90CRI, 4000K L950=90CRI, 5000K L83050=80CRI 3000K-5000K White Tuning ⁽¹⁵⁾ L93050=90CRI 3000K-5000K White Tuning ⁽¹⁵⁾ L82765=80CRI 2700K-6500K White Tuning ⁽¹⁵⁾ L92765=90CRI 2700K-6500K White Tuning ⁽¹⁵⁾	[Blank]=No Flex A3/8-4/18GDIM=3/8" Flex with 0-10V Dimming Leads A3/8-2/18C=3/8" Flex with lime and common A3/8-5/18GDIM=Flex with 0-10V Dimming leads and Blue for alternate wiring. See below for details.
Notes (11) Factory installed with integral test switch/indicator/laser test. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 7=700 lumens). ES-formal photometry for luminaire under emergency operation available. Battery option increases total height by 1 inch. (12) Used to bypass local control during outage. Must be used in conjunction with UL 1008 device (provided by others). Devices are universal voltage (UNV). 347 not available. (13) EL10WSD and EL14WSD not available with 347V. (14) UEL10WSD not available with 347V. (C) Consult WaveLinX Low-Voltage or DLPV system pages for additional details and compatibility.	Notes (15) White tuning provides correlated color temperatures (CCT) between 3000K (warm) to 6500K (cool). Must be used in conjunction with W2A driver only. Must be used with two (2) 10V dimming control channels, 1 color, 1 intensity. May be combined with WaveLinX sensor control systems only.	Notes (16) Matching width lens band on other side of sensor band may be supplied for symmetrical appearance. Required for use with sensor and emergency combination. Add 'D' to sensor ordering as shown: WAA, WAB, SVDPD. (17) WAA sensor to be used with CD, HCD or W2A driver. (18) WAB and SVDPD sensor to be used with CD or HCD driver. (19) WLA sensor to be used with LV driver. (20) If the space remains unoccupied for half of the timeout period, the lighting will automatically reduce to the Energy Saver light level. This adjustable light level is typically half of the occupied daylight level.	Flexible Metal Conduit Options Flex options available for 0-10V dimming control, DALI dimming control, emergency and night light functions. 72-inch factory-installed and pre-wired to driver, fitted to luminaire housing access plate with 90° enclosed FMC connector. Not all options may be combined and installation ratings vary by type. See online configurator for all flex options. A3/8-5/18GDIM=Flex with 0-10V Dimming leads and Blue for alternate wiring. See below for details.

Driver Type	Number of Drivers	Integrated Sensing Systems	Packaging
Driver Type	Number of Drivers	Integrated Sensing Systems ⁽¹⁸⁾	Packaging
CD=0-10V Driver (10%-100% Dimming) HCD=0-10V Driver (1%-100% Dimming) SLTD=DALI Driver (5%-100% Dimming) SLTHD=DALI Driver (1%-100% Dimming) LV=Low-voltage System Driver (0%-100% Dimming) ⁽⁶⁾ SD=Step Dimming Driver (50%-100% Dimming) LH=Lutron HiLume (LDE) series 1%-100% EcoSystem Driver with Soft-on Fade to Black dimming ⁽¹⁾ W2A=White Tuning, 2 ch, Analog 0-10V Intensity and CCT Control ⁽¹⁴⁾ SR=Sensor-ready Driver (1%-100% Dimming)	1=1 Driver 2=2 Drivers ⁽¹⁷⁾	[Blank]=No Sensor WAA=WaveLinX Wireless Integrated Sensor ^{(18),(14)} WAB=WaveLinX Lite Wireless Integrated Sensor ^{(20),(18)} WLA=Low-voltage Integrated Sensor ^{(21),(18)} SVDPD=0-10V Stand-alone Integrated Sensor ^{(20),(23),(18)}	U=Unit Pack PAL=Job Pack, out of carton PALC=Job Pack, in carton
Notes (16) White tuning provides correlated color temperatures (CCT) between 3000K (warm) to 6500K (cool) or 2700K (warm) to 6500K (cool). Must be used in conjunction with W2A driver only. Must be used with two (2) 10V dimming control channels, 1 color, 1 intensity. May be combined with WaveLinX sensor control systems only. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (C) Consult WaveLinX Low-Voltage or DLPV system pages for additional details and compatibility. (F) Consult Marketplace Options - Lutron system pages for additional details and compatibility. Compatible only with driver series shown, and may require two or more drivers. Requires field commissioning to operate or dim. Contact Lutron at www.lutron.com.	Notes (17) See lumen limitation notes for applications requiring 2 drivers or use online configurator. When combined with emergency total height is increased by 1 inch.	Notes (18) Matching width lens band on other side of sensor band may be supplied for symmetrical appearance. Required for use with sensor and emergency combination. Add 'D' to sensor ordering as shown: WAA, WAB, SVDPD. (19) WAA sensor to be used with CD, HCD or W2A driver. (20) WAB and SVDPD sensor to be used with CD or HCD driver. (21) WLA sensor to be used with LV driver. (22) If the space remains unoccupied for half of the timeout period, the lighting will automatically reduce to the Energy Saver light level. This adjustable light level is typically half of the occupied daylight level. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (A) Consult WaveLinX system pages for additional details and compatibility. (B) WaveLinX Lite devices are not currently compatible with the WaveLinX Wireless Area Controller. Consult WaveLinX Lite system pages for additional details and compatibility. (C) Consult WaveLinX Low-Voltage or DLPV system pages for additional details and compatibility. (D) Consult SVDPD series system pages for additional details and compatibility.	



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 24CZ2-40-UNV-L935-A3/8-4/18GDIM-
 CD1-U
 Notes:

Type:
L1
 LDI24-110942

Metalux **24CZ2 LED**

Accessories

Accessories (order separately) ⁽²⁴⁾
<p>CZ2-EQCLIP-U-PK=CZ2" Earthquake Clip Kit (4 clips per bag kit) ⁽²³⁾ DF-24W-U-2 x 4' Drywall Frame Kit SK-24-WS-2 x 4' Shallow Surface Mount Kit SK-24-WT-2 x 4' Tall Surface Mount Kit ISHH-01=Programming Remote for Integrated Sensor ⁽⁶⁾ ISHH-02=Personal Control Remote for Integrated Sensor ⁽⁶⁾</p>
<p>Notes (23) An EQ Grid Clip is recommended for all 9/16" ceiling systems. Four required per fixture. (24) Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (D) For use with SVPD sensor only. Consult SVPD series system pages for additional details and compatibility.</p>

Product Specifications

Construction

- Die formed of code gauge prime cold rolled steel with full length die-formed stiffeners
- Unibody endplates attached with interlocking tabs and screws
- Hemmed side flanges
- Four auxiliary fixture end suspension points
- Integral Grid-lock feature for endplates for added safety
- Optional earthquake clips available

Integrated Controls

- Standard with 0-10V dimming driver (10% standard, 1% optional)
- WaveLinx wireless sensor compatible for standalone, controlled, connected, and IoT capability
- SVPD sensor compatible for standalone functionality
- Low-voltage sensor and driver compatible for WaveLinx Low-Voltage and DLVP applications
- DALI 2.0, Lutron, and step-dimming available

LED and Light Engine

- LED's available in 3000K, 3500K, 4000K, or 5000K at 80 CRI minimum and 90 CRI minimum
- Color accuracy ≤ 3 -Step MacAdam ellipse (SDCM)
- TM21 life at 60,000 hours up to L90 and calculated L70 exceeds 203,000 hrs.
- Drivers available in 120-277V and 347V
- Tunable white options available with Cooper Lighting Solutions' VividTune

Emergency Options

- 120V-277V integral emergency battery pack comes in 7-watts, 10-watt, or 14-watts
- Self-diagnostic emergency battery available in 10 or watts (NFPA 101@ Life Safety Code®)
- Constant power to the LED system for controlled, predictable discharge
- Integrated test switch/indicator light visible from floor
- Min. 90-minute backup period for code compliance
- Integral emergency transfer relay available for generator equipped power systems

Shielding

- Ribbed acrylic frosted lens standard
- Optional smooth acrylic frosted lens (S)
- Optional metal perforated acrylic lens (RDP)
- Optional High-Efficiency Round Perf Inlay (HRP)

Compliance

- IC rated for insulation contact
- cULus listed for damp locations
- UL924 luminaire listing available, see Emergency Options
- RoHS compliant
- Tested to IESNA LM-79 and LM-80
- Stated life tested to TM21 standards
- Can be used for State of California Title 24 high efficacy luminaire

Warranty

- Five-year warranty standard. Optional ten year warranty available.

Finish

- Multistage, iron phosphate pretreatment
- 90% reflective, matte white enamel finish
- Full fixture housing painted after fabrication

Photometric Data

[View IES files](#)

	<p>24CZ2-35-UNV-L830-CD1-U Dimming Driver Linear LED 3000K Spacing criterion: (H) 1.22 x mounting height, (L) 1.28 x mounting height Lumens: 3618 Input Watts: 30.1W Efficacy: 120.2 LPW Test Report: 24CZ2-35-UNV-L830-CD1-U.IES</p>		<p>24CZ2-35HE-UNV-L830-CD1-U Dimming Driver Linear LED 3000K Spacing criterion: (H) 1.21 x mounting height, (L) 1.27 x mounting height Lumens: 3562 Input Watts: 26.9W Efficacy: 132.4 LPW Test Report: 24CZ2-35HE-UNV-L830-CD1-U.IES</p>
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Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
24CZ2-40-UNV-L935-A3/8-4/18GDIM-
CD1-U
Notes:

Type:
L1
LDI24-110942

Metalux **24CZ2 LED**

Energy and Performance Data

Standard Efficacy Versions – Single Row of LEDs

Catalog Number	Lumens	Watts	lm/W
24CZ2-30-UNV-L835-CD1-U	3028	22.4	135
24CZ2-35-UNV-L835-CD1-U	3633	27.3	133
24CZ2-40-UNV-L835-CD1-U	4178	30.4	137
24CZ2-45-UNV-L835-CD1-U	4602	35.0	132
24CZ2-50-UNV-L835-CD1-U	5049	39.6	128
24CZ2-55-UNV-L835-CD1-U	5571	41.1	135
24CZ2-60-UNV-L835-CD1-U	6056	46.3	131
24CZ2-65-UNV-L835-CD1-U	6601	50.1	132

High Efficacy Versions – Two Rows of LEDs

Catalog Number	Lumens	Watts	lm/W
24CZ2-30HE-UNV-L835-CD1-U	3100	22.3	139
24CZ2-35HE-UNV-L835-CD1-U	3685	27.0	137
24CZ2-40HE-UNV-L835-CD1-U	4144	30.7	135
24CZ2-45HE-UNV-L835-CD1-U	4712	35.3	134
24CZ2-50HE-UNV-L835-CD1-U	5164	38.6	134
24CZ2-55HE-UNV-L835-CD1-U	5722	43.5	132
24CZ2-60HE-UNV-L835-CD1-U	6182	44.1	140
24CZ2-65HE-UNV-L835-CD1-U	6777	48.9	139
24CZ2-70HE-UNV-L835-CD1-U	7218	49.3	146
24CZ2-75HE-UNV-L835-CD1-U	7787	55.4	141

Very High Efficacy Versions – Three Rows of LEDs

Catalog Number	Lumens	Watts	lm/W
24CZ2-30VHE-UNV-L835-CD1-U	3011	20.4	148
24CZ2-35VHE-UNV-L835-CD1-U	3526	22.8	155
24CZ2-40VHE-UNV-L835-CD1-U	4042	26.2	154
24CZ2-45VHE-UNV-L835-CD1-U	4559	29.6	154
24CZ2-50VHE-UNV-L835-CD1-U	5064	32.7	155
24CZ2-55VHE-UNV-L835-CD1-U	5570	36.1	154
24CZ2-60VHE-UNV-L835-CD1-U	6055	38.7	157
24CZ2-65VHE-UNV-L835-CD1-U	6565	42.2	156
24CZ2-70VHE-UNV-L835-CD1-U	7059	45.7	155
24CZ2-75VHE-UNV-L835-CD1-U	7662	49.9	154
24CZ2-80VHE-UNV-L835-CD1-U	8128	53.8	151
24CZ2-85VHE-UNV-L835-CD1-U	8600	57.9	149
24CZ2-90VHE-UNV-L835-CD1-U	9053	61.8	147
24CZ2-95VHE-UNV-L835-CD1-U	9521	65.6	145
24CZ2-100VHE-UNV-L835-CD1-U	10191	69.6	146
24CZ2-110VHE-UNV-L835-CD2-U	11098	77.4	143
24CZ2-120VHE-UNV-L835-CD2-U	12211	83.6	146
24CZ2-130VHE-UNV-L835-CD2-U	13271	90.7	146
24CZ2-150VHE-UNV-L835-CD2-U	15006	104.2	144
24CZ2-170VHE-UNV-L835-CD2-U	17021	123.4	138

Shielding

Lumen Adjustment Factors			
S	RDP	HRP	SQR
1.05	0.67	0.81	0.96

Lumen Calculator

CCT Multiplier	80 CRI	90 CRI ⁽¹⁾
3000K	0.965	0.827
3500K	1.000	0.847
4000K	1.019	0.856
5000K	1.019	0.909

Notes: (1) Input wattages for 90 CRI versions may vary. Refer to published IES-format photometry or LM-79 reports for more details.

Example of Lumen Adjustment Calculation

24CZ2-40-UNV-L835-CD1-U at 90CRI at 3500K
 Lumen Adjustment Factor = 0.845
 Total Light Output =
 $4,196 \text{ lm} \times 0.845 = 3,546 \text{ lm}$
 Efficacy = $\frac{3,546 \text{ lm}}{36.2\text{W}} = 98 \text{ lm/W}$

Lumen Maintenance

Version	TM-21 Lumen Maintenance (60,000 hours) ⁽²⁾	Theoretical L70 (Hours) ⁽³⁾
Standard	> 87%	> 151,000
High Efficiency	> 90%	> 203,000
Very High Efficiency	> 90%	> 203,000

Notes: (2) Supported by IES TM-21 standards. (3) Theoretical values represent estimations commonly used; however, refer to the IES position on LED Product Lifetime Prediction, IES PS-10-18, that explains proper use of IES TM-21 and LM-80.

Load Data (Stock Product)

Thd	6%
Power Factor	0.99
Weight (lbs.)	16
Low Temp. Start	-20°C

Shipping Data

Catalog No.	Wt.	Pallet 49"L x 52"W x 46"H
2' x 4'	20.4 lbs.	28

Air Return Volume

Negative Static Pressure (Inches H ₂ O)	Return Air Volume (CFM)
0.05	75
0.1	103
0.2	153
0.25	177
0.3	191
0.45	234



Metalux **24CZ2 LED**

Control Systems

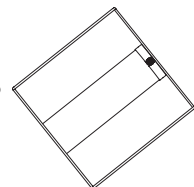
- WaveLinX Wireless
- WaveLinX Wired
- WaveLinX Lite
- DLVP
- VividTune

The Cruze ST with Integrated Sensor technology provides automatic energy savings without sacrificing performance. The Cruze ST delivers superior lighting with integrated occupancy and daylighting controls.

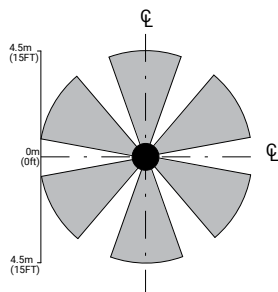
For standalone and controlled applications, the WaveLinX Lite integral sensor provides out-of-the-box functionality with no gateways required and factory startup is not needed.

When more connectivity is required, the WaveLinX Wireless sensor meets modern code and utility requirements, delivers energy and cost savings, while enabling buildings to become smart buildings.

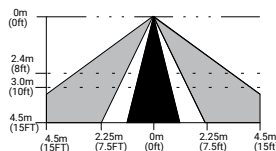
The WaveLinX Wireless Connected Lighting System combined with Trellix provides an open IoT platform and infrastructure that connects intelligent sensors leveraging the real-estate of the physical light fixture to solve higher complexity problems to deliver actionable insights through the aggregation of valuable data.



TOP VIEW:



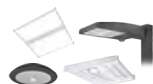
SIDE VIEW:



Note: Installation of integrated sensors within 3-ft (1m) of HVAC air vents is not recommended. The pattern shown is intended solely as a general guide and is not to scale.

Systems comparison chart

Cooper Lighting Solutions provides many lighting system solutions designed to satisfy code requirements and meet the unique needs of any project.



Luminaire with standalone sensor



Standalone Spaces WaveLinX Lite



Networked Spaces WaveLinX Pro



Enterprise Trellix

	Luminaire with standalone sensor	Standalone Spaces WaveLinX Lite	Networked Spaces WaveLinX Pro	Enterprise Trellix
Occupancy	Yes	Yes	Yes	Yes
Daylighting	Yes	Yes	Yes	Yes
Wallstations	-	Yes	Yes	Yes
Gateways	-	-	1 WAC	300 WACs
Devices (MAX)	-	50 per Area (1400 per site)	200 per WAC2	32,500 per Core Enterprise
Software	-	WaveLinX Lite Mobile App	WaveLinX Pro Mobile App	Trellix Core
Areas	-	28 per Site	50 per WAC2	up to 3,000
Zones	-	16 per Area	16 per Area	up to 9,000
Scheduling	-	-	Local	Global
VividTune™	-	-	Yes	Yes
Plug-Load Control	-	-	Yes	Yes
Low-Voltage Power	-	-	Yes	Yes
Integration	-	-	-	BACnet, API
Dashboards	-	-	-	Energy, Occupancy
Configuration	-	Installer	Technician	Technician / IT

SCALABILITY



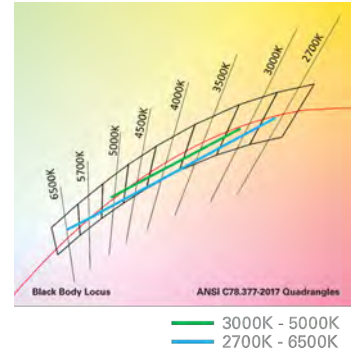


Metalux **24CZ2 LED**



24 Cruze ST LED with VividTune Tunable White

VividTune tunable white luminaires from Cooper Lighting Solutions deliver high-quality light in a broad range of continuously variable color temperatures and intensities. Create a dynamic environment by adjusting the ambient light warmer or cooler to influence mood, support the task at hand, or create a dramatic ambience. The ability to control correlated color temperature and intensity separately using simple controls is the next evolution of LED lighting for the commercial, educational, healthcare and hospitality space. The unparalleled flexibility and number of available lighting environments enable users to find the right light with tunable white.



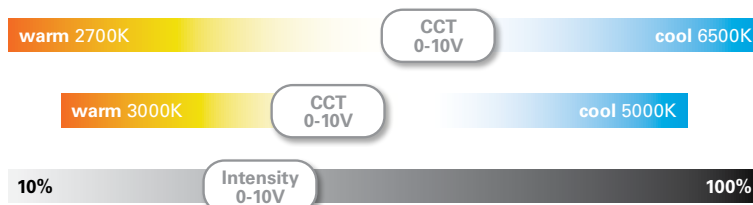
Performance Data*

Tunable White - Lumen Adjustment Factors				
CCT	3000K-5000K		2700K-6500K	
	80 CRI	90 CRI	80 CRI	90 CRI
2700K	-	-	0.878	0.750
3000K	0.904	0.744	0.903	0.779
3500K	0.956	0.813	0.934	0.819
4000K	1.004	0.878	0.954	0.844
4500K	1.014	0.893	0.972	0.866
5000K	1.014	0.893	0.985	0.884
6500K	-	-	0.999	0.908

2' x 4' Cruze ST LED - Example of Approximate Lumen Calculation			
	Standard Catalog #	VividTune 80 CRI Catalog #	VividTune 90 CRI Catalog #
CCT Setting	24CZ2-40HE-UNV-L835-CD1-U	24CZ2-40HE-UNV-L83050-W2A1-U	24CZ2-40HE-UNV-L93050-W2A1-U
3000K	-	3641	2998
3500K	4029	3853	3275
4000K	-	4046	3537
4500K	-	4084	3599
5000K	-	4084	3599

Controlling VividTune Tunable White

VividTune luminaires make tunable white more accessible by using simple and familiar controls. From wall dimmers to wireless controls, VividTune tunable white luminaires are compatible with industry standard 0-10V dimming controls. A single 0-10V dimming input is used to control intensity (brightness) while a second 0-10V dimming input is used to adjust CCT. For suggested control configurations, go to www.cooperlighting.com for tunable white application guides.



Example of Lumen Adjustment Calculation

24CZ2-40HE-UNV-L83050-W2A1-U
at 80 CRI tuned to 3500K

Adjusted Lumen = published lm x adjusted lm factor

Adjusted Lumen = 4029 x 0.956

Adjusted Lumen = 3853 lm

** Lumen adjustment factors are for reference and may be different for each product selected. Refer to IES files for actual performance data on each.*



Job Name:
South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
24CZ2-40-UNV-EL7W-L935-A3/8-5/
18GDIM-CD1-U
Notes:

Type:
L1E
LDI24-110942

Project		Catalog #		Type	
Prepared by		Notes		Date	



Metalux

Cruze ST 24CZ2

2' x 4' LED Specification Grade Troffer

Typical Applications

Office • Education • Healthcare • Hospitality • Retail

Interactive Menu

- Order Information [page 2](#)
- Photometric Data [page 3](#)
- Control Solutions [page 5](#)
- VividTune™ Color Tuning Solutions [page 6](#)
- BioUp - Melanopic Lighting [page 7](#)
- Product Warranty

Product Certification



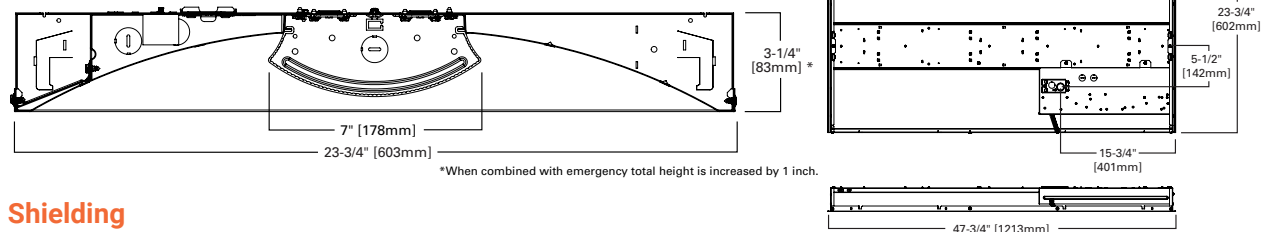
Product Features



Top Product Features

- Latch-less design provides clean architectural look
- BioUp melanopic lighting options for 30% circadian boost and earn WELL Building Standard points
- VividTune CCT tuning options from 3000K-5000K or 2700K-6500K
- Designers delight - ribbed, smooth and round perforated lens options
- High performance efficacy up to 167 lm/W
- Integrated sensor systems - occupancy, daylight and IoT connectivity
- Options to meet Buy American and other domestic preference requirements

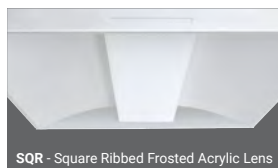
Dimensional and Mounting Details



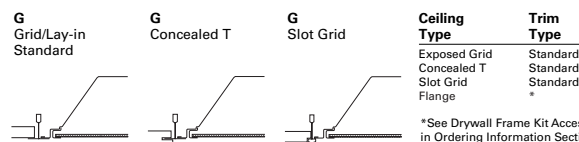
Shielding



See ordering information for more shielding options.



Ceiling Compatibility





Job Name:
South Dade Regional Library Specifications
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
24CZ2-40-UNV-EL7W-L935-A3/8-5/
18GDIM-CD1-U

Notes:

Type:

L1E

LDI24-110942

Metalux

24CZ2 LED

Order Information

SAMPLE ORDER NUMBER: 24CZ2-45HE-UNV-L835-CD1-U

Domestic Preferences	Rating	Series	Air	Lumen Output	Shielding	Voltage		
Domestic Preferences (1)	Rating	Series	Air	Lumen Level	Efficacy	Shielding	Voltage (9)	
[Blank]=Standard BAA=Buy American Act TAA=Trade Agreements Act	[Blank]=Standard ATW-SW4=Chicago Rated	24CZ2=2x4 Cruze ST	[Blank]=Standard A=Air (Vented) (17)	30=3000 Lumens 35=3500 Lumens 40=4000 Lumens 45=4500 Lumens 50=5000 Lumens 55=5500 Lumens (2) 60=6000 Lumens (2) 65=6500 Lumens (2),(4),(5) 70=7000 Lumens 75=7500 Lumens (4),(5)	80=8000 Lumens (4) 85=8500 Lumens (4) 90=9000 Lumens (4) 95=9500 Lumens (4) 100=10000 Lumens (4) 110=11000 Lumens (4) 120=12000 Lumens (4) 130=13000 Lumens (4) 150=15000 Lumens (4) 170=17000 Lumens (4)	[Blank]=Standard Efficacy (3) HE=High Efficacy (7) VHE=Very High Efficacy (4),(5),(8)	[Blank]=Ribbed Frosted Acrylic Lens (standard) S=Smooth Frosted Acrylic Lens RDP=Smooth Lens with Round Pattern Insert HRP=High-Efficiency Round Perf Inlay SQR=Square Lens	UNV=Universal Voltage 120-277 347V=347 Volt (10) 48V=48 Volt Low-Voltage (Class 2) (2)
Notes (1) Only product configurations with these designated prefixes are built to be compliant with the Buy American Act of 1933 (BAA) or Trade Agreements Act of 1979 (TAA), respectively. Please refer to DOMESTIC PREFERENCES website for more information. Components shipped separately may be separately analyzed under domestic preference requirements.			Notes (2) Air version is intended for air return through plenum. See air return data table for air flow volumes. Air option not available with ATW-SW4.	Notes (3) Not available with white tuning and Standard Efficacy. (4) Available with CD or HCD drivers only. (5) 6500 lumens standard efficacy and 7500 lumens and higher are not available with WN driver. (6) Available up to 6500 lumens. (7) Available up to 7500 lumens. (8) Requires 2 CD-1 Drivers above 100VHE.		Notes (9) Products also available in non-US voltages and frequencies for international markets. (10) Some 347V versions require a transformer. Total wattage will increase by 2 watts if used. (C) Consult WaveLinX Low-Voltage or DLPV system pages for additional details and compatibility.		

Options	Emergency Options	CRI/CCT	Flex
Options	Emergency Options	CRI/CCT	Flex
GL=Single Element Fuse GM=Double Element Fuse	[Blank]=No emergency EL7W=7-watt 120V-277V emergency battery pack (11) EL10W=10-watt 120V-277V emergency battery pack (11) EL14W=14-watt 120V-277V emergency battery pack (11) EL10WSD=10W emergency battery pack with self-diagnostic installed (11),(13) EL14WSD=14W emergency battery pack with self-diagnostic installed (11),(13) EL7W-Low-voltage system, 7-watt emergency battery pack (2) EL14W-Low-voltage system, 14-watt emergency battery pack (2) ETRD=Emergency Transfer Relay with dimming control (12) RRU=LVS Controls Emergency Transfer Relay with dimming control (12) UEL7W=UL924 Listed luminaire, 7-watt, 120V-277V emergency battery pack (11) UEL14W=UL924 Listed luminaire, 14-watt 120V-277V emergency battery pack (11) UEL10WSD=Bodine 10W emergency battery pack with self diagnostic installed (11),(14) UETRD=UL924 Listed luminaire, Emergency Transfer Relay with dimming control (12) URRU=UL924 Listed luminaire, LVS Controls Emergency Transfer Relay with dimming control (12)	L830=80CRI, 3000K L835=80CRI, 3500K L840=80CRI, 4000K L850=80CRI, 5000K L930=90CRI, 3000K L935=90CRI, 3500K L940=90CRI, 4000K L950=90CRI, 5000K L83050=80CRI 3000K-5000K White Tuning (15) L93050=90CRI 3000K-5000K White Tuning (15) L82765=80CRI 2700K-6500K White Tuning (15) L92765=90CRI 2700K-6500K White Tuning (15)	[Blank]=No Flex A3/8-4/18GDIM=3/8" Flex with 0-10V Dimming Leads A3/8-2/18C=3/8" Flex with line and common A3/8-5/18GDIM=Flex with 0-10V Dimming leads and Blue for alternate wiring. See below for details.
Notes (11) Factory installed with integral test switch/indicator/laser test. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 7=700 lumens). IE3-format photometry for luminaire under emergency operation available. Battery option increases total height by 1 inch. (12) Used to bypass local control during outage. Must be used in conjunction with UL 1008 device (provided by others). Devices are universal voltage (UNV). 347 not available. (13) EL10WSD and EL14WSD not available with 347V. (14) UEL10WSD not available with 347V. (C) Consult WaveLinX Low-Voltage or DLPV system pages for additional details and compatibility.		Notes (15) White tuning provides correlated color temperatures (CCT) between 3000K (warm) to 6500K (cool). Must be used in conjunction with W2A driver only. Must be used with two (2) 10V dimming control channels, 1 color, 1 intensity. May be combined with WaveLinX sensor control systems only.	Flexible Metal Conduit Options Flex options available for 0-10V dimming control, DALI dimming control, emergency and night light functions. 72-inch factory-installed and pre-wired to driver, fitted to luminaire housing access plate with 90° enclosed FMC connector. Not all options may be combined and installation ratings vary by type. See online configurator for all flex options. A3/8-4/18GDIM series notes: Factory installed dimming option 3/8" flexible metal conduit with 2-#18 power and ground wires and 2-#18 UL-listed jacketed 0-10V +/- control wires. Meets UL 66, 83, 1479, 1569, 1581, 2556. NEC@ 250.118, 300.22(C), 392, 396, 330, 501, 502, 503, 504, 505, 518, 520, 530, 645, 72; Federal Specification A-A-59544 (formerly J-C-308); all applicable OSHA and HUD Requirements. UL Classified 1, 2, and 3-hour through penetration with applicable fire stop product (not included). May be surface mounted, fished and/or embedded in plaster. Cable tray and approved raceway rated, install per NEC@; Environmental Air-Handling Space Installation per NEC@ 300.22(C).

Driver Type	Number of Drivers	Integrated Sensing Systems	Packaging
Driver Type	Number of Drivers	Integrated Sensing Systems (18)	Packaging
CD=0-10V Driver (10%-100% Dimming) HCD=0-10V Driver (1%-100% Dimming) SLTD=DALI Driver (5%-100% Dimming) SLTHD=DALI Driver (1%-100% Dimming) LV=Low-voltage System Driver (0%-100% Dimming) SD=Step Dimming Driver (50%-100% Dimming) LH=Lutron HiLume (LDE1 series) 1%-100% EcoSystem Driver with Soft-on Fade to Black dimming (1) WZA=White Tuning, 2 ch, Analog 0-10V Intensity and CCT Control (14) SR=Sensor-ready Driver (1%-100% Dimming)	1=1 Driver 2=2 Drivers (11)	[Blank]=No Sensor WAA=WaveLinX Wireless Integrated Sensor (18),(14) WAB=WaveLinX Lite Wireless Integrated Sensor (20),(18) WLA=Low-voltage Integrated Sensor (21),(2) SVDP1=0-10V Stand-alone Integrated Sensor (20),(23),(2)	U=Unit Pack PAL=Job Pack, out of carton PALC=Job Pack, in carton
Notes (16) White tuning provides correlated color temperatures (CCT) between 3000K (warm) to 6500K (cool) or 2700K (warm) to 6500K (cool). Must be used in conjunction with W2A driver only. Must be used with two (2) 10V dimming control channels, 1 color, 1 intensity. May be combined with WaveLinX sensor control systems only. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (C) Consult WaveLinX Low-Voltage or DLPV system pages for additional details and compatibility. (F) Consult Marketplace Options - Lutron system pages for additional details and compatibility. Compatible only with driver series shown, and may require two or more drivers. Requires field commissioning to operate or dim. Contact Lutron at www.lutron.com.	Notes (17) See lumen limitation notes for applications requiring 2 drivers or use online configurator. When combined with emergency total height is increased by 1 inch.	Notes (18) Matching width lens band on other side of sensor band may be supplied for symmetrical appearance. Required for use with sensor and emergency combination. Add 'D' to sensor ordering as shown: WAA, WAB, SVDP1. (19) WAA sensor to be used with CD, HCD or W2A driver. (20) WAB and SVDP1 sensor to be used with CD or HCD driver. (21) WLA sensor to be used with LV driver. (22) If the space remains unoccupied for half of the timeout period, the lighting will automatically reduce to the Energy Saver light level. This adjustable light level is typically half of the occupied daylight level. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (A) Consult WaveLinX system pages for additional details and compatibility. (B) WaveLinX Lite devices are not currently compatible with the WaveLinX Wireless Area Controller. Consult WaveLinX Lite system pages for additional details and compatibility. (C) Consult WaveLinX Low-Voltage or DLPV system pages for additional details and compatibility. (D) Consult SVDP series system pages for additional details and compatibility.	



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 24CZ2-40-UNV-EL7W-L935-A3/8-5/
 18GDIM-CD1-U
 Notes:

Type:
L1E
 LDI24-110942

Metalux **24CZ2 LED**

Order Information

CONTINUED

Number of Drivers	Integrated Sensing Systems ⁽²¹⁾	Packaging	Accessories (order separately) ⁽²⁵⁾
1=1 Driver 2=2 Drivers ⁽²⁰⁾	[Blank]=No Sensor WLS (formerly WAB) =WaveLinX LITE Wireless Sensor, Occupancy w/ photocell, Independent & Networked ^{(23), (8)} WPS (formerly WAA) =WaveLinX PRO Wireless Sensor, Occupancy w/ photocell, Networked ^{(22), (A)} WLN =WaveLinX LITE Wireless Control Node, without sensor ^{(23), (8)} WPN =WaveLinX PRO Wireless Control Node, without sensor ^{(22), (A)}	U=Unit Pack PAL =Job Pack, out of carton PALC =Job Pack, in carton	CZ2-EQCLIP-U-PK =“CZ2” Earthquake Clip Kit (4 clips per bag kit) ⁽²⁴⁾ DF-24W-U =2' x 4' Drywall Frame Kit SK-24-WS =2' x 4' Shallow Surface Mount Kit SK-24-WT =2' x 4' Tall Surface Mount Kit
Notes <small>(20) See lumen limitation notes for applications requiring 2 drivers or use online configurator. When combined with emergency total height is increased by 1 inch.</small>	Notes <small>(21) Matching width lens band on other side of sensor band may be supplied for symmetrical appearance. Required for use with sensor and emergency combination. Add "D" to sensor ordering as shown - WPSD, WLSD. (22) WPS sensor and WPN node to be used with CD, HCD or W2A driver. (23) WLS Sensor and WLN node to be used with CD or HCD driver. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (A) Consult WaveLinX PRO system pages for additional details and compatibility. (B) Consult WaveLinX LITE system pages for additional details and compatibility.</small>		Notes <small>(24) An EQ Grid Clip is recommended for all 9/16" ceiling systems. Four required per fixture. (25) Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information.</small>

Product Specifications

Construction

- Die formed of code gauge prime cold rolled steel with full length die-formed stiffeners
- Unibody endplates attached with interlocking tabs and screws
- Hemmed side flanges
- Four auxiliary fixture end suspension points
- Integral Grid-lock feature for endplates for added safety
- Optional earthquake clips available

Integrated Controls

- Standard with 0-10V dimming driver (10% standard, 1% optional)
- Integrated WaveLinX options provide wireless individual fixture control and enable code compliance, increased energy savings, grouping of fixtures, and connection to WaveLinX control systems
- DALI 2.0, Lutron, and step-dimming available

LED and Light Engine

- LED's available in 3000K, 3500K, 4000K, or 5000K at 80 CRI minimum and 90 CRI minimum
- Color accuracy ≤ 3 -Step MacAdam ellipse (SDCM)
- TM21 life at 60,000 hours up to L90 and calculated L70 exceeds 203,000 hrs.
- Drivers available in 120-277V and 347V
- Tunable white options available with Cooper Lighting Solutions' VividTune
- BioUp melanopic lighting options available in static or tunable white

Emergency Options

- 120V-277V integral emergency battery pack comes in 7-watts, 10-watt, or 14-watts
- Self-diagnostic emergency battery available in 10 or watts (NFPA 101® Life Safety Code®)
- Constant power to the LED system for controlled, predictable discharge
- Integrated test switch/indicator light visible from floor
- Min. 90-minute backup period for code compliance
- Integral emergency transfer relay available for generator equipped power systems

Shielding

- Ribbed acrylic frosted lens standard
- Optional smooth acrylic frosted lens (S)
- Optional square ribbed frosted acrylic lens (SQR)
- Optional High-Efficiency Round Perf Inlay (HRP)
- Replacement lenses available, contact factory

Compliance

- IC rated for insulation contact
- cULus listed for damp locations
- UL924 luminaire listing available, see Emergency Options
- RoHS compliant
- Tested to IESNA LM-79 and LM-80
- Stated life tested to TM21 standards
- Can be used for State of California Title 24 high efficacy luminaire

Warranty

- Five-year limited warranty standard. Optional ten year limited warranty available.

Finish

- Multistage, iron phosphate pretreatment
- 90% reflective, matte white enamel finish
- Full fixture housing pre-painted matte white (choose PAF option for "Paint after Fabrication")

Photometric Data

[View IES files](#)

	<p>24CZ2-35-UNV-L830-CD1-U Dimming Driver Linear LED 3000K Spacing criterion: () 1.22 x mounting height, (⊥) 1.28 x mounting height Lumens: 3618 Input Watts: 30.1W Efficacy: 120.2 LPW Test Report: 24CZ2-35-UNV-L830-CD1-U.IES</p>		<p>24CZ2-35HE-UNV-L830-CD1-U Dimming Driver Linear LED 3000K Spacing criterion: () 1.21 x mounting height, (⊥) 1.27 x mounting height Lumens: 3562 Input Watts: 26.9W Efficacy: 132.4 LPW Test Report: 24CZ2-35HE-UNV-L830-CD1-U.IES</p>
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**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

24CZ2-40-UNV-EL7W-L935-A3/8-5/
18GDIM-CD1-U

Notes:

Type:**L1E**

LDI24-110942

Metalux**24CZ2 LED****Energy and Performance Data**

Standard Efficacy Versions – Single Row of LEDs
Default CCT/Lumen Setting: 3500K/Med

Catalog Number	Lumens	Watts	lm/W
24CZ2-30-UNV-L835-CD1-U	3028	22.4	135
24CZ2-35-UNV-L835-CD1-U	3633	27.3	133
24CZ2-40-UNV-L835-CD1-U	4178	30.4	137
24CZ2-45-UNV-L835-CD1-U	4602	35.0	132
24CZ2-50-UNV-L835-CD1-U	5049	39.6	128
24CZ2-55-UNV-L835-CD1-U	5571	41.1	135
24CZ2-60-UNV-L835-CD1-U	6056	46.3	131
24CZ2-65-UNV-L835-CD1-U	6601	50.1	132

High Efficacy Versions – Two Rows of LEDs
Default CCT/Lumen Setting: 3500K/Med

Catalog Number	Lumens	Watts	lm/W
24CZ2-30HE-UNV-L835-CD1-U	3100	22.3	139
24CZ2-35HE-UNV-L835-CD1-U	3685	27.0	137
24CZ2-40HE-UNV-L835-CD1-U	4144	30.7	135
24CZ2-45HE-UNV-L835-CD1-U	4712	35.3	134
24CZ2-50HE-UNV-L835-CD1-U	5164	38.6	134
24CZ2-55HE-UNV-L835-CD1-U	5722	43.5	132
24CZ2-60HE-UNV-L835-CD1-U	6182	44.1	140
24CZ2-65HE-UNV-L835-CD1-U	6777	48.9	139
24CZ2-70HE-UNV-L835-CD1-U	7218	49.3	146
24CZ2-75HE-UNV-L835-CD1-U	7787	55.4	141

Very High Efficacy Versions – Three Rows of LEDs
Default CCT/Lumen Setting: 3500K/Med

Catalog Number	Lumens	Watts	lm/W
24CZ2-30VHE-UNV-L835-CD1-U	3011	20.4	148
24CZ2-35VHE-UNV-L835-CD1-U	3526	22.8	155
24CZ2-40VHE-UNV-L835-CD1-U	4042	26.2	154
24CZ2-45VHE-UNV-L835-CD1-U	4559	29.6	154
24CZ2-50VHE-UNV-L835-CD1-U	5064	32.7	155
24CZ2-55VHE-UNV-L835-CD1-U	5570	36.1	154
24CZ2-60VHE-UNV-L835-CD1-U	6055	38.7	157
24CZ2-65VHE-UNV-L835-CD1-U	6565	42.2	156
24CZ2-70VHE-UNV-L835-CD1-U	7059	45.7	155
24CZ2-75VHE-UNV-L835-CD1-U	7662	49.9	154
24CZ2-80VHE-UNV-L835-CD1-U	8128	53.8	151
24CZ2-85VHE-UNV-L835-CD1-U	8600	57.9	149
24CZ2-90VHE-UNV-L835-CD1-U	9053	61.8	147
24CZ2-95VHE-UNV-L835-CD1-U	9521	65.6	145
24CZ2-100VHE-UNV-L835-CD1-U	10191	69.6	146
24CZ2-110VHE-UNV-L835-CD2-U	11098	77.4	143
24CZ2-120VHE-UNV-L835-CD2-U	12211	83.6	146
24CZ2-130VHE-UNV-L835-CD2-U	13271	90.7	146
24CZ2-150VHE-UNV-L835-CD2-U	15006	104.2	144
24CZ2-170VHE-UNV-L835-CD2-U	17021	123.4	138

Shielding

Lumen Adjustment Factors		
S	HRP	SQR
1.05	0.81	0.96

Lumen Calculator

CCT Multiplier	80 CRI	90 CRI ⁽¹⁾	BioUp Static
3000K	0.965	0.827	-
3500K	1.000	0.847	0.912
4000K	1.019	0.856	0.899
5000K	1.019	0.909	0.879

Notes: (1) Input wattages for 90 CRI versions may vary. Refer to published IES-format photometry or LM-79 reports for more details.

Example of Lumen Adjustment Calculation

24CZ2-40-UNV-L835-CD1-U at 90CRI at 3500K

Lumen Adjustment Factor = 0.845

Total Light Output =

4,196 lm x 0.845 = 3,546 lm

Efficacy = $\frac{3,546 \text{ lm}}{36.2 \text{ W}}$ = 98 lm/W

Lumen Maintenance

Version	TM-21 Lumen Maintenance (60,000 hours) ⁽²⁾	Theoretical L70 (Hours) ⁽³⁾
Standard	> 87%	> 151,000
High Efficiency	> 90%	> 203,000
Very High Efficiency	> 90%	> 203,000

Notes: (2) Supported by IES TM-21 standards. (3) Theoretical values represent estimations commonly used; however, refer to the IES position on LED Product Lifetime Prediction, IES PS-10-18, that explains proper use of IES TM-21 and LM-80.

Load Data (Stock Product)

Thd	6%
Power Factor	0.99
Weight (lbs.)	16
Low Temp. Start	-20°C

Shipping Data

Catalog No.	Wt.	Pallet 49"L x 52"W x 46"H
2' x 4'	20.4 lbs.	28

Air Return Volume

Negative Static Pressure (Inches H ₂ O)	Return Air Volume (CFM)
0.05	75
0.1	103
0.2	153
0.25	177
0.3	191
0.45	234



Metalux

24CZ2 LED

Control Solutions

- WaveLinX LITE wireless
- WaveLinX PRO wireless
- WaveLinX CAT wired
- WaveLinX Wired



The Cruze ST with WaveLinX offers no-hassle lighting control with multiple luminaire level control solutions.



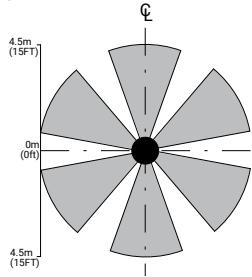
WaveLinX PRO is a wireless lighting control solution, for connected spaces, that significantly reduces a building's energy consumption. From a single floor to an entire campus, WaveLinX PRO connects more than lighting assets; it shares aggregated sensor data with the WaveLinX CORE platform and other building systems, so building owners can improve operations, spaces environment, and tenants' experience. WaveLinX PRO offers a rich portfolio of wireless devices, WaveLinX PRO-enabled luminaires, and an intuitive WaveLinX mobile app for office, education, warehouse, and parking garage applications.



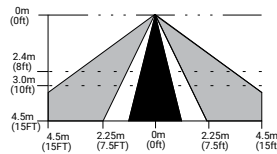
WaveLinX LITE is a cost effective, wireless digital lighting control solution, with out-of-the-box functionality, that saves energy and meets code. It's designed for applications that require occupancy-based, daylighting, or manual light control. Customize installations for office, education, warehouse and parking garages using the secure, simple mobile app.

Integrated Sensor Coverage Pattern

TOP VIEW:

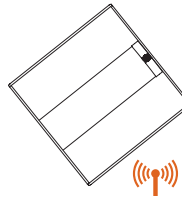


SIDE VIEW:

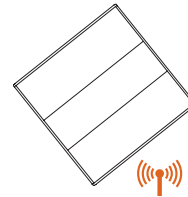


Note: Installation of integrated sensors within 3-ft (1m) of HVAC air vents is not recommended. The pattern shown is intended solely as a general guide and is not to scale.

With Integrated WaveLinX Sensor



With Integrated WaveLinX Node



Add a hidden WaveLinX sensor node (WPN, WLN) to your space lighting design!

Allows to:

- Keeps luminaire aesthetics
- Connect fixtures without the realstate to include sensor option such as downlights
- Connect sealed fixtures without a standard sensor option such as products for clinical space.

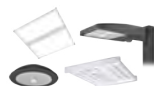
Integrated Controls Options

Option	Out of the Box Functionality	Luminaire Level Lighting Control (LLC)	Automatic Dimming Photocell	Occupancy Sensing	CCT Control
WLS	X	X	X	X	
WLN		X			
WPS		X	X	X	X
WPN		X			X

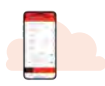
Note: WaveLinX utilizes scenes to allow users to change an area's fixtures Correlated Color Temperature (CCT) and intensity using commissioned manual wireless wallstation scene control. To enable CCT adjustments through WaveLinX, include WPS or WPN devices in addition to VividTune or BioUp technologies for integrated fixture control.

Systems comparison chart

Cooper Lighting Solutions provides many lighting system solutions designed to satisfy code requirements and meet the unique needs of any project.



Luminaire with standalone sensor



Standalone Spaces WaveLinX LITE



Standalone Spaces WaveLinX CAT



Networked Spaces WaveLinX PRO



Enterprise WaveLinX CORE

	Luminaire with standalone sensor	Standalone Spaces WaveLinX LITE	Standalone Spaces WaveLinX CAT	Networked Spaces WaveLinX PRO	Enterprise WaveLinX CORE
Occupancy	Yes	Yes	Yes	Yes	Yes
Daylighting	Yes	Yes	Yes	Yes	Yes
Wallstations	-	Yes	Yes	Yes	Yes
Gateways	-	-	-	1 WAC	300 WACs
Devices (MAX)	-	40 per Area (1120 per space)	40 per Area	200 per WAC2	32,500 per CORE Enterprise
Software	-	WaveLinX LITE Mobile App	WaveLinX CAT Mobile App	WaveLinX Mobile App	CORE
Areas	-	28 per Space	Unlimited	50 per WAC2	up to 3,000
Zones	-	16 per Area	16 per Area	16 per Area	up to 9,000
Scheduling	-	-	-	Local	Global
VividTune™	-	-	-	Yes	Yes
Plug-Load Control	-	Yes	Yes	Yes	Yes
Low-Voltage Power	-	-	Yes	Yes	Yes
Integration	-	-	-	-	BACnet, API
Dashboards	-	-	-	-	Energy, Occupancy
Configuration	-	Installer	Installer	Technician	Technician / IT



Job Name:
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 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 24CZ2-40-UNV-EL7W-L935-A3/8-5/
 18GDIM-CD1-U
 Notes:

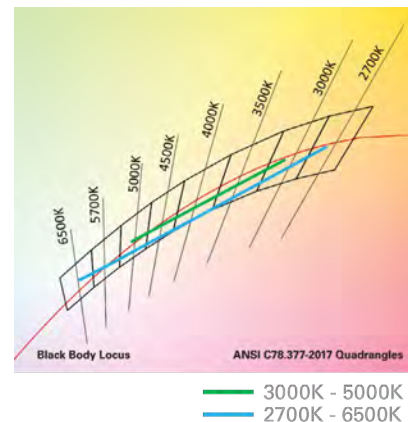
Type:
L1E
 LDI24-110942

Metalux **24CZ2 LED**



24 Cruze ST LED with VividTune Tunable White

VividTune tunable white luminaires from Cooper Lighting Solutions deliver high-quality light in a broad range of continuously variable color temperatures and intensities. Create a dynamic environment by adjusting the ambient light warmer or cooler to influence mood, support the task at hand, or create a dramatic ambience. The ability to control correlated color temperature and intensity separately using simple controls is the next evolution of LED lighting for the commercial, educational, healthcare and hospitality space. The unparalleled flexibility and number of available lighting environments enable users to find the right light with tunable white.



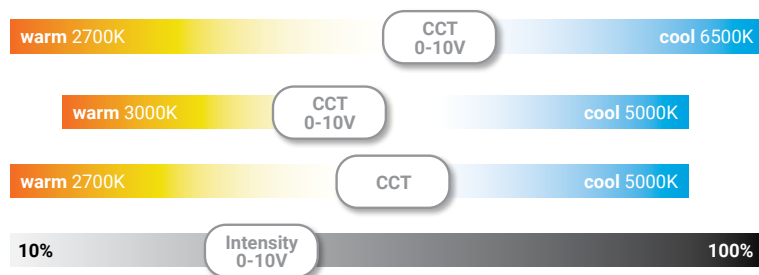
Energy and Performance Data

CCT	Tunable White - Lumen Adjustment Factors					
	VividTune 3000K-5000K		VividTune 2700K-6500K		BioUp Tunable White 2700K-5000K	
	80 CRI	90 CRI	80 CRI	90 CRI	CRI	Lumen Adjustment
2700K	-	-	0.903	0.771	95	0.938
3000K	0.929	0.765	0.928	0.801	94	0.929
3500K	0.983	0.836	0.961	0.842	90	0.912
4000K	1.033	0.903	0.981	0.868	87	0.899
4500K	1.042	0.918	0.999	0.891	85	0.890
5000K	1.042	0.918	1.013	0.909	84	0.879
6500K	-	-	1.028	0.933	-	-

CCT Setting	2' x 4' Cruze ST LED - Example of Approximate Lumen Calculation			
	Standard Catalog #	VividTune 80 CRI Catalog #	VividTune 90 CRI Catalog #	BioUp Tunable White
2700K	24CZ2-40HE-UNV-L835-CD1-U	24CZ2-40HE-UNV-L83050-W2A1-U	24CZ2-40HE-UNV-L93050-W2A1-U	24CZ2-40HE-UNV-B2750-W2A1-U
2700K	-	3638	3106	3779
3000K	-	3641	2998	3743
3500K	4029	3853	3275	3674
4000K	-	4046	3537	3622
4500K	-	4084	3599	3586
5000K	-	4084	3599	3541
6500K	-	4142	3579	-

Controlling VividTune and BioUp Tunable White

From wall dimmers to wireless controls, tunable white luminaires are compatible with industry standard 0-10V and DALI controls. One channel to control intensity (brightness) and a second channel to adjust CCT.



Example of Lumen Adjustment Calculation

24CZ2-40HE-UNV-L83050-W2A1-U at 80 CRI tuned to 3500K

Adjusted Lumen = published lm x adjusted lm factor

Adjusted Lumen = 4029 x 0.956

Adjusted Lumen = 3853 lm

** Lumen adjustment factors are for reference and may be different for each product selected. Refer to IES files for actual performance data on each.*



Job Name:
South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
24CZ2-40-UNV-EL7W-L935-A3/8-5/
18GDIM-CD1-U
Notes:

Type:
L1E
LDI24-110942

Metalux

24CZ2 LED

Proven Research. Industry Recognized.

BioUp
Melanopic Lighting



See better



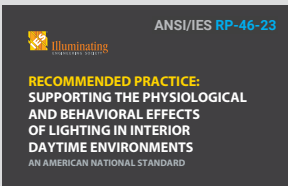
Feel better



Function better



See [BioUp brochure](#) for more details

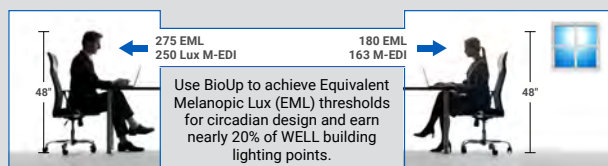


ANSI/IES RP-46-23 / TM18 published March 2024 based on over 40 years of research.

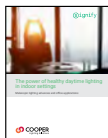
"...circadian clock synchronization is paramount to the body's efficient and appropriate functioning." – TM18



BioUp solutions maximize WELL points for Circadian Lighting Design (L03):



MDER, M-EDI and EML are key metrics used to quantify non-visual performance of indoor lighting systems.



See [BioUp white paper](#) for more details

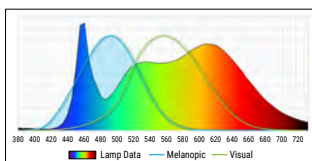
30% boost Biological impact
compared to traditional LED sources

CCT	LED MDER ~83 CRI	BioUp Static		BioUp Dynamic	
		MDER	CRI	MDER	CRI
2700K	0.44	-	-	0.43	95
3000K	0.49	-	-	0.54	94
3500K	0.56	0.71	90	0.71	90
4000K	0.64	0.84	87	0.82	87
5000K	0.77	0.98	84	0.98	84

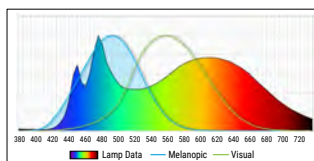
BioUp enhances the LED spectrum with cyan light at 475nm increasing the biological impact of the light to enhance our circadian rhythm which regulates our sleep/wake cycle, daytime engagement, and mood – **all without distorting visual color impression.**

MDER - Melanopic Daylight Efficacy Ratio (MDER) measures the amount of light stimulating to the melanopsin receptors.

Standard 4000K LED
MDER = .62

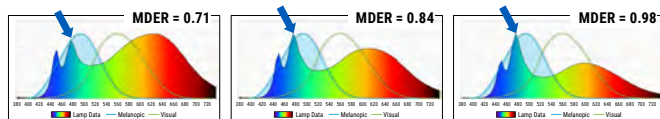


BioUp 4000K LED
MDER = .82



Static (non-tunable)

Static BioUp is used when simple Melanopic Lighting is desired at all times.



3500K or 4000K or 5000K

Cyan light component always present

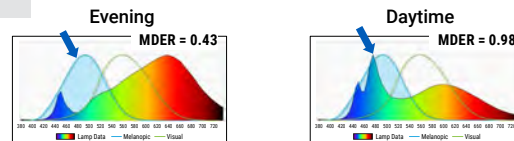


> no CCT control needed

Arrow in graph shows BioUp spectrum boost is at 475nm where non-visual biological response is enhanced.

Dynamic - (Tunable)

Dynamic BioUp is used when Melanopic Lighting is desired to adjust during the day.



Warmer CCT **Without** Cyan content ← → Cooler Light **With** Cyan content

2700K - 5000K



> Control with Wavelinx, 2ch 0-10V, or DALI



Cooper Lighting Solutions
1121 Highway 74 South
Peachtree City, GA 30269
P. 770-486-4800
www.cooperlighting.com

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Specifications and dimensions
subject to change without notice.



Job Name:
South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
22CZ2-39-UNV-L935-A3/8-4/18GDIM-CD1-U
Notes:

Type:
L2
LDI24-110942

Project		Catalog #		Type	
Prepared by		Notes		Date	



Metalux

Cruze ST 22CZ2

2' x 2' LED Specification Grade Troffer

Typical Applications

Office • Education • Healthcare • Hospitality • Retail

Interactive Menu

- Order Information [page 2](#)
- Photometric Data [page 3](#)
- Control Solutions [page 5](#)
- VividTune™ Color Tuning Solutions [page 6](#)
- BioUp - Melanopic Lighting [page 7](#)
- Product Warranty

Product Certification



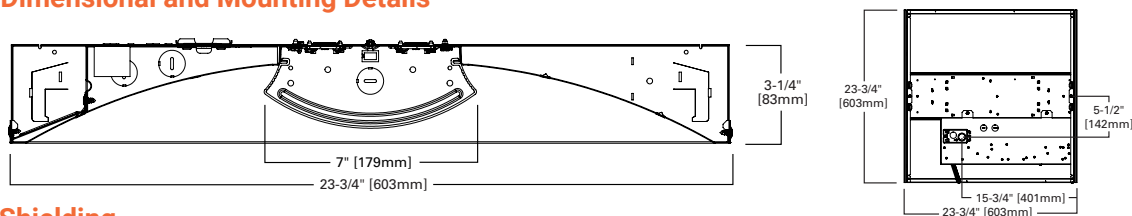
Product Features



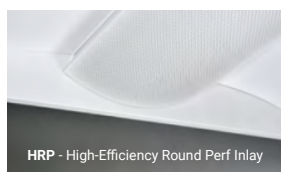
Top Product Features

- Latch-less design provides clean architectural look
- BioUp melanopic lighting options for 30% circadian boost and earn WELL Building Standard points
- VividTune CCT tuning options from 3000K-5000K or 2700K-6500K
- Designers delight - ribbed, smooth and round perforated lens options
- High performance efficacy up to 151 lm/W
- Integrated sensor systems - occupancy, daylight and IoT connectivity
- Options to meet Buy American and other domestic preference requirements

Dimensional and Mounting Details



Shielding



See ordering information for more shielding options.



Ceiling Compatibility

G	G	G	Ceiling Type	Trim Type
Grid/Lay-in Standard	Concealed T	Slot Grid	Exposed Grid	Standard
			Concealed T	Standard
			Slot Grid	Standard
			Flange	*

*See Drywall Frame Kit Accessory in Ordering Information Section



Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

22CZ2-39-UNV-L935-A3/8-4/18GDIM-
CD1-U

Notes:

Type:

L2

LDI24-110942

Metalux

22CZ2 LED

Order Information

SAMPLE ORDER NUMBER: 22CZ2-34HE-UNV-L835-CD1-U

Domestic Preferences ⁽¹⁾	Rating	Series	Air	Lumen Level / Efficacy Option			Shielding	Voltage ⁽⁵⁾	Options
[Blank]-Standard BAA=Buy American Act TAA=Trade Agreements Act	[Blank]-Standard ATW-SW4= Chicago Rated	22CZ2-2x2 Cruze ST	[Blank]-Standard A=Air (Vented) ⁽²⁾	Standard [Blank] 20=2000 Lumens 24=2400 Lumens 32=3200 Lumens ⁽³⁾ 39=3900 Lumens ⁽³⁾ 44=4400 Lumens ⁽³⁾	High Efficacy [HE] 20HE=2000 Lumens 24HE=2400 Lumens 29HE=2900 Lumens 34HE=3400 Lumens 39HE=3900 Lumens 44HE=4400 Lumens	Very High Efficacy [VHE] 20VHE=2000 Lumens ⁽³⁾ 24VHE=2400 Lumens ⁽³⁾ 29VHE=2900 Lumens ⁽³⁾ 34VHE=3400 Lumens ⁽³⁾ 39VHE=3900 Lumens ⁽³⁾ 44VHE=4400 Lumens ⁽³⁾ 50VHE=5000 Lumens ⁽³⁾ 55VHE=5500 Lumens ⁽³⁾ 60VHE=6000 Lumens ⁽³⁾ 65VHE=6500 Lumens ⁽³⁾ 70VHE=7000 Lumens ^{(3),(4)} 75VHE=7500 Lumens ^{(3),(4)} 80VHE=8000 Lumens ^{(3),(4)} 85VHE=8500 Lumens ^{(3),(4)} 90VHE=9000 Lumens ^{(3),(4)} 95VHE=9500 Lumens ^{(3),(4)} 100VHE=10000 Lumens ^{(3),(4)} 110VHE=11000 Lumens ^{(3),(4)}	[Blank]-Ribbed Frosted Acrylic Lens (standard) S-Smooth Frosted Acrylic Lens HRP=High- Efficiency Round Perf Inlay SQR=Square Ribbed Frosted Acrylic Lens	UNV=Universal Voltage 120-277 347V=347 Volt	GL=Single Element Fuse GM=Double Element Fuse PAF=Painted After Fabrication
Notes (1) Only product configurations with these designated prefixes are built to be compliant with the Buy American Act of 1933 (BAA) or Trade Agreements Act of 1979 (TAA), respectively. Please refer to DOMESTIC PREFERENCES website for more information. Components shipped separately may be separately analyzed under domestic preference requirements.			Notes (2) Air version is intended for air return through plenum. See air return data table for air flow volumes. Air option not available with ATW-SW4. Air requires *PAF* option.	Notes (3) VividTune white tuning and BioUp static and dynamic options are not available with these lumen/efficacy selections. (4) Available with CD and HCD drivers only.				Notes (5) Products also available in non-US voltages and frequencies for international markets.	

Emergency Options	CRI/CCT	Flex
[Blank]-No emergency EL7W=7-watt 120V-277V emergency battery pack ⁽⁶⁾ EL10W=10-watt 120V-277V emergency battery pack ⁽⁶⁾ EL14W=14-watt 120V-277V emergency battery pack ⁽⁶⁾ EL10WSD=10W emergency battery pack with self-diagnostic installed ^{(6),(8)} EL14WSD=14W emergency battery pack with self-diagnostic installed ^{(6),(8)} ETRD=Emergency Transfer Relay with dimming control ⁽⁷⁾ RRU=LVS Controls Emergency Transfer Relay with dimming control ⁽⁷⁾ UEL7W=UL924 Listed luminaire, 7-watt, 120V-277V emergency battery pack ^{(6),(10)} UEL14W=UL924 Listed luminaire, 14-watt 120V-277V emergency battery pack ^{(6),(10)} UEL10WSD=Bodine 10W emergency battery pack with self diagnostic installed ^{(6),(9),(10)} UETRD=UL924 Listed luminaire, Emergency Transfer Relay with dimming control ^{(7),(10)} URRU=UL924 Listed luminaire, LVS Controls Emergency Transfer Relay with dimming control ^{(7),(10)}	L830=80CRI, 3000K L835=80CRI, 3500K L840=80CRI, 4000K L850=80CRI, 5000K L930=90CRI, 3000K L935=90CRI, 3500K L940=90CRI, 4000K L950=90CRI, 5000K L83050=80CRI 3000K-5000K White Tuning ⁽¹²⁾ L93050=90CRI 3000K-5000K White Tuning ⁽¹²⁾ L82765=80CRI 2700K-6500K White Tuning ⁽¹²⁾ L92765=90CRI 2700K-6500K White Tuning ⁽¹²⁾ B35=BioUp Static 3500K ⁽¹³⁾ B40=BioUp Static 4000K ⁽¹³⁾ B50=BioUp Static 5000K ⁽¹³⁾ B2750=BioUp Tunable 2700K-5000K ⁽¹⁴⁾	[Blank]-No Flex A3/8-4/18GDIM=3/8" Flex with 0-10V Dimming Leads A3/8-2/18G=3/8" Flex with line and common A3/8-5/18GDIM=Flex with 0-10V Dimming leads and Blue for alternate wiring. See below for details.
Notes (6) Factory installed with integral test switch/indicator/laser test. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 7=700 lumens). IES-format photometry for luminaire under emergency operation available. Battery option increases total height by 1 inch. (7) Used to bypass local control during outage. Must be used in conjunction with UL 1008 device (provided by others). Devices are universal voltage (UNV). 347 not available. (8) EL10WSD and EL14WSD not available with 347V. (9) UEL10WSD not available with 347V. (10) Cannot be used with BioUp options.	Notes (12) VividTune provides correlated color temperatures (CCT) between 3000K (warm) to 5000K (cool) or 2700K (warm) to 6500K (cool). Must be used in conjunction with WZA driver only. Must be used with two (2) 10V dimming control channels, 1 cct, 1 intensity. May be combined with Wavelinx sensor control systems. (13) BioUp Static to be used with HCD driver. (14) BioUp Tunable provides correlated color temperatures (CCT) between 2700K (warm) to 5000K (cool). Must be used with WZA (for two channel 0-10V Control) or W2D (for 2 channel DALI Control) driver. See BioUp page for more information.	Flexible Metal Conduit Options Flex options available for 0-10V dimming control, DALI dimming control, emergency and night light functions. 72-inch factory-installed and pre-wired to driver, fitted to luminaire housing access plate with 90° enclosed FMC connector. Not all options may be combined and installation ratings vary by type. See online configurator for all flex options. A3/8-4/18GDIM series notes: Factory installed dimming option 3/8" flexible metal conduit with 2-#18 power and ground wires and 2-#18 UL-listed jacketed 0-10V +/- control wires. Meets UL 66, 83, 1479, 1569, 1581, 2556, NEC® 250.118, 300.22(C), 392, 396, 330, 501, 502, 503, 530, 504, 505, 518, 520, 530, 645, 72; Federal Specification A-A-59544 (formerly J-C-30B); all applicable OSHA and HUD Requirements. UL Classified 1, 2, and 3-hour through penetration with applicable fire stop product (not included). May be surface mounted, fished and/or embedded in plaster. Cable tray and approved raceway rated, install per NEC®; Environmental Air-Handling Space Installation per NEC® 300.22(C).

Driver Type	Number of Drivers	Integrated Sensing Systems ⁽¹⁷⁾	Packaging	Accessories (order separately) ⁽²¹⁾
CD=0-10V Driver (10%-100% Dimming) HCD=0-10V Driver (1%-100% Dimming) SLTD=DALI Driver (5%-100% Dimming) SLTHD=DALI Driver (1%-100% Dimming) SD=Step Dimming Driver (50%-100% Dimming) LH=Lutron HiLume 1% EcoSystems (LDE1) ⁽¹⁵⁾ W2A=White Tuning, 2 ch, Analog 0-10V (1%-100% Dimming) ⁽¹⁵⁾ W2D=White Tuning, 2 ch, DALI Type 8 (1%-100% Dimming) ⁽¹⁶⁾	1=1 Driver	[Blank]-No Sensor WLS (formerly WRAB)=WaveLinX LITE Wireless Sensor, Occupancy w/ photocell, Independent & Networked ^{(18),(19)} WPS (formerly WAA)=WaveLinX PRO Wireless Sensor, Occupancy w/ photocell, Networked ^{(18),(19)} WLN=WaveLinX LITE Wireless Control Node, without sensor ^{(18),(19)} WPN=WaveLinX PRO Wireless Control Node, without sensor ^{(18),(19)}	U=Unit Pack P=300 Pack O=Out of carton PALC=Job Pack, in carton	C22-EQCLIP-U-PK="C22" Earthquake Clip Kit (4 clips per bag kit) ⁽²⁰⁾ DF-22W-U-2 x 2 Drywall Frame Kit SK-22-WS-2 x 2 Shallow Surface Mount Kit SK-22-WT-2 x 2 Tall Surface Mount Kit
Notes (15) W2A used with two (2) 10V dimming control channels - CCT and intensity. (16) W2D for use with BioUp options only. White tuning CCT between 2700K and 5000K. Must be used with DALI controls; one address to control two channels - intensity and CCT. May not be used with sensing systems. For Emergency options ONLY EL10WSD can be used. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (F) Consult Marketplace Options - Lutron system pages for additional details and compatibility. Compatible only with driver series shown, and may require two or more drivers. Requires field commissioning to operate or dim. Contact Lutron at www.lutron.com.		Notes (17) Matching width lens band on other side of sensor band may be supplied for symmetrical appearance. Required for use with sensor and emergency combination. Add "D" to sensor ordering as shown - WPSD, WPSD. (18) WPS sensor and WPN node to be used with CD, HCD or WZA driver. (19) WLS sensor and WLN node to be used with CD or HCD driver. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (A) Consult WaveLinX PRO system pages for additional details and compatibility. (B) Consult WaveLinX LITE system pages for additional details and compatibility.		Notes (20) An EQ Grid Clip is recommended for all 9/16" ceiling systems. Four required per fixture. (21) Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information.

**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

22CZ2-39-UNV-L935-A3/8-4/18GDIM-
CD1-U

Notes:

Type:**L2**

LDI24-110942

Metalux**22CZ2 LED****Product Specifications****Construction**

- Die formed of code gauge prime cold rolled steel with full length die-formed stiffeners
- Unibody endplates attached with interlocking tabs and screws
- Hemmed side flanges
- Four auxiliary fixture end suspension points
- Integral Grid-lock feature for endplates for added safety
- Optional earthquake clips available

Integrated Controls

- Standard with 0-10V dimming driver (10% standard, 1% optional)
- Integrated WaveLinx options provide wireless individual fixture control and enable code compliance, increased energy savings, grouping of fixtures, and connection to WaveLinx control systems
- DALI 2.0, Lutron, and step-dimming available

LED and Light Engine

- LED's available in 3000K, 3500K, 4000K, or 5000K at 80 CRI minimum and 90 CRI minimum
- Color accuracy ≤ 3 -Step MacAdam ellipse (SDCM)
- TM21 life at 60,000 hours up to L90 and calculated L70 exceeds 203,000 hrs.
- Drivers available in 120-277V and 347V
- Tunable white options available with Cooper Lighting Solutions' VividTune
- BioUp melanopic lighting options available in static or tunable white

Emergency Battery Options

- 120V-277V integral emergency battery pack comes in 7-watts, 10-watt, or 14-watts
- Self-diagnostic emergency battery available in 10 or 14-watts (NFPA 101@ Life Safety Code®)
- Constant power to the LED system for controlled, predictable discharge
- Integrated test switch/indicator light visible from floor
- Min. 90-minute backup period for code compliance
- Integral emergency transfer relay available for generator equipped power systems

Shielding

- Ribbed acrylic frosted lens standard
- Optional smooth acrylic frosted lens (S)
- Optional square ribbed frosted acrylic lens (SQR)
- Optional High-Efficiency Round Perf Inlay (HRP)
- Replacement lenses available, contact factory

Compliance

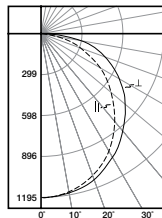
- IC rated for insulation contact
- cULus listed for damp locations
- RoHS compliant
- Tested to IESNA LM-79 and LM-80
- Stated life tested to TM21 standards
- Can be used for State of California Title 24 high efficacy luminaire

Warranty

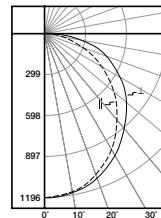
- Five-year limited warranty standard. Optional ten year limited warranty available.

Finish

- Multistage, iron phosphate pretreatment
- 90% reflective, matte white enamel finish
- Full fixture housing pre-painted matte white (choose PAF option for "Paint after Fabrication")

Photometric Data
[View IES files](#)
**22CZ2-24-UNV-L830-CD1-U**

Dimming Driver
Linear LED 3000K
Spacing criterion: (H) 1.2 x mounting height, (L) 1.28 x mounting height
Lumens: 2437
Input Watts: 21.9W
Efficacy: 111.3 LPW
Test Report: 22CZ2-24-UNVL830-CD1-U.IES

**22CZ2-24HE-UNV-L830-CD1-U**

Dimming Driver
Linear LED 3000K
Spacing criterion: (H) 1.19 x mounting height, (L) 1.27 x mounting height
Lumens: 2402
Input Watts: 19.2W
Efficacy: 125.1 LPW
Test Report: 14CZ2-29-UNV-L830-CD1-U.IES

**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

22CZ2-39-UNV-L935-A3/8-4/18GDIM-
CD1-U

Notes:

Type:**L2**

LDI24-110942

Metalux**22CZ2 LED****Energy and Performance Data**

Standard Efficacy Versions – Single Row of LEDs
Default CCT/Lumen Setting: 3500K/Med

Catalog Number	Lumens	Watts	lm/W
22CZ2-20-UNV-L835-CD1-U	2142	16.2	132
22CZ2-24-UNV-L835-CD1-U	2454	18.5	133
22CZ2-32-UNV-L835-CD1-U	3272	24.2	135
22CZ2-39-UNV-L835-CD1-U	3953	31	128
22CZ2-44-UNV-L835-CD1-U	4462	33	134

High Efficacy Versions – Two Rows of LEDs

Catalog Number	Lumens	Watts	lm/W
22CZ2-20HE-UNV-L835-CD1-U	2030	15.0	135
22CZ2-24HE-UNV-L835-CD1-U	2474	18.1	137
22CZ2-29HE-UNV-L835-CD1-U	2982	20.9	143
22CZ2-34HE-UNV-L835-CD1-U	3426	24.3	141
22CZ2-39HE-UNV-L835-CD1-U	3997	28.5	140
22CZ2-44HE-UNV-L835-CD1-U	4567	32.8	139

Very High Efficacy Versions – Three Rows of LEDs

Catalog Number	Lumens	Watts	lm/W
22CZ2-20VHE-UNV-L835-CD1-U	2008	14.2	141
22CZ2-24VHE-UNV-L835-CD1-U	2501	17.5	143
22CZ2-29VHE-UNV-L835-CD1-U	3114	21.7	144
22CZ2-34VHE-UNV-L835-CD1-U	3598	25.1	143
22CZ2-39VHE-UNV-L835-CD1-U	4078	28.6	143
22CZ2-44VHE-UNV-L835-CD1-U	4620	32.6	142
22CZ2-50VHE-UNV-L835-CD1-U	5095	36.2	141
22CZ2-55VHE-UNV-L835-CD1-U	5530	39.4	140
22CZ2-60VHE-UNV-L835-CD1-U	6110	44.1	139
22CZ2-65VHE-UNV-L835-CD1-U	6559	47.9	137
22CZ2-70VHE-UNV-L835-CD1-U	7017	50.3	140
22CZ2-75VHE-UNV-L835-CD1-U	7557	54.7	138
22CZ2-80VHE-UNV-L835-CD1-U	8092	59.1	137
22CZ2-85VHE-UNV-L835-CD1-U	8615	63.6	136
22CZ2-90VHE-UNV-L835-CD1-U	9125	68.2	134
22CZ2-95VHE-UNV-L835-CD1-U	9610	72.7	132
22CZ2-100VHE-UNV-L835-CD1-U	10108	77.7	130
22CZ2-110VHE-UNV-L835-CD1-U	11065	87.7	126

Shielding

Lumen Adjustment Factors		
S	HRP	SQR
1.05	0.80	0.96

Lumen Calculator

CCT Multiplier	80 CRI	90 CRI ⁽¹⁾	BioUp Static
3000K	0.965	0.827	-
3500K	1.000	0.847	0.912
4000K	1.019	0.856	0.899
5000K	1.019	0.909	0.879

Notes: (1) Input wattages for 90 CRI versions may vary. Refer to published IES-format photometry or LM-79 reports for more details.

Example of Lumen Adjustment Calculation

22CZ2-32-UNV-L935-CD1-U at 90CRI at 3500K

Lumen Adjustment Factor = 0.845

Total Light Output =

3,280 lm x 0.845 = 2,772 lm

Efficacy = 2,772 lm = 103.8 lm/W
26.7W

Lumen Maintenance

Version	TM-21 Lumen Maintenance (60,000 hours) ⁽²⁾	Theoretical L70 (Hours) ⁽³⁾
Standard	> 85%	> 151,000
High Efficiency	> 90%	> 203,000
Very High Efficiency	> 90%	> 203,000

Notes: (2) Supported by IES TM-21 standards. (3) Theoretical values represent estimations commonly used; however, refer to the IES position on LED Product Lifetime Prediction, IES PS-10-18, that explains proper use of IES TM-21 and LM-80.

Load Data (Stock Product)

Thd	6%
Power Factor	0.99
Weight (lbs.)	10.6
Low Temp. Start	-20°C

Shipping Data

Catalog No.	Wt.	Pallet 49"L x 52"W x 55"H
2' x 2'	12.5 lbs.	48

Air Return Volume

Negative Static Pressure (Inches H ₂ O)	Return Air Volume (CFM)
0.05	79
0.1	112
0.2	161
0.25	177
0.3	198
0.45	239



Metalux **22CZ2 LED**

Control Solutions

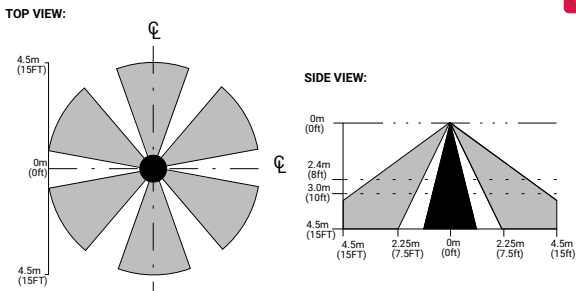
- WaveLinX LITE wireless
- WaveLinX PRO wireless
- WaveLinX CAT wired
- WaveLinX Wired

The Cruze ST with WaveLinX offers no-hassle lighting control with multiple luminaire level control solutions.

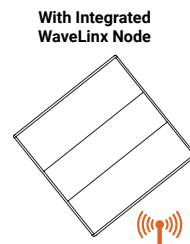
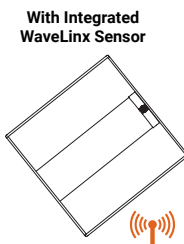
WaveLinX PRO is a wireless lighting control solution, for connected spaces, that significantly reduces a building's energy consumption. From a single floor to an entire campus, WaveLinX PRO connects more than lighting assets; it shares aggregated sensor data with the WaveLinX CORE platform and other building systems, so building owners can improve operations, spaces environment, and tenants' experience. WaveLinX PRO offers a rich portfolio of wireless devices, WaveLinX PRO-enabled luminaires, and an intuitive WaveLinX mobile app for office, education, warehouse, and parking garage applications.

WaveLinX LITE is a cost effective, wireless digital lighting control solution, with out-of-the-box functionality, that saves energy and meets code. It's designed for applications that require occupancy-based, daylighting, or manual light control. Customize installations for office, education, warehouse and parking garages using the secure, simple mobile app.

Integrated Sensor Coverage Pattern



Note: Installation of integrated sensors within 3-ft (1m) of HVAC air vents is not recommended. The pattern shown is intended solely as a general guide and is not to scale.



Add a hidden WaveLinX sensor node (WPN, WLN) to your space lighting design!

- Allows to:**
- Keeps luminaire aesthetics
 - Connect fixtures without the realstate to include sensor option such as downlights
 - Connect sealed fixtures without a standard sensor option such as products for clinical space.

Integrated Controls Options					
Option	Out of the Box Functionality	Luminaire Level Lighting Control (LLC)	Automatic Dimming Photocell	Occupancy Sensing	CCT Control
WLS	X	X	X	X	
WLN		X			
WPS		X	X	X	X
WPN		X			X

Note: WaveLinX utilizes scenes to allow users to change an area's fixtures Correlated Color Temperature (CCT) and intensity using commissioned manual wireless wallstation scene control. To enable CCT adjustments through WaveLinX, include WPS or WPN devices in addition to VividTune or BioUp technologies for integrated fixture control.

Systems comparison chart

Cooper Lighting Solutions provides many lighting system solutions designed to satisfy code requirements and meet the unique needs of any project.



	Luminaire with standalone sensor	Standalone Spaces WaveLinX LITE	Standalone Spaces WaveLinX CAT	Networked Spaces WaveLinX PRO	Enterprise WaveLinX CORE
Occupancy	Yes	Yes	Yes	Yes	Yes
Daylighting	Yes	Yes	Yes	Yes	Yes
Wallstations	-	Yes	Yes	Yes	Yes
Gateways	-	-	-	1 WAC	300 WACs
Devices (MAX)	-	40 per Area (1120 per space)	40 per Area	200 per WAC2	32,500 per CORE Enterprise
Software	-	WaveLinX LITE Mobile App	WaveLinX CAT Mobile App	WaveLinX Mobile App	CORE
Areas	-	28 per Space	Unlimited	50 per WAC2	up to 3,000
Zones	-	16 per Area	16 per Area	16 per Area	up to 9,000
Scheduling	-	-	-	Local	Global
VividTune™	-	-	-	Yes	Yes
Plug-Load Control	-	Yes	Yes	Yes	Yes
Low-Voltage Power	-	-	Yes	Yes	Yes
Integration	-	-	-	-	BACnet, API
Dashboards	-	-	-	-	Energy, Occupancy
Configuration	-	Installer	Installer	Technician	Technician / IT

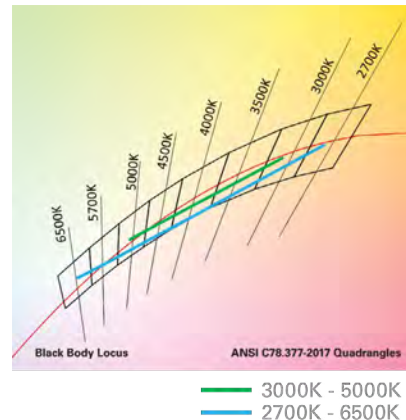


Metalux **22CZ2 LED**



22 Cruze ST LED with VividTune Tunable White

VividTune tunable white luminaires from Cooper Lighting Solutions deliver high-quality light in a broad range of continuously variable color temperatures and intensities. Create a dynamic environment by adjusting the ambient light warmer or cooler to influence mood, support the task at hand, or create a dramatic ambience. The ability to control correlated color temperature and intensity separately using simple controls is the next evolution of LED lighting for the commercial, educational, healthcare and hospitality space. The unparalleled flexibility and number of available lighting environments enable users to find the right light with tunable white.



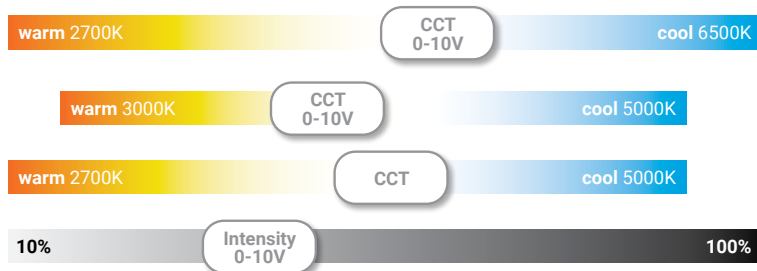
Energy and Performance Data

Tunable White - Lumen Adjustment Factors						
CCT	VividTune 3000K-5000K		VividTune 2700K-6500K		BioUp Tunable White 2700K-5000K	
	80 CRI	90 CRI	80 CRI	90 CRI	CRI	Lumen Adjustment
2700K	-	-	0.903	0.771	95	0.938
3000K	0.929	0.765	0.928	0.801	94	0.929
3500K	0.983	0.836	0.961	0.842	90	0.912
4000K	1.033	0.903	0.981	0.868	87	0.899
4500K	1.042	0.918	0.999	0.891	85	0.890
5000K	1.042	0.918	1.013	0.909	84	0.879
6500K	-	-	1.028	0.933	-	-

2' x 2' Cruze ST LED - Example of Approximate Lumen Calculation				
	Standard Catalog #	VividTune 80 CRI Catalog #	VividTune 90 CRI Catalog #	BioUp Tunable White
CCT Setting	22CZ2-34HE-UNV-L835-CD1-U	22CZ2-34HE-UNV-L83050-W2A1-U	22CZ2-34HE-UNV-L93050-W2A1-U	22CZ2-34HE-UNV-B2750-W2A1-U
2700K	-	3058	2611	3176
3000K	-	3026	2491	3146
3500K	3386	3202	2722	3088
4000K	-	3362	2940	3044
4500K	-	3394	2991	3014
5000K	-	3394	2991	2976
6500K	-	3481	3159	-

Controlling VividTune and BioUp Tunable White

From wall dimmers to wireless controls, tunable white luminaires are compatible with industry standard 0-10V and DALI controls. One channel to control intensity (brightness) and a second channel to adjust CCT.



Example of Lumen Adjustment Calculation

22CZ2-34HE-UNV-L83050-W2A1-U at 80 CRI tuned to 3500K

Adjusted Lumen = published lm x adjusted lm factor

Adjusted Lumen = 3386 x 0.946

Adjusted Lumen = 3202 lm

** Lumen adjustment factors are for reference and may be different for each product selected. Refer to IES files for actual performance data on each.*



Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
22CZ2-39-UNV-L935-A3/8-4/18GDIM-
CD1-U
Notes:

Type:
L2
LDI24-110942

Metalux

22CZ2 LED

Proven Research. Industry Recognized.

BioUp
Melanopic Lighting



See better



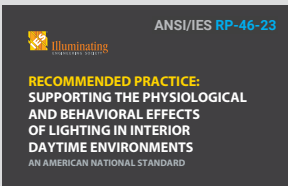
Feel better



Function better



See [BioUp brochure](#) for more details

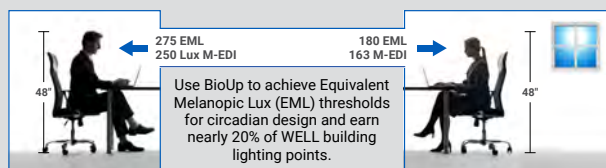


ANSI/IES RP-46-23 / TM18 published March 2024 based on over 40 years of research.

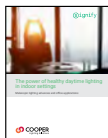
"...circadian clock synchronization is paramount to the body's efficient and appropriate functioning." – TM18



BioUp solutions maximize WELL points for Circadian Lighting Design (L03):



MDER, M-EDI and EML are key metrics used to quantify non-visual performance of indoor lighting systems.



See [BioUp white paper](#) for more details

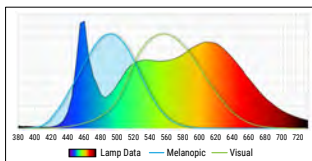
30% boost Biological impact compared to traditional LED sources

CCT	LED MDER ~83 CRI	BioUp Static		BioUp Dynamic	
		MDER	CRI	MDER	CRI
2700K	0.44	-	-	0.43	95
3000K	0.49	-	-	0.54	94
3500K	0.56	0.71	90	0.71	90
4000K	0.64	0.84	87	0.82	87
5000K	0.77	0.98	84	0.98	84

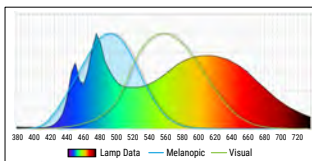
BioUp enhances the LED spectrum with cyan light at 475nm increasing the biological impact of the light to enhance our circadian rhythm which regulates our sleep/wake cycle, daytime engagement, and mood – **all without distorting visual color impression.**

MDER - Melanopic Daylight Efficacy Ratio (MDER) measures the amount of light stimulating to the melanopsin receptors.

Standard 4000K LED
MDER = .62

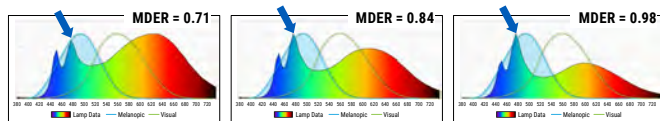


BioUp 4000K LED
MDER = .82



Static (non-tunable)

Static BioUp is used when simple Melanopic Lighting is desired at all times.



3500K or 4000K or 5000K

Cyan light component always present

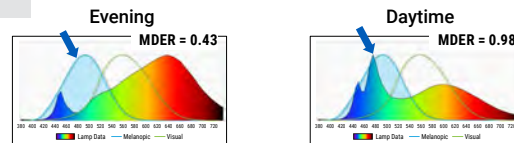


> no CCT control needed

Arrow in graph shows BioUp spectrum boost is at 475nm where non-visual biological response is enhanced.

Dynamic - (Tunable)

Dynamic BioUp is used when Melanopic Lighting is desired to adjust during the day.



Warmer CCT **Without** Cyan content ← → **Cooler Light With** Cyan content

2700K - 5000K



> Control with Wavelinx, 2ch 0-10V, or DALI



Cooper Lighting Solutions
1121 Highway 74 South
Peachtree City, GA 30269
P. 770-486-4800
www.cooperlighting.com

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Specifications and dimensions
subject to change without notice.

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April 18, 2024 1:30 PM



Job Name:
South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
22CZ2-39-UNV-EL7W-L935-A3/8-5/
18GDIM-CD1-U
Notes:

Type:
L2E
LDI24-110942

Project		Catalog #		Type	
Prepared by		Notes		Date	



Metalux

Cruze ST 22CZ2

2' x 2' LED Specification Grade Troffer

Typical Applications

Office • Education • Healthcare • Hospitality • Retail

Interactive Menu

- Order Information [page 2](#)
- Photometric Data [page 3](#)
- Control Solutions [page 5](#)
- VividTune™ Color Tuning Solutions [page 6](#)
- BioUp - Melanopic Lighting [page 7](#)
- Product Warranty

Product Certification



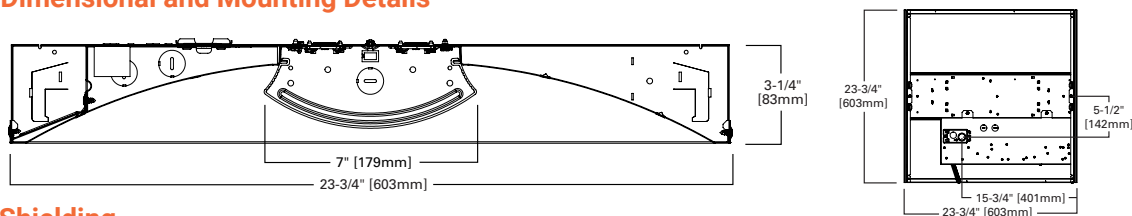
Product Features



Top Product Features

- Latch-less design provides clean architectural look
- BioUp melanopic lighting options for 30% circadian boost and earn WELL Building Standard points
- VividTune CCT tuning options from 3000K-5000K or 2700K-6500K
- Designers delight - ribbed, smooth and round perforated lens options
- High performance efficacy up to 151 lm/W
- Integrated sensor systems - occupancy, daylight and IoT connectivity
- Options to meet Buy American and other domestic preference requirements

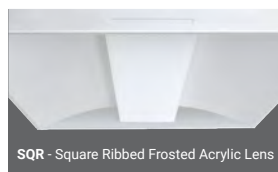
Dimensional and Mounting Details



Shielding



See ordering information for more shielding options.



Ceiling Compatibility

G Grid/Lay-in Standard	G Concealed T	G Slot Grid	Ceiling Type	Trim Type
			Exposed Grid	Standard
			Concealed T	Standard
			Slot Grid	Standard
			Flange	*

*See Drywall Frame Kit Accessory in Ordering Information Section



Job Name:
South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
22CZ2-39-UNV-EL7W-L935-A3/8-5/
18GDIM-CD1-U

Type:
L2E

Notes:

LDI24-110942

Metalux

22CZ2 LED

Order Information

SAMPLE ORDER NUMBER: 22CZ2-34HE-UNV-L835-CD1-U

Domestic Preferences ⁽¹⁾	Rating	Series	Air	Lumen Level / Efficacy Option			Shielding	Voltage ⁽⁵⁾	Options
[Blank]-Standard BAA=Buy American Act TAA=Trade Agreements Act	[Blank]-Standard ATW-SW4= Chicago Rated	22CZ2-2x2 Cruze ST	[Blank]-Standard A=Air (Vented) ⁽²⁾	Standard [Blank] 20=2000 Lumens 24=2400 Lumens 32=3200 Lumens ⁽³⁾ 39=3900 Lumens ⁽³⁾ 44=4400 Lumens ⁽³⁾	High Efficacy [HE] 20HE=2000 Lumens 24HE=2400 Lumens 29HE=2900 Lumens 34HE=3400 Lumens 39HE=3900 Lumens 44HE=4400 Lumens	Very High Efficacy [VHE] 20VHE=2000 Lumens ⁽³⁾ 24VHE=2400 Lumens ⁽³⁾ 29VHE=2900 Lumens ⁽³⁾ 34VHE=3400 Lumens ⁽³⁾ 39VHE=3900 Lumens ⁽³⁾ 44VHE=4400 Lumens ⁽³⁾ 50VHE=5000 Lumens ⁽³⁾ 55VHE=5500 Lumens ⁽³⁾ 60VHE=6000 Lumens ⁽³⁾ 65VHE=6500 Lumens ⁽³⁾ 70VHE=7000 Lumens ^{(3),(4)} 75VHE=7500 Lumens ^{(3),(4)} 80VHE=8000 Lumens ^{(3),(4)} 85VHE=8500 Lumens ^{(3),(4)} 90VHE=9000 Lumens ^{(3),(4)} 95VHE=9500 Lumens ^{(3),(4)} 100VHE=10000 Lumens ^{(3),(4)} 110VHE=11000 Lumens ^{(3),(4)}	[Blank]-Ribbed Frosted Acrylic Lens (standard) S-Smooth Frosted Acrylic Lens HRP=High- Efficiency Round Perf Inlay SQR=Square Ribbed Frosted Acrylic Lens	UNV=Universal Voltage 120-277 347V=347 Volt	GL=Single Element Fuse GM=Double Element Fuse PAF=Painted After Fabrication
Notes (1) Only product configurations with these designated prefixes are built to be compliant with the Buy American Act of 1933 (BAA) or Trade Agreements Act of 1979 (TAA), respectively. Please refer to DOMESTIC PREFERENCES website for more information. Components shipped separately may be separately analyzed under domestic preference requirements.			Notes (2) Air version is intended for air return through plenum. See air return data table for air flow volumes. Air option not available with ATW-SW4. Air requires *PAF* option.	Notes (3) VividTune white tuning and BioUP static and dynamic options are not available with these lumen/efficacy selections. (4) Available with CD and HCD drivers only.				Notes (5) Products also available in non-US voltages and frequencies for international markets.	

Emergency Options	CRI/CCT	Flex
[Blank]=No emergency EL7W=7-watt 120V-277V emergency battery pack ⁽⁶⁾ EL10W=10-watt 120V-277V emergency battery pack ⁽⁶⁾ EL14W=14-watt 120V-277V emergency battery pack ⁽⁶⁾ EL10WSD=10W emergency battery pack with self-diagnostic installed ^{(6),(8)} EL14WSD=14W emergency battery pack with self-diagnostic installed ^{(6),(8)} ETRD=Emergency Transfer Relay with dimming control ⁽⁷⁾ RRU=LVS Controls Emergency Transfer Relay with dimming control ⁽⁷⁾ UEL7W=UL924 Listed luminaire, 7-watt, 120V-277V emergency battery pack ^{(6),(10)} UEL14W=UL924 Listed luminaire, 14-watt 120V-277V emergency battery pack ^{(6),(10)} UEL10WSD=Bodine 10W emergency battery pack with self diagnostic installed ^{(6),(9),(10)} UETRD=UL924 Listed luminaire, Emergency Transfer Relay with dimming control ^{(7),(10)} URRU=UL924 Listed luminaire, LVS Controls Emergency Transfer Relay with dimming control ^{(7),(10)}	L830=80CRI, 3000K L835=80CRI, 3500K L840=80CRI, 4000K L850=80CRI, 5000K L930=90CRI, 3000K L935=90CRI, 3500K L940=90CRI, 4000K L950=90CRI, 5000K L83050=80CRI 3000K-5000K White Tuning ⁽¹²⁾ L93050=90CRI 3000K-5000K White Tuning ⁽¹²⁾ L82765=80CRI 2700K-6500K White Tuning ⁽¹²⁾ L92765=90CRI 2700K-6500K White Tuning ⁽¹²⁾ B35=BioUp Static 3500K ⁽¹³⁾ B40=BioUp Static 4000K ⁽¹³⁾ B50=BioUp Static 5000K ⁽¹³⁾ B2750=BioUp Tunable 2700K-5000K ⁽¹⁴⁾	[Blank]=No Flex A3/8-4/18GDIM=3/8" Flex with 0-10V Dimming Leads A3/8-2/18G=3/8" Flex with line and common A3/8-5/18GDIM=Flex with 0-10V Dimming leads and Blue for alternate wiring. See below for details.
Notes (6) Factory installed with integral test switch/indicator/laser test. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 7=700 lumens). IES-format photometry for luminaire under emergency operation available. Battery option increases total height by 1 inch. (7) Used to bypass local control during outage. Must be used in conjunction with UL 1008 device (provided by others). Devices are universal voltage (UNV), 347 not available. (8) EL10WSD and EL14WSD not available with 347V. (9) UEL10WSD not available with 347V. (10) Cannot be used with BioUP options.	Notes (12) VividTune provides correlated color temperatures (CCT) between 3000K (warm) to 5000K (cool) or 2700K (warm) to 6500K (cool). Must be used in conjunction with WZA driver only. Must be used with two (2) 10V dimming control channels, 1 cct, 1 intensity. May be combined with Wavelinx sensor control systems. (13) BioUp Static to be used with HCD driver. (14) BioUp Tunable provides correlated color temperatures (CCT) between 2700K (warm) to 5000K (cool). Must be used with WZA (for two channel 0-10V Control) or W2D (for 2 channel DALI Control) driver. See BioUp page for more information.	Flexible Metal Conduit Options Flex options available for 0-10V dimming control, DALI dimming control, emergency and night light functions. 72-inch factory-installed and pre-wired to driver, fitted to luminaire housing access plate with 90° enclosed FMC connector. Not all options may be combined and installation ratings vary by type. See online configurator for all flex options. A3/8-4/18GDIM series notes: Factory installed dimming option 3/8" flexible metal conduit with 2-#18 power and ground wires and 2-#18 UL-listed jacketed 0-10V +/- control wires. Meets UL 66, 83, 1479, 1569, 1581, 2556, NEMA 250.118, 300.22(C), 392, 396, 330, 501, 502, 503, 530, 504, 505, 518, 520, 530, 645, 72; Federal Specification A-A-59544 (formerly J-C-30B); all applicable OSHA and HUD Requirements. UL Classified 1, 2, and 3-hour through penetration with applicable fire stop product (not included). May be surface mounted, fished and/or embedded in plaster. Cable tray and approved raceway rated, install per NEC®; Environmental Air-Handling Space Installation per NEC® 300.22(C).

Driver Type	Number of Drivers	Integrated Sensing Systems ⁽¹⁷⁾	Packaging	Accessories (order separately) ⁽²¹⁾
CD=0-10V Driver (10%-100% Dimming) HCD=0-10V Driver (1%-100% Dimming) SLTD=DALI Driver (5%-100% Dimming) SLTHD=DALI Driver (1%-100% Dimming) SD=Step Dimming Driver (50%-100% Dimming) LH=Lutron HiLume 1% EcoSystems (LDE1) ⁽¹⁵⁾ WZA=White Tuning, 2 ch, Analog 0-10V (1%-100% Dimming) ⁽¹⁵⁾ W2D=White Tuning, 2 ch, DALI Type 8 (1%-100% Dimming) ⁽¹⁶⁾	1=1 Driver	[Blank]=No Sensor WLS (formerly WRAB)=WaveLinX LITE Wireless Sensor, Occupancy w/ photocell, Independent & Networked ^{(18),(19)} WPS (formerly WAA)=WaveLinX PRO Wireless Sensor, Occupancy w/ photocell, Networked ^{(18),(19)} WLN=WaveLinX LITE Wireless Control Node, without sensor ^{(18),(19)} WPN=WaveLinX PRO Wireless Control Node, without sensor ^{(18),(19)}	U=Unit Pack P=300 Pack O=Out of carton PALC=Job Pack, in carton	C22-EQCLIP-U-PK="C22" Earthquake Clip Kit (4 clips per bag kit) ⁽²⁰⁾ DF-22W-U-2 x 2 Drywall Frame Kit SK-22-WS-2 x 2 Shallow Surface Mount Kit SK-22-WT-2 x 2 Tall Surface Mount Kit
Notes (15) WZA used with two (2) 10V dimming control channels - CCT and intensity. (16) W2D for use with BioUP options only. White tuning CCT between 2700K and 5000K. Must be used with DALI controls; one address to control two channels - intensity and CCT. May not be used with sensing systems. For Emergency options ONLY EL10WSD can be used. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (F) Consult Marketplace Options - Lutron system pages for additional details and compatibility. Compatible only with driver series shown, and may require two or more drivers. Requires field commissioning to operate or dim. Contact Lutron at www.lutron.com.		Notes (17) Matching width lens band on other side of sensor band may be supplied for symmetrical appearance. Required for use with sensor and emergency combination. Add "D" to sensor ordering as shown - WPSD, W2SD. (18) WPS sensor and WPN node to be used with GD, HCD or WZA driver. (19) WLS sensor and WLN node to be used with CD or HCD driver. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (A) Consult WaveLinX PRO system pages for additional details and compatibility. (B) Consult WaveLinX LITE system pages for additional details and compatibility.		Notes (20) An EQ Grid Clip is recommended for all 9/16" ceiling systems. Four required per fixture. (21) Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information.

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

22CZ2-39-UNV-EL7W-L935-A3/8-5/
18GDIM-CD1-U

Notes:

Type:**L2E**

LDI24-110942

Metalux**22CZ2 LED****Product Specifications****Construction**

- Die formed of code gauge prime cold rolled steel with full length die-formed stiffeners
- Unibody endplates attached with interlocking tabs and screws
- Hemmed side flanges
- Four auxiliary fixture end suspension points
- Integral Grid-lock feature for endplates for added safety
- Optional earthquake clips available

Integrated Controls

- Standard with 0-10V dimming driver (10% standard, 1% optional)
- Integrated WaveLinx options provide wireless individual fixture control and enable code compliance, increased energy savings, grouping of fixtures, and connection to WaveLinx control systems
- DALI 2.0, Lutron, and step-dimming available

LED and Light Engine

- LED's available in 3000K, 3500K, 4000K, or 5000K at 80 CRI minimum and 90 CRI minimum
- Color accuracy ≤ 3 -Step MacAdam ellipse (SDCM)
- TM21 life at 60,000 hours up to L90 and calculated L70 exceeds 203,000 hrs.
- Drivers available in 120-277V and 347V
- Tunable white options available with Cooper Lighting Solutions' VividTune
- BioUp melanopic lighting options available in static or tunable white

Emergency Battery Options

- 120V-277V integral emergency battery pack comes in 7-watts, 10-watt, or 14-watts
- Self-diagnostic emergency battery available in 10 or 14-watts (NFPA 101@ Life Safety Code®)
- Constant power to the LED system for controlled, predictable discharge
- Integrated test switch/indicator light visible from floor
- Min. 90-minute backup period for code compliance
- Integral emergency transfer relay available for generator equipped power systems

Shielding

- Ribbed acrylic frosted lens standard
- Optional smooth acrylic frosted lens (S)
- Optional square ribbed frosted acrylic lens (SQR)
- Optional High-Efficiency Round Perf Inlay (HRP)
- Replacement lenses available, contact factory

Compliance

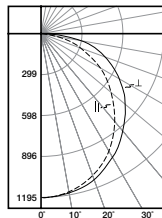
- IC rated for insulation contact
- cULus listed for damp locations
- RoHS compliant
- Tested to IESNA LM-79 and LM-80
- Stated life tested to TM21 standards
- Can be used for State of California Title 24 high efficacy luminaire

Warranty

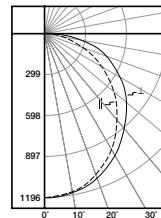
- Five-year limited warranty standard. Optional ten year limited warranty available.

Finish

- Multistage, iron phosphate pretreatment
- 90% reflective, matte white enamel finish
- Full fixture housing pre-painted matte white (choose PAF option for "Paint after Fabrication")

Photometric Data
[View IES files](#)
**22CZ2-24-UNV-L830-CD1-U**

Dimming Driver
Linear LED 3000K
Spacing criterion: (H) 1.2 x mounting height, (L) 1.28 x mounting height
Lumens: 2437
Input Watts: 21.9W
Efficacy: 111.3 LPW
Test Report: 22CZ2-24-UNV-L830-CD1-U.IES

**22CZ2-24HE-UNV-L830-CD1-U**

Dimming Driver
Linear LED 3000K
Spacing criterion: (H) 1.19 x mounting height, (L) 1.27 x mounting height
Lumens: 2402
Input Watts: 19.2W
Efficacy: 125.1 LPW
Test Report: 14CZ2-29-UNV-L830-CD1-U.IES

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

22CZ2-39-UNV-EL7W-L935-A3/8-5/
18GDIM-CD1-U

Notes:

Type:**L2E**

LDI24-110942

Metalux**22CZ2 LED****Energy and Performance Data**

Standard Efficacy Versions – Single Row of LEDs
Default CCT/Lumen Setting: 3500K/Med

Catalog Number	Lumens	Watts	lm/W
22CZ2-20-UNV-L835-CD1-U	2142	16.2	132
22CZ2-24-UNV-L835-CD1-U	2454	18.5	133
22CZ2-32-UNV-L835-CD1-U	3272	24.2	135
22CZ2-39-UNV-L835-CD1-U	3953	31	128
22CZ2-44-UNV-L835-CD1-U	4462	33	134

High Efficacy Versions – Two Rows of LEDs

Catalog Number	Lumens	Watts	lm/W
22CZ2-20HE-UNV-L835-CD1-U	2030	15.0	135
22CZ2-24HE-UNV-L835-CD1-U	2474	18.1	137
22CZ2-29HE-UNV-L835-CD1-U	2982	20.9	143
22CZ2-34HE-UNV-L835-CD1-U	3426	24.3	141
22CZ2-39HE-UNV-L835-CD1-U	3997	28.5	140
22CZ2-44HE-UNV-L835-CD1-U	4567	32.8	139

Very High Efficacy Versions – Three Rows of LEDs

Catalog Number	Lumens	Watts	lm/W
22CZ2-20VHE-UNV-L835-CD1-U	2008	14.2	141
22CZ2-24VHE-UNV-L835-CD1-U	2501	17.5	143
22CZ2-29VHE-UNV-L835-CD1-U	3114	21.7	144
22CZ2-34VHE-UNV-L835-CD1-U	3598	25.1	143
22CZ2-39VHE-UNV-L835-CD1-U	4078	28.6	143
22CZ2-44VHE-UNV-L835-CD1-U	4620	32.6	142
22CZ2-50VHE-UNV-L835-CD1-U	5095	36.2	141
22CZ2-55VHE-UNV-L835-CD1-U	5530	39.4	140
22CZ2-60VHE-UNV-L835-CD1-U	6110	44.1	139
22CZ2-65VHE-UNV-L835-CD1-U	6559	47.9	137
22CZ2-70VHE-UNV-L835-CD1-U	7017	50.3	140
22CZ2-75VHE-UNV-L835-CD1-U	7557	54.7	138
22CZ2-80VHE-UNV-L835-CD1-U	8092	59.1	137
22CZ2-85VHE-UNV-L835-CD1-U	8615	63.6	136
22CZ2-90VHE-UNV-L835-CD1-U	9125	68.2	134
22CZ2-95VHE-UNV-L835-CD1-U	9610	72.7	132
22CZ2-100VHE-UNV-L835-CD1-U	10108	77.7	130
22CZ2-110VHE-UNV-L835-CD1-U	11065	87.7	126

Shielding

Lumen Adjustment Factors		
S	HRP	SQR
1.05	0.80	0.96

Lumen Calculator

CCT Multiplier	80 CRI	90 CRI ⁽¹⁾	BioUp Static
3000K	0.965	0.827	-
3500K	1.000	0.847	0.912
4000K	1.019	0.856	0.899
5000K	1.019	0.909	0.879

Notes: (1) Input wattages for 90 CRI versions may vary. Refer to published IES-format photometry or LM-79 reports for more details.

Example of Lumen Adjustment Calculation

22CZ2-32-UNV-L935-CD1-U at 90CRI at 3500K

Lumen Adjustment Factor = 0.845

Total Light Output =

3,280 lm x 0.845 = 2,772 lm

Efficacy = 2,772 lm = 103.8 lm/W
26.7W

Lumen Maintenance

Version	TM-21 Lumen Maintenance (60,000 hours) ⁽²⁾	Theoretical L70 (Hours) ⁽³⁾
Standard	> 85%	> 151,000
High Efficiency	> 90%	> 203,000
Very High Efficiency	> 90%	> 203,000

Notes: (2) Supported by IES TM-21 standards. (3) Theoretical values represent estimations commonly used; however, refer to the IES position on LED Product Lifetime Prediction, IES PS-10-18, that explains proper use of IES TM-21 and LM-80.

Load Data (Stock Product)

Thd	6%
Power Factor	0.99
Weight (lbs.)	10.6
Low Temp. Start	-20°C

Shipping Data

Catalog No.	Wt.	Pallet 49"L x 52"W x 55"H
2' x 2'	12.5 lbs.	48

Air Return Volume

Negative Static Pressure (Inches H ₂ O)	Return Air Volume (CFM)
0.05	79
0.1	112
0.2	161
0.25	177
0.3	198
0.45	239



Metalux

22CZ2 LED

Control Solutions

- WaveLinX LITE wireless
- WaveLinX PRO wireless
- WaveLinX CAT wired
- WaveLinX Wired



The Cruze ST with WaveLinX offers no-hassle lighting control with multiple luminaire level control solutions.



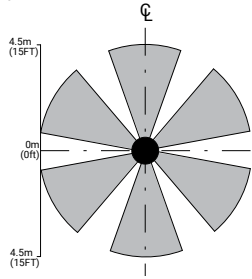
WaveLinX PRO is a wireless lighting control solution, for connected spaces, that significantly reduces a building's energy consumption. From a single floor to an entire campus, WaveLinX PRO connects more than lighting assets; it shares aggregated sensor data with the WaveLinX CORE platform and other building systems, so building owners can improve operations, spaces environment, and tenants' experience. WaveLinX PRO offers a rich portfolio of wireless devices, WaveLinX PRO-enabled luminaires, and an intuitive WaveLinX mobile app for office, education, warehouse, and parking garage applications.



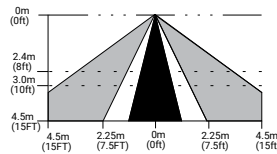
WaveLinX LITE is a cost effective, wireless digital lighting control solution, with out-of-the-box functionality, that saves energy and meets code. It's designed for applications that require occupancy-based, daylighting, or manual light control. Customize installations for office, education, warehouse and parking garages using the secure, simple mobile app.

Integrated Sensor Coverage Pattern

TOP VIEW:

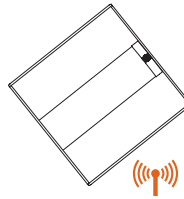


SIDE VIEW:

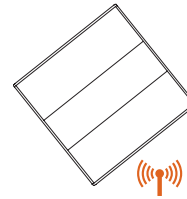


Note: Installation of integrated sensors within 3-ft (1m) of HVAC air vents is not recommended. The pattern shown is intended solely as a general guide and is not to scale.

With Integrated WaveLinX Sensor



With Integrated WaveLinX Node



Add a hidden WaveLinX sensor node (WPN, WLN) to your space lighting design!

Allows to:

- Keeps luminaire aesthetics
- Connect fixtures without the realstate to include sensor option such as downlights
- Connect sealed fixtures without a standard sensor option such as products for clinical space.

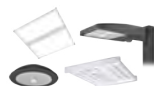
Integrated Controls Options

Option	Out of the Box Functionality	Luminaire Level Lighting Control (LLC)	Automatic Dimming Photocell	Occupancy Sensing	CCT Control
WLS	X	X	X	X	
WLN		X			
WPS		X	X	X	X
WPN		X			X

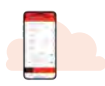
Note: WaveLinX utilizes scenes to allow users to change an area's fixtures Correlated Color Temperature (CCT) and intensity using commissioned manual wireless wallstation scene control. To enable CCT adjustments through WaveLinX, include WPS or WPN devices in addition to VividTune or BioUp technologies for integrated fixture control.

Systems comparison chart

Cooper Lighting Solutions provides many lighting system solutions designed to satisfy code requirements and meet the unique needs of any project.



Luminaire with standalone sensor



Standalone Spaces WaveLinX LITE



Standalone Spaces WaveLinX CAT



Networked Spaces WaveLinX PRO



Enterprise WaveLinX CORE

	Luminaire with standalone sensor	Standalone Spaces WaveLinX LITE	Standalone Spaces WaveLinX CAT	Networked Spaces WaveLinX PRO	Enterprise WaveLinX CORE
Occupancy	Yes	Yes	Yes	Yes	Yes
Daylighting	Yes	Yes	Yes	Yes	Yes
Wallstations	-	Yes	Yes	Yes	Yes
Gateways	-	-	-	1 WAC	300 WACs
Devices (MAX)	-	40 per Area (1120 per space)	40 per Area	200 per WAC2	32,500 per CORE Enterprise
Software	-	WaveLinX LITE Mobile App	WaveLinX CAT Mobile App	WaveLinX Mobile App	CORE
Areas	-	28 per Space	Unlimited	50 per WAC2	up to 3,000
Zones	-	16 per Area	16 per Area	16 per Area	up to 9,000
Scheduling	-	-	-	Local	Global
VividTune™	-	-	-	Yes	Yes
Plug-Load Control	-	Yes	Yes	Yes	Yes
Low-Voltage Power	-	-	Yes	Yes	Yes
Integration	-	-	-	-	BACnet, API
Dashboards	-	-	-	-	Energy, Occupancy
Configuration	-	Installer	Installer	Technician	Technician / IT

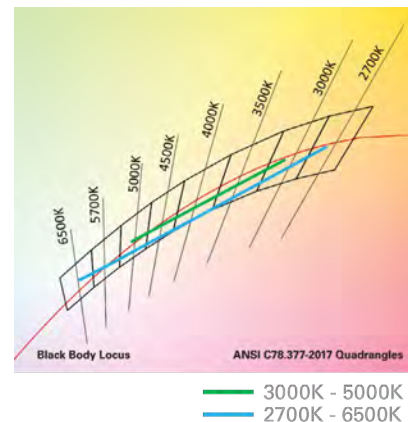


Metalux **22CZ2 LED**



22 Cruze ST LED with VividTune Tunable White

VividTune tunable white luminaires from Cooper Lighting Solutions deliver high-quality light in a broad range of continuously variable color temperatures and intensities. Create a dynamic environment by adjusting the ambient light warmer or cooler to influence mood, support the task at hand, or create a dramatic ambience. The ability to control correlated color temperature and intensity separately using simple controls is the next evolution of LED lighting for the commercial, educational, healthcare and hospitality space. The unparalleled flexibility and number of available lighting environments enable users to find the right light with tunable white.



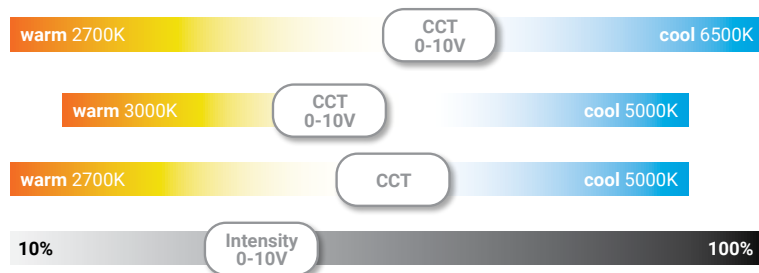
Energy and Performance Data

CCT	Tunable White - Lumen Adjustment Factors					
	VividTune 3000K-5000K		VividTune 2700K-6500K		BioUp Tunable White 2700K-5000K	
	80 CRI	90 CRI	80 CRI	90 CRI	CRI	Lumen Adjustment
2700K	-	-	0.903	0.771	95	0.938
3000K	0.929	0.765	0.928	0.801	94	0.929
3500K	0.983	0.836	0.961	0.842	90	0.912
4000K	1.033	0.903	0.981	0.868	87	0.899
4500K	1.042	0.918	0.999	0.891	85	0.890
5000K	1.042	0.918	1.013	0.909	84	0.879
6500K	-	-	1.028	0.933	-	-

CCT Setting	2' x 2' Cruze ST LED - Example of Approximate Lumen Calculation			
	Standard Catalog #	VividTune 80 CRI Catalog #	VividTune 90 CRI Catalog #	BioUp Tunable White
2700K	22CZ2-34HE-UNV-L835-CD1-U	22CZ2-34HE-UNV-L83050-W2A1-U	22CZ2-34HE-UNV-L93050-W2A1-U	22CZ2-34HE-UNV-B2750-W2A1-U
2700K	-	3058	2611	3176
3000K	-	3026	2491	3146
3500K	3386	3202	2722	3088
4000K	-	3362	2940	3044
4500K	-	3394	2991	3014
5000K	-	3394	2991	2976
6500K	-	3481	3159	-

Controlling VividTune and BioUp Tunable White

From wall dimmers to wireless controls, tunable white luminaires are compatible with industry standard 0-10V and DALI controls. One channel to control intensity (brightness) and a second channel to adjust CCT.



Example of Lumen Adjustment Calculation

22CZ2-34HE-UNV-L83050-W2A1-U at 80 CRI tuned to 3500K

Adjusted Lumen = published lm x adjusted lm factor

Adjusted Lumen = 3386 x 0.946

Adjusted Lumen = 3202 lm

* Lumen adjustment factors are for reference and may be different for each product selected. Refer to IES files for actual performance data on each.



Job Name:
South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
22CZ2-39-UNV-EL7W-L935-A3/8-5/
18GDIM-CD1-U

Notes:

Type:

L2E

LDI24-110942

Metalux

22CZ2 LED

Proven Research. Industry Recognized.

BioUp
Melanopic Lighting



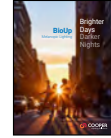
See better



Feel better



Function better



See [BioUp brochure](#) for more details

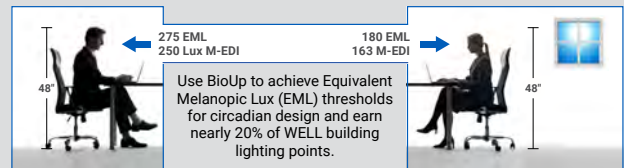


ANSI/IES RP-46-23 / TM18 published March 2024 based on over 40 years of research.

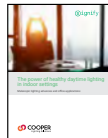
"...circadian clock synchronization is paramount to the body's efficient and appropriate functioning." – TM18



BioUp solutions maximize WELL points for Circadian Lighting Design (L03):



MDER, M-EDI and EML are key metrics used to quantify non-visual performance of indoor lighting systems.



See [BioUp white paper](#) for more details

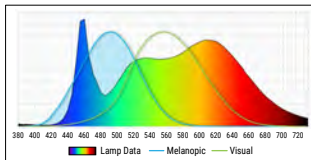
30% boost Biological impact compared to traditional LED sources

CCT	LED MDER ~83 CRI	BioUp Static		BioUp Dynamic	
		MDER	CRI	MDER	CRI
2700K	0.44	-	-	0.43	95
3000K	0.49	-	-	0.54	94
3500K	0.56	0.71	90	0.71	90
4000K	0.64	0.84	87	0.82	87
5000K	0.77	0.98	84	0.98	84

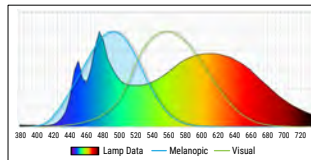
BioUp enhances the LED spectrum with cyan light at 475nm increasing the biological impact of the light to enhance our circadian rhythm which regulates our sleep/wake cycle, daytime engagement, and mood – **all without distorting visual color impression.**

MDER - Melanopic Daylight Efficacy Ratio (MDER) measures the amount of light stimulating to the melanopsin receptors.

Standard 4000K LED
MDER = .62

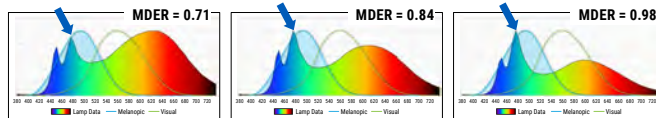


BioUp 4000K LED
MDER = .82



Static (non-tunable)

Static BioUp is used when simple Melanopic Lighting is desired at all times.



3500K or 4000K or 5000K

Cyan light component always present

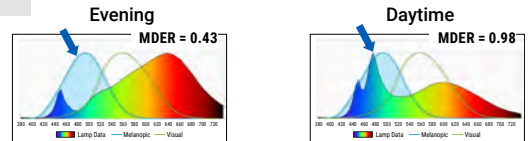


> no CCT control needed

Arrow in graph shows BioUp spectrum boost is at 475nm where non-visual biological response is enhanced.

Dynamic - (Tunable)

Dynamic BioUp is used when Melanopic Lighting is desired to adjust during the day.



Warmer CCT **Without** Cyan content ← → Cooler Light **With** Cyan content

2700K - 5000K



Dimming Control 0% Intensity 100%

> Control with Wavelinx, 2ch 0-10V, or DALI



Cooper Lighting Solutions
1121 Highway 74 South
Peachtree City, GA 30269
P. 770-486-4800
www.cooperlighting.com

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Specifications and dimensions
subject to change without notice.

PS519305EN page 7
April 18, 2024 1:30 PM



Project		Catalog #		Type	
Prepared by		Notes		Date	



HALO Commercial

HC4 | HM4 | 41/41PS

4-inch LED downlight and wall wash

Typical Applications

Office • Healthcare • Hospitality • Institutional • Mixed-Use/Retail

Interactive Menu

- Order Information [page 2](#)
- Product Specifications [page 4](#)
- Photometric Data [page 5](#)
- Energy & Performance Data [page 8](#)
- Connected Systems [page 9](#)
- Product Warranty

Product Certification



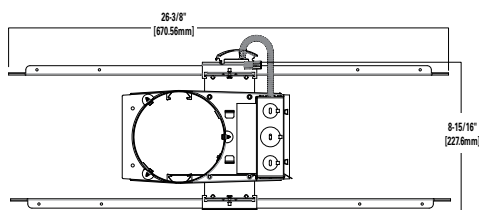
Product Features



Top Product Features

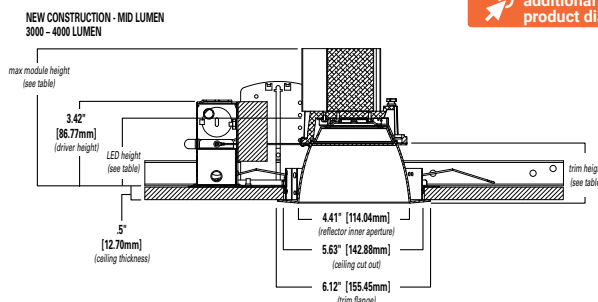
- New construction/remodel series; 500 to 6,000 lumens
- Narrow, Medium and Wide distributions; Wall wash with rotatable linear spread lens
- 2700K, 3000K, 3500K, 4000K and 5000K CCT; 80 or 90 CRI
- Universal voltage 120V-277V; Standard 0-10V driver dims to 1%
- Mounting frame converts to remodel that installs from below the ceiling
- Rapid Response emergency backup mounting frames - fast delivery option

Dimensional and Mounting Details



Mid Lumen (3000 – 4000 Lumens)

Distribution	Max. Module Height	Trim Height	LED Height
Narrow	5.6"	2.5"	2.9"
Medium	5.7"	2.6"	3.0"
Wide	5.5"	2.4"	2.8"
Baffle	5.5"	2.4"	2.8"



[additional product diagrams](#)



Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
HC415D010 HM40525935
41MDHWF
Notes:

Type:
L3
LDI24-110942

HALO Commercial

HC4 | HM4 | 41/41PS

Mounting Frame Order Information

Sample Number : HC420D010REM7 - HM40525930 - 41MDC

A complete luminaire consists of a housing frame, LED module, and reflector (ordered separately)

Mounting Frame	Lumens	Driver Options	Factory Installed Emergency & Connected Lighting Options	Accessories (Order & Install Separately)
HC4 = 4" new construction downlight housing	05 = 500 lm 07 = 750 lm 10 = 1000 lm	D010=UNV 120-277V, 50/60Hz, 0-10V 1%-100% dimming at 120-277V on 0-10V controls	REM7 = 7 watt emergency battery pack with remote test / indicator light, use with D010 only ⁽¹⁾⁽²⁾⁽⁶⁾ REM14 = 14 watt emergency battery pack with remote test / indicator light, use with D010 only ⁽¹⁾⁽²⁾⁽⁶⁾ IEM7 = 7 watt emergency battery pack with integral test / indicator light, use with D010 only ⁽¹⁾⁽²⁾⁽⁶⁾⁽¹⁰⁾ IEM14 = 14 watt emergency battery pack with integral test / indicator light, use with D010 only ⁽¹⁾⁽²⁾⁽⁶⁾⁽¹⁰⁾ BOD7ST = 7.5 watt Bodine self-test emergency battery pack with remote test / indicator light, use with D010 only ⁽¹⁾⁽²⁾⁽⁶⁾ WTA = Factory WaveLinX Tilemount Sensor Kit ⁽⁴⁾ WTK = Factory WaveLinX Lite Commercial Tilemount Sensor Kit ⁽⁵⁾	HB128APK = L channel hanger bar, 26", pair (replacement) RMB22 = Adjustable wood joist mounting bars, pair, extend to 22" long H347 = 347 to 120V step down transformer, 75VA H347200 = 347 to 120V step down transformer, 200VA WTA = Field WaveLinX Tilemount Sensor Kit ⁽⁴⁾ WTK = Field WaveLinX Lite Commercial Tilemount Sensor Kit ⁽⁵⁾
HC4CP = 4" new construction housing, Chicago Plenum - CCEA compliant	15 = 1500 lm 20 = 2000 lm 25 = 2500 lm 30 = 3000 lm 35 = 3500 lm 40 = 4000 lm 45 = 4500 lm ⁽⁷⁾ 50 = 5000 lm ⁽⁷⁾ 55 = 5500 lm ⁽⁷⁾ 60 = 6000 lm ⁽⁷⁾	Canada Option 500-5000 lumens: D010347 = 347VAC 50/60Hz 0-10V 1%-100% dimming. For 500, 750, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000lm models only ⁽¹⁾ Canada Option 5500-6000 lumens: D010X347 = step down transformer factory installed (with standard "D010" 120V-277V LED driver). For 5500, 6000lm models only ⁽¹⁾ DLV = Distributed Low Voltage driver 1%-100% dimming. DLV for use with DLVP system only. Refer to DLVP low-voltage power module and DLVP specifications for details. ⁽¹⁾	REM7 = 7 watt emergency battery pack with remote test / indicator light, use with DLV only ⁽¹⁾⁽²⁾⁽³⁾⁽⁶⁾ REM14 = 14 watt emergency battery pack with remote test / indicator light, use with DLV only ⁽¹⁾⁽²⁾⁽³⁾⁽⁶⁾ IEM7 = 7 watt emergency battery pack with integral test / indicator light, use with DLV only ⁽¹⁾⁽²⁾⁽³⁾⁽⁶⁾⁽¹⁰⁾ IEM14 = 14 watt emergency battery pack with integral test / indicator light, use with DLV only ⁽¹⁾⁽²⁾⁽³⁾⁽⁶⁾⁽¹⁰⁾	
Notes	Notes	Notes	Notes	Notes
	(7) Marked Spacing: Center to Center of Adjacent Luminaires = 36" Center of Luminaire to Building Member = 18" Minimum overhead = 0.5	(1) Not available with CP models	(1) Not available with CP models (2) Not available with D010347 (347V models) (3) ULUS for U.S. only (4) WTA = WaveLinX tile mount sensor kit for daylight dimming, PIR motion sensing, and optional RLTS - Real Time Location Services, use with D010 only (Refer to WaveLinX specifications) (5) WTK = WaveLinX Lite tile mount sensor kit for daylight dimming, PIR motion sensing, use with D010 only (Refer to WaveLinX Lite specifications) (6) Emergency battery backup options are Non-IC only, and rated for a minimum starting temperature of 0°C (10) IEM option requires compatible IEM reflector or baffle trim. See Trim Ordering below.	(4) WTA = WaveLinX tile mount sensor kit for daylight dimming, PIR motion sensing, and optional RLTS - Real Time Location Services, use with D010 only (Refer to WaveLinX specifications) (5) WTK = WaveLinX Lite tile mount sensor kit for daylight dimming, PIR motion sensing, use with D010 only (Refer to WaveLinX Lite specifications)

Rapid Response Emergency Mounting Frame Order Information

Sample Number :

Rapid Response Emergency Mounting Frame: RR-HC420D010REM7

LED module and reflectors are ordered separately.

Order separately: LED Module: HM40525835 | Reflector: 41MDC

Select from the Rapid Response Mounting Frame ordering information to receive the **Fast Delivery** option for the frame.

RR Code	Mounting Frame	Lumens	Driver Options	Factory Installed Emergency Options	Accessories (Order & Install Separately)
RR = East Region BRR = West Region	HC4 = 4" new construction downlight housing	05 = 500 lm 07 = 750 lm 10 = 1000 lm 15 = 1500 lm 20 = 2000 lm 25 = 2500 lm 30 = 3000 lm 35 = 3500 lm 40 = 4000 lm 45 = 4500 lm ⁽⁷⁾ 50 = 5000 lm ⁽⁷⁾ 55 = 5500 lm ⁽⁷⁾ 60 = 6000 lm ⁽⁷⁾	D010=UNV 120-277V, 50/60Hz, 0-10V 1%-100% dimming at 120-277V on 0-10V controls	REM7 = 7 watt emergency battery pack with remote test / indicator light, use with D010 only ⁽²⁾⁽⁶⁾ REM14 = 14 watt emergency battery pack with remote test / indicator light, use with D010 only ⁽²⁾⁽⁶⁾ IEM7 = 7 watt emergency battery pack with integral test / indicator light, use with D010 only ⁽²⁾⁽⁶⁾⁽¹⁰⁾ IEM14 = 14 watt emergency battery pack with integral test / indicator light, use with D010 only ⁽²⁾⁽⁶⁾⁽¹⁰⁾ BOD7ST = 7.5 watt Bodine self-test emergency battery pack with remote test / indicator light, use with D010 only ⁽²⁾⁽⁶⁾	HB128APK = L channel hanger bar, 26", pair (replacement) RMB22 = Adjustable wood joist mounting bars, pair, extend to 22" long
Notes	Notes	Notes	Notes	Notes	
	(7) Marked Spacing: Center to Center of Adjacent Luminaires = 36" Center of Luminaire to Building Member = 18" Minimum overhead = 0.5		(2) Not available with D010347 (347V models) (6) Emergency battery backup options are Non-IC only, and rated for a minimum starting temperature of 0°C (10) IEM option requires compatible IEM reflector or baffle trim. See Trim Ordering below.		



HALO Commercial **HC4 | HM4 | 41/41PS**

LED Module Order Information

LED Module	Lumens	CRI/CCT	
HM4 = 4" LED module	0525 = 500 - 2500 lumen	827 = 80CRI, 2700K	927 = 90CRI, 2700K
	3040 = 3000-4000 lumen	830 = 80CRI, 3000K	930 = 90CRI, 3000K
	4560 = 4500-6000 lumen	835 = 80CRI, 3500K	935 = 90CRI, 3500K
		840 = 80CRI, 4000K	940 = 90CRI, 4000K
		850 = 80CRI, 5000K	950 = 90CRI, 5000K
Notes	Notes	Notes	

Trim Order Information

Reflector	Distribution ⁽⁸⁾	Finish	Flange	Accessories
41 = 4" conical reflector	ND = narrow 50° beam angle 0.84 SC (nominal) MD = medium 60° beam angle 1.00 SC (nominal) WD = wide 75° beam angle 1.24 SC (nominal) RWW = rotatable wall wash with linear spread lens	C = Specular clear H = Semi-specular clear W = White	Blank = Polished flange standard with C & H reflectors Blank = White flange standard with W reflector WF = White flange option available with C & H reflectors	41RWWPK = Replacement part kit - wall wash lens insert - for use with 41RWW* only.
Notes	Notes	Notes	Notes	Notes
(8) Values are nominal for white reflector, others may vary.				

Baffle	Distribution ⁽⁸⁾	Finish	Flange	Accessories
41 = 4" baffle reflector	WD = wide 75° beam angle 1.24 SC (nominal) RWW = rotatable wall wash with linear spread lens	BB = Black baffle WB = White baffle	Blank = White flange standard with BB, & WB BF = Black flange option available with BB	41RWWPK = Replacement part kit - wall wash lens insert - for use with 41RWW* only.
Notes	Notes	Notes	Notes	Notes
(8) Values are nominal for white reflector, others may vary.				

Reflector	Distribution ⁽⁸⁾	Finish	Flange
41PS = 4" non-conductive polymer 'dead front' conical reflector⁽⁹⁾	MD = medium 60° beam angle 1.00 SC (nominal)	W = White	Blank = White flange standard with W reflector
Notes	Notes	Notes	Notes
(9) 41PS* is 1000-3000 lumens Non-IC rated. 500 & 750 lumens IC rated. 41PS is not for use over 3000 lumens in Non-IC or over 750 lumens in IC.		(8) Values are nominal for white reflector, others may vary.	

IEM Reflector	Distribution ⁽⁸⁾	Finish	Flange	Integral Emergency
41 = 4" conical reflector for integral emergency only	ND = narrow 50° beam angle 0.84 SC (nominal) MD = medium 60° beam angle 1.00 SC (nominal) WD = wide 75° beam angle 1.24 SC (nominal)	C = Specular clear H = Semi-specular clear W = White	Blank = Polished flange standard with C & H reflectors Blank = White flange standard with W reflector WF = White flange option available with C & H reflectors	IEM = Reflector for use with integral emergency housings only. Provides access hole for integral emergency test switch.
Notes	Notes	Notes	Notes	Notes
(8) Values are nominal for white reflector, others may vary.				

IEM Baffle	Distribution ⁽⁸⁾	Finish	Flange	Integral Emergency
41 = 4" baffle reflector for integral emergency only	WD = wide 75° beam angle 1.24 SC (nominal)	BB = Black baffle WB = White baffle	Blank = White flange standard with BB, & WB BF = Black flange option with BB	IEM = Reflector for use with integral emergency housings only. Provides access hole for integral emergency test switch.
Notes	Notes	Notes	Notes	Notes
(8) Values are nominal for white reflector, others may vary.				

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

HC415D010 HM40525935

41MDHWF

Notes:

Type:**L3**

LDI24-110942

HALO Commercial**HC4 | HM4 | 41/41PS****Product Specifications****Housing Frame**

- Boat shaped galvanized steel plaster frame with adjustable plaster lip
- Accommodates 1/2" to 1-1/2" thick ceilings
- Installs in new construction or from below the finished ceiling (non-accessible) for remodeling
- Provided with two remodel clips to secure the frame to the ceiling

Universal Mounting Bracket

- Adjusts 2" vertically from above and below the ceiling
- Use with the included mounting bars or with 1/2" Electric Metallic Tube (EMT)
- Removable to facilitate remodeling installation from below the finished ceiling

Mounting Bars

- Captive pre-installed No Fuss™ mounting bars lock to T-grid with screwdriver or pliers
- Centering detents allow for consistent positioning of fixtures

LED Module

- Proximity phosphors over chip on board LEDs provide a uniform source with high efficiency and no pixilation
- Available in 80 or 90 color rendering index (CRI)
- Color accuracy within 3 SDCM provides color consistency and uniformity
- 90 CRI option: R9>50 (refer to chromaticity information for details)
- Available in 2700K, 3000K, 3500K, 4000K and 5000K correlated color temperature (CCT)
- Lumen options include 500, 750, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000 lumens (nominal)
- Passive thermal management achieves 60,000 hours at 70% lumen maintenance (L70) in insulated ceilings (IC) and non-IC applications
- Integral diffuse lens provides visual shielding
- Integral connector allows quick connection to housing flex

Reflector

- Self-flanged aluminum reflectors available in narrow, medium or wide distribution patterns
- Medium distribution polymer non-conductive matte white reflector may be used to meet local codes for 'dead front' applications (500 & 750 lumen max. in IC and 3000 lumen max. in Non-IC)
- Wall wash reflector features a rotatable linear spread lens for alignment of vertical illumination
- Reflectors attach to LED module with three speed clamps
- Available in multiple painted or plated finishes

Reflector/Module Retention

- Reflector/module assembly is securely retained in the housing with two torsion springs

Driver

- Field-replaceable constant current driver provides low noise operation
- Universal 120-277VAC 50/60Hz input standard
- Continuous, 1% to 100% dimming with 0-10V analog control
- Optional low-voltage DC driver for use with Distributed Low Voltage Power (DLVP) system
- Distributed Low Voltage Power (DLVP) system combines power, lighting and controls with ease of installation (refer to DLVP Design Guide at www.cooperlighting.com for details)

Canada Options

- 347VAC 50/60Hz; 1% dimming on 0-10V analog control, for 500, 750, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000 lumen models only
- 347V step down transformer factory installed with the standard "D010" 120V-277V, LED driver on 5500, 6000 lumen models only

Emergency Option

- Provides 90 minutes of standby lighting, meeting most life safety codes for egress lighting
- Available with integral or remote charge indicator and test switch
- Available Self-Test (self-diagnostic) with remote charge indicator and test switch
- Rapid Response emergency ordering option for quick-turn projects

Connected Lighting System Options

Two WaveLinx connected systems to choose. Summary information provided below, refer to WaveLinx system specifications and application guides for details.

WaveLinx System Tilemount Sensor Kit

- WaveLinx WTA tile mount sensor kit offers daylight dimming, PIR motion sensing, scene and zone configuration, automatic commissioning, and optional RLTS - Real Time Location Services available.

WaveLinx Lite System Tilemount Sensor Kit

- WaveLinx Lite WTK tile mount sensor kit offers daylight dimming and PIR motion sensing, scene and grouping configuration.

WaveLinx Tilemount Kits Application

- The WTA and WTK tilemount kits include a control module mounted on the luminaire junction box via 1/2" knock-out, and a tilemount sensor on 54-inch whip; for ceiling installation by direct-mount spring clips or via mounting bracket in octagon ceiling boxes.
- The WTA and WTK tilemount kits may be ordered as factory installed on the luminaire, or ordered separately as a field installed accessory kit.

Junction Box

- Galvanized steel junction box
- 20 in³ internal volume excluding voltage barrier
- 25 in³ internal total volume
- Voltage barrier for 0-10V dimming wires (occupies one 1/2" pry-out space)
- Listed for eight #12 AWG (four in, four out) 90°C conductors and feed-thru branch wiring
- Three 1/2" and two 3/4" trade size pry-outs available
- Three 4-port push wire nuts for mains voltage with 1-port for fixture connection

Compliance

- cULus Listed to UL 1598 / C22.2 No. 250.0, suitable for damp locations and wet locations in covered ceilings only
 - Emergency options provided with UL Listed emergency drivers to UL 924 / C22.2 No. 141, suitable for indoor/damp locations
 - IP20 - Above finished ceiling; IP64 - Below finished ceiling
 - Non-Insulated ceiling (Non-IC) rated for 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000 lumen models (insulation must be kept 3" from top and sides)
 - Insulated ceiling (IC) rated for 500, 750, 1000, 1500 lumen models and suitable for direct contact with air permeable insulation* (IC models are also suitable for Non-IC installations)
 - Non-IC marked spacing required for 4500, 5000, 5500, 6000 lumen models
 - Marked Spacing Center to Center of Adjacent Luminaires = 36"
 - Center of Luminaire to Building Member = 18"
 - Minimum overhead = 0.5"
 - Airtight per ASTM-E283-04
 - Suitable for use in clothes closets when installed in accordance with the NEC 410.16 spacing requirements
 - EMI/RFI emissions FCC CFR Title 47 Part 15 Class A at 120/277V
 - Contains no mercury or lead and RoHS compliant
 - Photometric testing completed in accordance of IES LM-79-08
 - Lumen maintenance projection in accordance of IES LM-80-08 and TM-21-11
 - 1,000 and 1,500 lumen, 90 CRI, ICAT models may be used to comply with State of California Title 24 residential code, per JA8 certification standards
 - May be used to comply with State of California Title 24 non-residential code as a dimmable LED luminaire
 - ENERGY STAR® certified, reference certified light fixtures database
- *Not for use in direct contact with spray foam insulation, consult NEMA LSD57-2013

Warranty

- Five year limited warranty, consult website for details. www.cooperlighting.com/legal



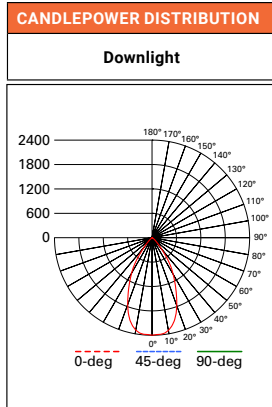
HALO Commercial **HC4 | HM4 | 41/41PS**

Photometric Data

[View IES files](#)

NARROW DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

NARROW (50° BEAM*)	
Test Number	P571728
Housing	HC420D010
Module	HM40525835
Reflector	41NDC
Lumens	2010 Lm
Efficacy	100.5 Lm/W
SC	0.84
UGR	12.2



CONE OF LIGHT			
MH	FC	L	W
5.5'	79.3	4.6	4.6
7'	49	5.8	5.8
8'	37.5	6.6	6.6
9'	29.6	7.4	7.4
10'	24	8.4	8.4
12'	16.7	10	10

CANDELA TABLE	
Degrees Vertical	Candela
0	2400
5	2387
15	2110
25	1368
35	676
45	152
55	23
65	5
75	1
85	0
90	0

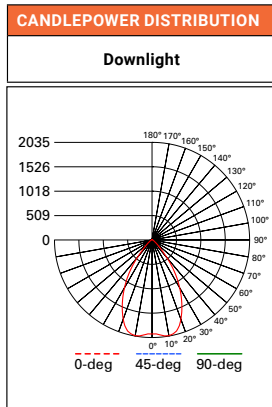
ZONAL LUMEN SUMMARY		
Zone	Lumens	% Fixture
0-30	1436	71.5
0-40	1848	92
0-60	2002	99.6
0-90	2010	100
90-180	0	0
0-180	2010	100

LUMINANCE	
Average Candela Degrees	Average 0° Luminance
45	26514
55	4968
65	1576
75	667
85	0

*Value are nominal for specular clear reflectors, other may vary.
SC = Spacing Criteria
UGR = Unified Glare Rating

MEDIUM DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

MEDIUM (60° BEAM*)	
Test Number	P571727
Housing	HC420D010
Module	HM40525835
Reflector	41MDC
Lumens	2096 Lm
Efficacy	104.8 Lm/W
SC	1.0
UGR	13.6



CONE OF LIGHT			
MH	FC	L	W
5.5'	65.3	5.4	5.4
7'	40.3	6.8	6.8
8'	30.9	7.8	7.8
9'	24.4	8.8	8.8
10'	19.8	9.8	9.8
12'	13.7	11.8	11.8

CANDELA TABLE	
Degrees Vertical	Candela
0	1969
5	1997
15	1974
25	1467
35	800
45	192
55	26
65	4
75	1
85	0
90	0

ZONAL LUMEN SUMMARY		
Zone	Lumens	% Fixture
0-30	1408	67.1
0-40	1899	90.6
0-60	2091	99.7
0-90	2096	100
90-180	0	0
0-180	2096	100

LUMINANCE	
Average Candela Degrees	Average 0° Luminance
45	33405
55	5548
65	1197
75	667
85	0

*Value are nominal for specular clear reflectors, other may vary.
SC = Spacing Criteria
UGR = Unified Glare Rating

Note: Refer to IES files for more product data.



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WIDE DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

WIDE (75° BEAM*)		CANDLEPOWER DISTRIBUTION		CONE OF LIGHT		CANDELA TABLE		ZONAL LUMEN SUMMARY												
Test Number	P571730					Degrees Vertical	Candela	Zone	Lumens	% Fixture										
Housing	HC420D010					0	1509	0-30	1334	57.9										
Module	HM40525835					5	1525	0-40	1960	85.1										
Reflector	41WDC					15	1630	0-60	2296	99.7										
Lumens	2304 Lm					25	1603	0-90	2304	100										
Efficacy	115.2 Lm/W					35	1012	90-180	0	0										
SC	1.25					45	369	0-180	2304	100										
UGR	15.7	55	44	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #f4a460; color: white;"> <th colspan="2">LUMINANCE</th> </tr> <tr> <th style="text-align: center;">Average Candela Degrees</th> <th style="text-align: center;">Average 0° Luminance</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">45</td> <td style="text-align: center;">64437</td> </tr> <tr> <td style="text-align: center;">55</td> <td style="text-align: center;">9355</td> </tr> <tr> <td style="text-align: center;">65</td> <td style="text-align: center;">1576</td> </tr> <tr> <td style="text-align: center;">75</td> <td style="text-align: center;">667</td> </tr> <tr> <td style="text-align: center;">85</td> <td style="text-align: center;">0</td> </tr> </tbody> </table>			LUMINANCE		Average Candela Degrees	Average 0° Luminance	45	64437	55	9355	65	1576	75	667	85	0
LUMINANCE																				
Average Candela Degrees	Average 0° Luminance																			
45	64437																			
55	9355																			
65	1576																			
75	667																			
85	0																			
		MH	FC	L	W															
		5.5'	49.9	6.8	6.8															
		7'	30.8	8.6	8.6															
		8'	23.6	9.8	9.8															
		9'	18.6	11.2	11.2															
		10'	15.1	12.4	12.4															
		12'	10.5	14.8	14.8															

*Value are nominal for specular clear reflectors, other may vary.
SC = Spacing Criteria
UGR = Unified Glare Rating

Photometric Multipliers (Nominal Lumen Values)

500 Lumen	750 Lumen	1000 Lumen	1500 Lumen	2000 Lumen	2500 Lumen	3000 Lumen	3500 Lumen
0.33	0.44	0.54	0.74	1.00	1.24	1.54	1.85
4000 Lumen	4500 Lumen	5000 Lumen	5500 Lumen	6000 Lumen			
2.15	2.28	2.44	2.52	2.62			

Multipliers for relative lumen values with other series models.

Color Finish Multipliers

Finish code	C	H	W/WB	BB
Finish	Specular Clear	Semi-Specular	Matte White White Baffle	Black Baffle
Multiplier	1.00	0.94	0.88	0.76

Multipliers for relative lumen values with other color finishes.

CCT Multipliers - 80CRI

2700K	3000K	3500K	4000K	5000K
0.89	0.96	1.00	1.03	1.03

Multipliers for relative lumen values with other series color temperatures.

CCT Multipliers - 90CRI

2700K	3000K	3500K	4000K	5000K
0.76	0.85	0.89	0.93	0.93

Multipliers for relative lumen values with other series color temperatures.

Note: Refer to IES files for more product data.

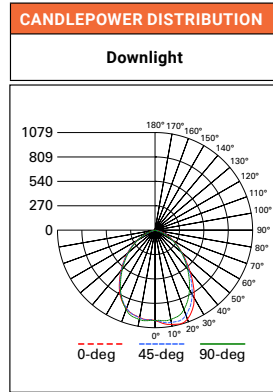


HALO Commercial

HC4 | HM4 | 41/41PS

WALL WASH DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

WALL WASH	
Test Number	P571729
Housing	HC420D010
Module	HM40525835
Reflector	41RWWC
Lumens	2094 Lm
Efficacy	104.7 Lm/W
SC	1.15



CANDELA TABLE	
Degrees Vertical	Candela
0	1005
5	1041
15	1079
25	980
35	743
45	494
55	312
65	180
75	80
85	10
90	0

ZONAL LUMEN SUMMARY		
Zone	Lumens	% Fixture
0-30	789	37.7
0-40	1221	58.3
0-60	1872	89.4
0-90	2094	100
90-180	0	0
0-180	2094	100

LUMINANCE	
Average Candela Degrees	Average 0° Luminance
45	86207
55	67159
65	52681
75	38173
85	13445

SC = Spacing Criteria, nominal for specular clear reflector, other may vary.

SINGLE UNIT FOOTCANDLES							
2.5' from wall (distance from fixture along wall)							
1	18.7	13.6	6.1	2.3	0.8	0.3	0.1
2	28.4	22.3	12.2	5.7	2.6	1.2	0.6
3	25.9	21.4	13.3	7.2	3.8	2	1.1
4	19.6	16.9	11.6	7	4.1	2.4	1.4
5	13.6	12.3	9.2	6.2	3.9	2.5	1.5
6	9.3	8.6	7	5.1	3.5	2.3	1.6
7	6.4	6.1	5.2	4.1	3	2.1	1.5
8	4.6	4.4	3.9	3.2	2.5	1.8	1.3
9	3.3	3.2	2.9	2.5	2	1.6	1.2
10	2.5	2.4	2.2	2	1.7	1.4	1.1

MULTIPLE UNIT FOOTCANDLES								
2.5' from wall (Distance from fixture along wall)						2.5' from wall (Distance from fixture along wall)		
3			4					
1	21	18.8	21	19.5	12.1	19.5		
2	34.1	34.1	34.1	31	24.4	31		
3	33.1	34.4	33.1	29.7	26.5	29.7		
4	26.7	28.7	26.7	23.7	23.3	23.7		
5	19.8	21.7	19.8	17.5	18.5	17.5		
6	14.4	15.8	14.4	12.8	14	12.8		
7	10.5	11.4	10.5	9.4	10.4	9.4		
8	7.8	8.3	7.8	7	7.7	7		
9	5.8	6.2	5.8	5.4	5.9	5.4		
10	4.4	4.7	4.4	4.1	4.5	4.1		

Photometric Multipliers (Nominal Lumen Values)

500 Lumen	750 Lumen	1000 Lumen	1500 Lumen	2000 Lumen	2500 Lumen	3000 Lumen	3500 Lumen
0.33	0.44	0.54	0.74	1.00	1.24	1.54	1.85

4000 Lumen	4500 Lumen	5000 Lumen	5500 Lumen	6000 Lumen
2.15	2.28	2.44	2.52	2.62

Multipliers for relative lumen values with other series models.

Color Finish Multipliers

Finish code	C	H	W/WB	BB
Finish	Specular Clear	Semi-Specular	Matte White White Baffle	Black Baffle
Multiplier	1.00	0.94	0.88	0.76

Multipliers for relative lumen values with other color finishes.

CCT Multipliers – 80CRI

2700K	3000K	3500K	4000K	5000K
0.89	0.96	1.00	1.03	1.03

Multipliers for relative lumen values with other series color temperatures.

CCT Multipliers – 90CRI

2700K	3000K	3500K	4000K	5000K
0.76	0.85	0.89	0.93	0.93

Multipliers for relative lumen values with other series color temperatures.

Note: Refer to IES files for more product data.



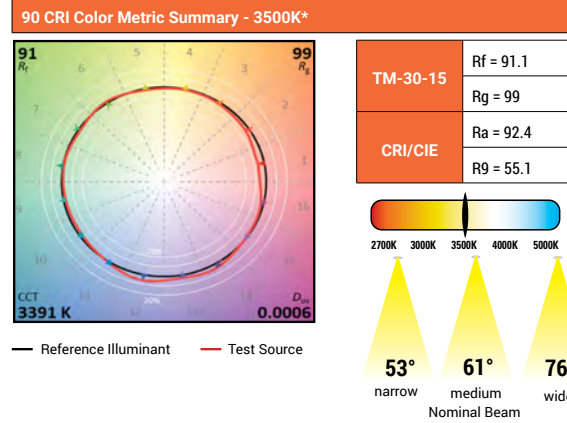
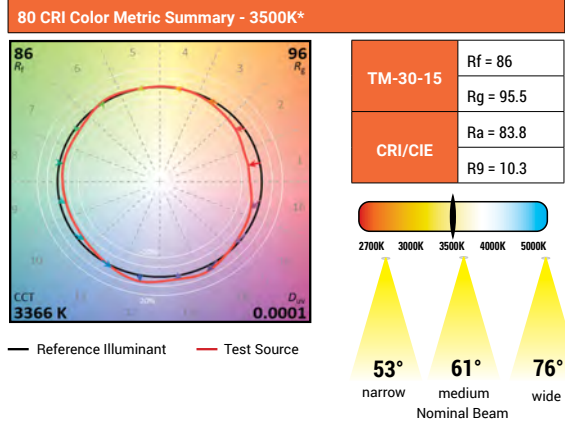


HALO Commercial

HC4 | HM4 | 41/41PS

Energy & Performance Data

COLOR METRICS - TM-30-15 & CRI/CIE (3500K)



* Color values are based on 61WDWB reflector, other finishes and field results may vary.

ENERGY DATA

Series	500 lumen		750 lumen		1000 lumen		1500 lumen		2000 lumen	
	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V
Input Voltage 120-277VAC	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V
Input Current (A)	0.051	0.026	0.067	0.036	0.083	0.039	0.119	0.053	0.171	0.077
Input Power (W)	6.1	6.5	7.9	8.3	10	10.4	14.5	14.5	20.9	20.6
In-rush (A)	1.9	8.4	2	8.4	2.2	8.5	2.7	8.5	2.1	9.7
Inrush duration (µs)	251	135	237	133	250	134	250	139	245	131
THD (%)	6.2	13.5	7.4	8.8	5.4	10.3	10	6.7	6.5	7.9
PF	≥ 0.99	≥ 0.9	≥ 0.98	≥ 0.92	≥ 0.99	≥ 0.95	≥ 0.99	≥ 0.97	≥ 0.99	≥ 0.96

Series	2500 lumen		3000 lumen		3500 lumen		4000 lumen		4500 lumen	
	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V
Input Voltage 120-277VAC	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V
Input Current (A)	0.23	0.103	0.24	0.107	0.292	0.152	0.351	0.159	0.384	0.172
Input Power (W)	27.5	27.5	28.6	28.5	34.6	35.1	42.1	42.1	45.9	45.6
In-rush (A)	2.5	5.6	2.5	11.6	3.4	13.9	3.1	14.7	3.1	14.8
Inrush duration (µs)	232	123	216	111	183	95	200	98	202	100
THD (%)	6.5	8.1	7.8	8.3	5.6	10	4.1	9.5	4.5	8.5
PF	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.93	≥ 0.99	≥ 0.94	≥ 0.99	≥ 0.95

Series	5000 lumen		5500 lumen		6000 lumen	
	120V	277V	120V	277V	120V	277V
Input Voltage 120-277VAC	120V	277V	120V	277V	120V	277V
Input Current (A)	0.419	0.186	0.457	0.201	0.489	0.214
Input Power (W)	50.1	49.5	54.6	53.7	58.4	57.4
In-rush (A)	3.1	15	3.2	14.8	3.4	14.8
Inrush duration (µs)	202	117	196	131	192	121
THD (%)	5.5	7.6	7	7.2	8.1	7.2
PF	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.97

Minimum starting temperature -30°C (-22°F)*
(Nominal input 120-277VAC & 100% of rated output power)

Sound Rating: Class A standards

Notes:

* Emergency Battery packs are rated for a minimum starting temperature of 0°C.

HALO Commercial HC4 | HM4 | 41/41PS

Connected Systems

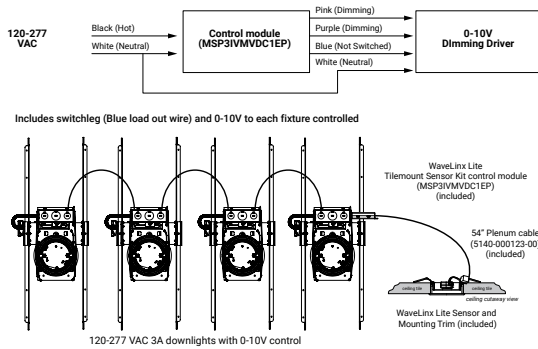
WaveLinx Lite - WTK Tilemount Sensor



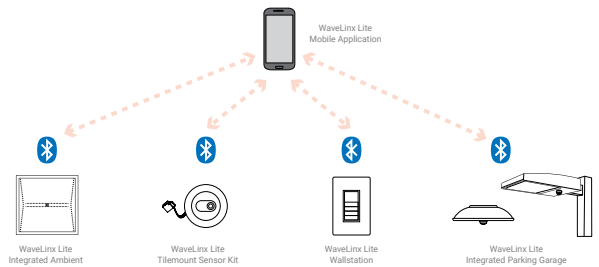
- Intuitive Android™ or Apple® iOS® app for basic system code compliant set up and configuration via Bluetooth
- Up to 28 unique areas per project site (WaveLinx Lite Bluetooth network)
- Up to 50 devices for an area, any one of 16 control zones, up to 6 occupancy sets, and custom lighting scenes
- Automatic occupancy or vacancy, sensor sensitivity, daylight dimming, etc. configurable through the app
- Refer to the WaveLinx system specifications for details



WaveLinx Lite WTK Tilemount Wiring Diagram



WaveLinx Lite Bluetooth Enabled System



WaveLinx – WTA Tilemount Sensor



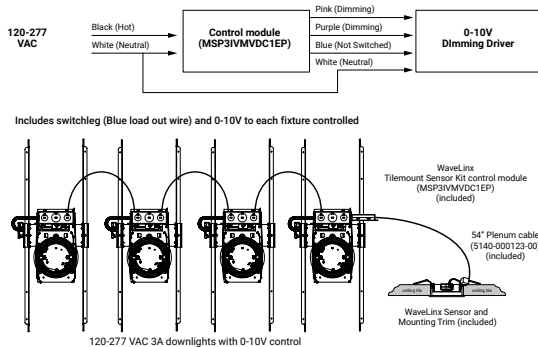
- WaveLinx functionality configures zones and customizes settings from one secure mobile app
- Automatic code commissioning that meets the strictest codes
- Fixtures and sensors integrate with Wireless Area Controller, Wall Stations, and Control Devices
- Stand-Alone Offices or Entire Building Network Installations



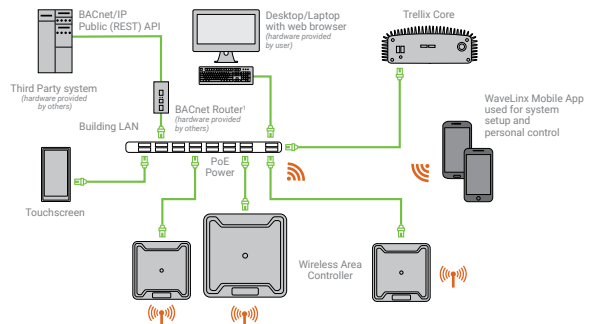
WaveLinx mobile app settings



WaveLinx WTA Tilemount Wiring Diagram



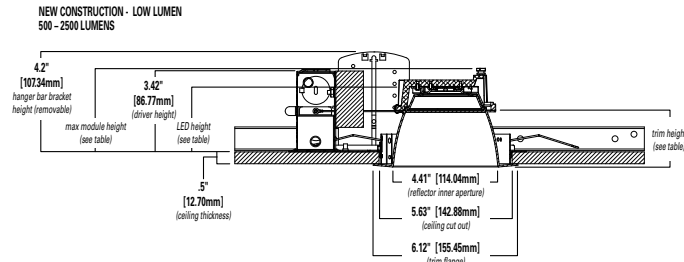
WaveLinx Trellix Building Management Integration



HALO Commercial **HC4 | HM4 | 41/41PS**

Dimensional and Mounting Details

NEW CONSTRUCTIONS - LOW LUMEN 500 – 2500 LUMENS

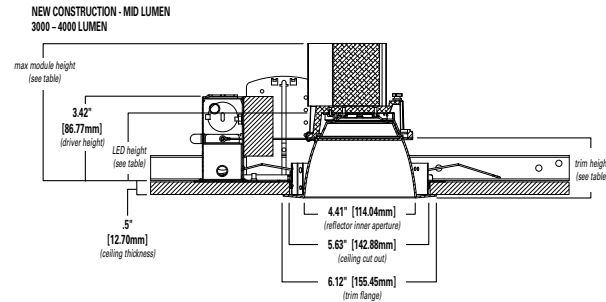


Low Lumen (500 – 2500 Lumens)*

Distribution	Max. Module Height	Trim Height	LED Height
Narrow	3.6"	2.5"	2.7"
Medium	3.7"	2.6"	2.8"
Wide	3.5"	2.4"	2.6"
Baffle	3.1"	2.4"	2.6"

*Max. height w/removable hanger bar bracket 4.2"

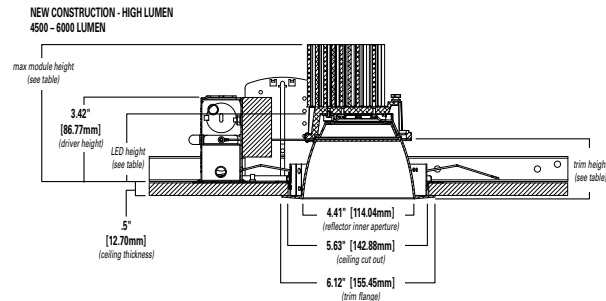
NEW CONSTRUCTIONS - MID LUMEN 3000 – 4000 LUMENS



Mid Lumen (3000 – 4000 Lumens)

Distribution	Max. Module Height	Trim Height	LED Height
Narrow	5.6"	2.5"	2.9"
Medium	5.7"	2.6"	3.0"
Wide	5.5"	2.4"	2.8"
Baffle	5.5"	2.4"	2.8"

NEW CONSTRUCTIONS - HIGH LUMEN 4500 – 6000 LUMENS



High Lumen (4500 – 6000 Lumens)

Distribution	Max. Module Height	Trim Height	LED Height
Narrow	5.9"	2.5"	2.9"
Medium	6.0"	2.6"	3.0"
Wide	5.8"	2.4"	2.8"
Baffle	5.8"	2.4"	2.8"



Project		Catalog #		Type	
Prepared by		Notes		Date	



HALO Commercial

HC4 | HM4 | 41/41PS

4-inch LED downlight and wall wash

Typical Applications

Office • Healthcare • Hospitality • Institutional • Mixed-Use/Retail

Interactive Menu

- Order Information page 2
- Product Specifications page 4
- Photometric Data page 5
- Energy & Performance Data page 8
- Connected Systems page 10
- Product Warranty

Product Certification



Product Features



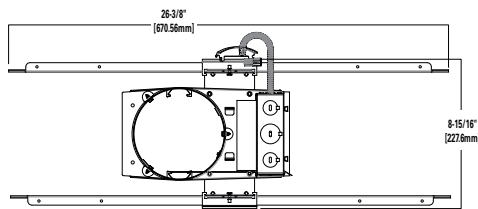
Control Compatibility



Top Product Features

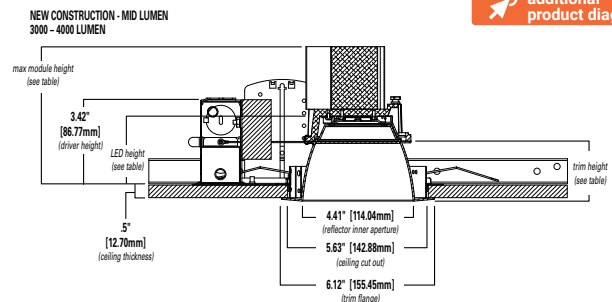
- New construction/remodel series; 500 to 6,000 lumens
- Narrow, Medium and Wide distributions; Wall wash with rotatable linear spread lens
- 2700K, 3000K, 3500K, 4000K and 5000K CCT; 80 or 90 CRI
- Universal voltage 120V-277V; Standard 0-10V driver dims to 1%
- Mounting frame converts to remodel that installs from below the ceiling
- Quick Spec emergency backup mounting frames - fast delivery option

Dimensional and Mounting Details



Mid Lumen (3000 – 4000 Lumens)

Distribution	Max. Module Height	Trim Height	LED Height
Narrow	5.6"	2.5"	2.9"
Medium	5.7"	2.6"	3.0"
Wide	5.5"	2.4"	2.8"
Baffle	5.5"	2.4"	2.8"



additional product diagrams



Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
HC415D010IEM7 HM40525935
41MDHWFIEM
Notes:

Type:
L3E
LDI24-110942

HALO Commercial

HC4 | HM4 | 41/41PS

Mounting Frame Order Information

Sample Number : HC420D010REM7 - HM40525930 - 41MDC

A complete luminaire consists of a housing frame, LED module, and reflector (ordered separately)

Mounting Frame	Lumens	Driver Options	Factory Installed Emergency & Connected Lighting Options	Accessories (Order & Install Separately)
HC4 = 4" new construction downlight housing	05 = 500 lm 07 = 750 lm 10 = 1000 lm	D010=UNV 120-277V, 50/60Hz, 0-10V 1%-100% dimming at 120-277V on 0-10V controls	REM7 = 7 watt emergency battery pack with remote test / indicator light, use with D010 only ⁽¹⁾⁽²⁾⁽⁶⁾ REM14 = 14 watt emergency battery pack with remote test / indicator light, use with D010 only ⁽¹⁾⁽²⁾⁽⁶⁾ IEM7 = 7 watt emergency battery pack with integral test / indicator light, use with D010 only ⁽¹⁾⁽²⁾⁽⁶⁾⁽¹⁰⁾ IEM14 = 14 watt emergency battery pack with integral test / indicator light, use with D010 only ⁽¹⁾⁽²⁾⁽⁶⁾⁽¹⁰⁾ B0D7ST = 7.5 watt Bodine self-test emergency battery pack with remote test / indicator light, use with D010 only ⁽¹⁾⁽²⁾⁽⁶⁾ WTA = Factory WaveLinX Tilemount Sensor Kit ⁽⁴⁾ WTK = Factory WaveLinX Lite Commercial Tilemount Sensor Kit ⁽⁵⁾	HB128APK = L channel hanger bar, 26", pair (replacement) RMB22 = Adjustable wood joist mounting bars, pair, extend to 22" long H347 = 347 to 120V step down transformer, 75VA H347Z00 = 347 to 120V step down transformer, 200VA WTA = Field WaveLinX Tilemount Sensor Kit ⁽⁴⁾ WTK = Field WaveLinX Lite Commercial Tilemount Sensor Kit ⁽⁵⁾
HC4CP = 4" new construction housing, Chicago Plenum - CCEA compliant	15 = 1500 lm 20 = 2000 lm 25 = 2500 lm 30 = 3000 lm 35 = 3500 lm 40 = 4000 lm 45 = 4500 lm ⁽⁷⁾ 50 = 5000 lm ⁽⁷⁾ 55 = 5500 lm ⁽⁷⁾ 60 = 6000 lm ⁽⁷⁾	Canada Option 500-5000 lumens: D010347 = 347VAC 50/60Hz 0-10V 1%-100% dimming. For 500, 750, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000lm models only ⁽¹⁾ Canada Option 5500-6000 lumens: D010X347 = step down transformer factory installed (with standard "D010" 120V-277V LED driver). For 5500, 6000lm models only ⁽¹⁾ DLV = Distributed Low Voltage driver 1%-100% dimming. DLV for use with DLVP system only. Refer to DLVP low-voltage power module and DLVP specifications for details. ⁽¹⁾	REM7 = 7 watt emergency battery pack with remote test / indicator light, use with DLV only ⁽¹⁾⁽²⁾⁽³⁾⁽⁶⁾ REM14 = 14 watt emergency battery pack with remote test / indicator light, use with DLV only ⁽¹⁾⁽²⁾⁽³⁾⁽⁶⁾ IEM7 = 7 watt emergency battery pack with integral test / indicator light, use with DLV only ⁽¹⁾⁽²⁾⁽³⁾⁽⁶⁾⁽¹⁰⁾ IEM14 = 14 watt emergency battery pack with integral test / indicator light, use with DLV only ⁽¹⁾⁽²⁾⁽³⁾⁽⁶⁾⁽¹⁰⁾	
Notes	Notes	Notes	Notes	Notes
	(7) Marked Spacing: Center to Center of Adjacent Luminaires = 36" Center of Luminaire to Building Member = 18" Minimum overhead = 0.5	(1) Not available with CP models	(1) Not available with CP models (2) Not available with D010347 (347V models) (3) ULUS for U.S. only (4) WTA = WaveLinX tile mount sensor kit for daylight dimming, PIR motion sensing, and optional RLTS - Real Time Location Services, use with D010 only (Refer to WaveLinX specifications) (5) WTK = WaveLinX Lite tile mount sensor kit for daylight dimming, PIR motion sensing, use with D010 only (Refer to WaveLinX Lite specifications) (6) Emergency battery backup options are Non-IC only, and rated for a minimum starting temperature of 0°C (10) IEM option requires compatible IEM reflector or baffle trim. See Trim Ordering below.	(4) WTA = WaveLinX tile mount sensor kit for daylight dimming, PIR motion sensing, and optional RLTS - Real Time Location Services, use with D010 only (Refer to WaveLinX specifications) (5) WTK = WaveLinX Lite tile mount sensor kit for daylight dimming, PIR motion sensing, use with D010 only (Refer to WaveLinX Lite specifications)

Rapid Response Emergency Mounting Frame Order Information

Sample Number :

Rapid Response Emergency Mounting Frame: RR-HC420D010REM7

LED module and reflectors are ordered separately.

Order separately: LED Module: HM40525835 | Reflector: 41MDC

Select from the Rapid Response Mounting Frame ordering information to receive the **Fast Delivery** option for the frame.

RR Code	Mounting Frame	Lumens	Driver Options	Factory Installed Emergency Options	Accessories (Order & Install Separately)
RR = East Region BRR = West Region	HC4 = 4" new construction downlight housing	05 = 500 lm 07 = 750 lm 10 = 1000 lm 15 = 1500 lm 20 = 2000 lm 25 = 2500 lm 30 = 3000 lm 35 = 3500 lm 40 = 4000 lm 45 = 4500 lm ⁽⁷⁾ 50 = 5000 lm ⁽⁷⁾ 55 = 5500 lm ⁽⁷⁾ 60 = 6000 lm ⁽⁷⁾	D010=UNV 120-277V, 50/60Hz, 0-10V 1%-100% dimming at 120-277V on 0-10V controls	REM7 = 7 watt emergency battery pack with remote test / indicator light, use with D010 only ⁽²⁾⁽⁶⁾ REM14 = 14 watt emergency battery pack with remote test / indicator light, use with D010 only ⁽²⁾⁽⁶⁾ IEM7 = 7 watt emergency battery pack with integral test / indicator light, use with D010 only ⁽²⁾⁽⁶⁾⁽¹⁰⁾ IEM14 = 14 watt emergency battery pack with integral test / indicator light, use with D010 only ⁽²⁾⁽⁶⁾⁽¹⁰⁾ B0D7ST = 7.5 watt Bodine self-test emergency battery pack with remote test / indicator light, use with D010 only ⁽²⁾⁽⁶⁾	HB128APK = L channel hanger bar, 26", pair (replacement) RMB22 = Adjustable wood joist mounting bars, pair, extend to 22" long
Notes	Notes	Notes	Notes	Notes	
	(7) Marked Spacing: Center to Center of Adjacent Luminaires = 36" Center of Luminaire to Building Member = 18" Minimum overhead = 0.5		(2) Not available with D010347 (347V models) (6) Emergency battery backup options are Non-IC only, and rated for a minimum starting temperature of 0°C (10) IEM option requires compatible IEM reflector or baffle trim. See Trim Ordering below.		



HALO Commercial **HC4 | HM4 | 41/41PS**

LED Module Order Information

LED Module	Lumens	CRI/CCT	
HM4 = 4" LED module	0525 = 500 - 2500 lumen	827 = 80CRI, 2700K	927 = 90CRI, 2700K
	3040 = 3000-4000 lumen	830 = 80CRI, 3000K	930 = 90CRI, 3000K
	4560 = 4500-6000 lumen	835 = 80CRI, 3500K	935 = 90CRI, 3500K
		840 = 80CRI, 4000K	940 = 90CRI, 4000K
		850 = 80CRI, 5000K	950 = 90CRI, 5000K
Notes	Notes	Notes	

Trim Order Information

Reflector	Distribution ⁽⁸⁾	Finish	Flange	Accessories
41 = 4" conical reflector	ND = narrow 50° beam angle 0.84 SC (nominal) MD = medium 60° beam angle 1.00 SC (nominal) WD = wide 75° beam angle 1.24 SC (nominal) RWW = rotatable wall wash with linear spread lens	C = Specular clear H = Semi-specular clear W = White	Blank = Polished flange standard with C & H reflectors Blank = White flange standard with W reflector WF = White flange option available with C & H reflectors	41RWWPK = Replacement part kit - wall wash lens insert - for use with 41RWW* only.
Notes	Notes	Notes	Notes	Notes
(8) Values are nominal for white reflector, others may vary.				

Baffle	Distribution ⁽⁸⁾	Finish	Flange	Accessories
41 = 4" baffle reflector	WD = wide 75° beam angle 1.24 SC (nominal) RWW = rotatable wall wash with linear spread lens	BB = Black baffle WB = White baffle	Blank = White flange standard with BB, & WB BF = Black flange option available with BB	41RWWPK = Replacement part kit - wall wash lens insert - for use with 41RWW* only.
Notes	Notes	Notes	Notes	Notes
(8) Values are nominal for white reflector, others may vary.				

Reflector	Distribution ⁽⁸⁾	Finish	Flange
41PS = 4" non-conductive polymer 'dead front' conical reflector⁽⁹⁾	MD = medium 60° beam angle 1.00 SC (nominal)	W = White	Blank = White flange standard with W reflector
Notes	Notes	Notes	Notes
(9) 41PS* is 1000-3000 lumens Non-IC rated. 500 & 750 lumens IC rated. 41PS is not for use over 3000 lumens in Non-IC or over 750 lumens in IC.		(8) Values are nominal for white reflector, others may vary.	

IEM Reflector	Distribution ⁽⁸⁾	Finish	Flange	Integral Emergency
41 = 4" conical reflector for integral emergency only	ND = narrow 50° beam angle 0.84 SC (nominal) MD = medium 60° beam angle 1.00 SC (nominal) WD = wide 75° beam angle 1.24 SC (nominal)	C = Specular clear H = Semi-specular clear W = White	Blank = Polished flange standard with C & H reflectors Blank = White flange standard with W reflector WF = White flange option available with C & H reflectors	IEM = Reflector for use with integral emergency housings only. Provides access hole for integral emergency test switch.
Notes	Notes	Notes	Notes	Notes
(8) Values are nominal for white reflector, others may vary.				

IEM Baffle	Distribution ⁽⁸⁾	Finish	Flange	Integral Emergency
41 = 4" baffle reflector for integral emergency only	WD = wide 75° beam angle 1.24 SC (nominal)	BB = Black baffle WB = White baffle	Blank = White flange standard with BB, & WB BF = Black flange option with BB	IEM = Reflector for use with integral emergency housings only. Provides access hole for integral emergency test switch.
Notes	Notes	Notes	Notes	Notes
(8) Values are nominal for white reflector, others may vary.				

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

HC415D010IEM7 HM40525935
41MDHWFIEM

Notes:

Type:**L3E**

LDI24-110942

HALO Commercial**HC4 | HM4 | 41/41PS****Product Specifications****Housing Frame**

- Boat shaped galvanized steel plaster frame with adjustable plaster lip
- Accommodates 1/2" to 1-1/2" thick ceilings
- Installs in new construction or from below the finished ceiling (non-accessible) for remodeling
- Provided with two remodel clips to secure the frame to the ceiling

Universal Mounting Bracket

- Adjusts 2" vertically from above and below the ceiling
- Use with the included mounting bars or with 1/2" Electric Metallic Tube (EMT)
- Removable to facilitate remodeling installation from below the finished ceiling

Mounting Bars

- Captive pre-installed No Fuss™ mounting bars lock to T-grid with screwdriver or pliers
- Centering detents allow for consistent positioning of fixtures

LED Module

- Proximity phosphors over chip on board LEDs provide a uniform source with high efficiency and no pixilation
- Available in 80 or 90 color rendering index (CRI)
- Color accuracy within 3 SDCM provides color consistency and uniformity
- 90 CRI option: R9>50 (refer to chromaticity information for details)
- Available in 2700K, 3000K, 3500K, 4000K and 5000K correlated color temperature (CCT)
- Lumen options include 500, 750, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000 lumens (nominal)
- Passive thermal management achieves 60,000 hours at 70% lumen maintenance (L70) in insulated ceilings (IC) and non-IC applications
- Integral diffuse lens provides visual shielding
- Integral connector allows quick connection to housing flex

Reflector

- Self-flanged aluminum reflectors available in narrow, medium or wide distribution patterns
- Medium distribution polymer non-conductive matte white reflector may be used to meet local codes for 'dead front' applications (500 & 750 lumen max. in IC and 3000 lumen max. in Non-IC)
- Wall wash reflector features a rotatable linear spread lens for alignment of vertical illumination
- Reflectors attach to LED module with three speed clamps
- Available in multiple painted or plated finishes

Reflector/Module Retention

- Reflector/module assembly is securely retained in the housing with two torsion springs

Driver

- Field-replaceable constant current driver provides low noise operation
- Universal 120-277VAC 50/60Hz input standard
- Continuous, 1% to 100% dimming with 0-10V analog control
- Optional low-voltage DC driver for use with Distributed Low Voltage Power (DLVP) system
- Distributed Low Voltage Power (DLVP) system combines power, lighting and controls with ease of installation (refer to DLVP Design Guide at www.cooperlighting.com for details)

Canada Options

- 347VAC 50/60Hz; 1% dimming on 0-10V analog control, for 500, 750, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000 lumen models only
- 347V step down transformer factory installed with the standard "D010" 120V-277V, LED driver on 5500, 6000 lumen models only

Emergency Option

- Provides 90 minutes of standby lighting, meeting most life safety codes for egress lighting
- Available with integral or remote charge indicator and test switch
- Available Self-Test (self-diagnostic) with remote charge indicator and test switch
- Quick Spec emergency ordering option for quick-turn projects

Connected Lighting System

Two WaveLinX connected solutions to choose from. Refer to WaveLinX system specifications and application guides for details.

WaveLinX PRO Tilemount Sensor Kit

- WaveLinX WTA tilemount sensor kit offers daylight dimming, PIR motion sensing, scene and zone configuration, automatic commissioning; and optional RLTS - Real Time Location Services available.

WaveLinX PRO Wireless Node

- WaveLinX PRO wireless node provides luminaire-level control with scene and zone configuration without an integrated sensor; Connects wirelessly with daylight dimming sensor and PIR motion sensor if desired. Use with 0-10V driver only.

WaveLinX LITE Tilemount Sensor Kit

- WaveLinX LITE WTK tilemount sensor kit offers daylight dimming and PIR motion sensing, scene and grouping configuration.

WaveLinX LITE Wireless Node

- WaveLinX Lite wireless node provides luminaire level control with scene and zone configuration without an integrated sensor; Connects wirelessly with daylight dimming sensor and PIR motion sensor if desired. Use with 0-10V driver only.

WaveLinX Tilemount Kits Application

- The WTA and WTK tilemount kits include a control module mounted on the luminaire junction box via 1/2" knock-out, and a tilemount sensor on 54-inch whip; for ceiling installation by direct-mount spring clips or via mounting bracket in octagon ceiling boxes.
- The WTA and WTK tilemount kits may be ordered as factory installed on the luminaire, or ordered separately as a field installed accessory kit.

Junction Box

- Galvanized steel junction box
- 20 in³ internal volume excluding voltage barrier
- 25 in³ internal total volume
- Voltage barrier for 0-10V dimming wires (occupies one 1/2" pry-out space)
- Listed for eight #12 AWG (four in, four out) 90°C conductors and feed-thru branch wiring
- Three 1/2" and two 3/4" trade size pry-outs available
- Three 4-port push wire nuts for mains voltage with 1-port for fixture connection

Compliance

- cULus Certified to UL 1598 / C22.2 No. 250.0, suitable for damp locations and wet locations in covered ceilings only
 - Emergency options provided with UL Listed emergency drivers to UL 924 / C22.2 No. 141, suitable for indoor/damp locations
 - IP20 - Above finished ceiling; IP64 - Below finished ceiling
 - Non-Insulated ceiling (Non-IC) rated for 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000 lumen models (insulation must be kept 3" from top and sides)
 - Insulated ceiling (IC) rated for 500, 750, 1000, 1500 lumen models and suitable for direct contact with air permeable insulation* (IC models are also suitable for Non-IC installations)
 - Non-IC marked spacing required for 4500, 5000, 5500, 6000 lumen models
 - Marked Spacing Center to Center of Adjacent Luminaires = 36"
 - Center of Luminaire to Building Member = 18"
 - Minimum overhead = 0.5"
 - Airtight per ASTM-E283-04
 - Suitable for use in clothes closets when installed in accordance with the NEC 410.16 spacing requirements
 - EMI/RFI emissions FCC CFR Title 47 Part 15 Class A at 120/277V
 - Contains no mercury or lead and RoHS compliant
 - Photometric testing completed in accordance of IES LM-79-08
 - Lumen maintenance projection in accordance of IES LM-80-08 and TM-21-11
 - 1,000 and 1,500 lumen, 90 CRI, ICAT models may be used to comply with State of California Title 24 residential code, per JA8 certification standards
 - May be used to comply with State of California Title 24 non-residential code as a dimmable LED luminaire
 - ENERGY STAR® certified, reference certified light fixtures database
- *Not for use in direct contact with spray foam insulation, consult NEMA LSD57-2013

Warranty

- Five year limited warranty, consult website for details: www.cooperlighting.com/legal



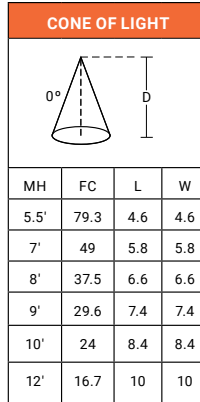
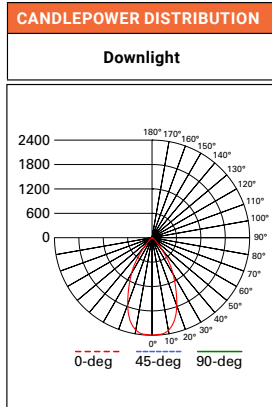
HALO Commercial **HC4 | HM4 | 41/41PS**

Photometric Data

[View IES files](#)

NARROW DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

NARROW (50° BEAM*)	
Test Number	P571728
Housing	HC420D010
Module	HM40525835
Reflector	41NDC
Lumens	2010 Lm
Efficacy	100.5 Lm/W
SC	0.84
UGR	12.2



Degrees Vertical	Candela
0	2400
5	2387
15	2110
25	1368
35	676
45	152
55	23
65	5
75	1
85	0
90	0

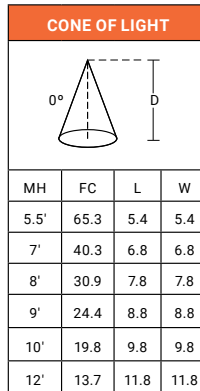
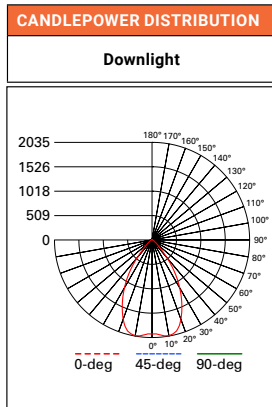
ZONAL LUMEN SUMMARY		
Zone	Lumens	% Fixture
0-30	1436	71.5
0-40	1848	92
0-60	2002	99.6
0-90	2010	100
90-180	0	0
0-180	2010	100

LUMINANCE	
Average Candela Degrees	Average 0° Luminance
45	26514
55	4968
65	1576
75	667
85	0

*Value are nominal for specular clear reflectors, other may vary.
SC = Spacing Criteria
UGR = Unified Glare Rating

MEDIUM DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

MEDIUM (60° BEAM*)	
Test Number	P571727
Housing	HC420D010
Module	HM40525835
Reflector	41MDC
Lumens	2096 Lm
Efficacy	104.8 Lm/W
SC	1.0
UGR	13.6



Degrees Vertical	Candela
0	1969
5	1997
15	1974
25	1467
35	800
45	192
55	26
65	4
75	1
85	0
90	0

ZONAL LUMEN SUMMARY		
Zone	Lumens	% Fixture
0-30	1408	67.1
0-40	1899	90.6
0-60	2091	99.7
0-90	2096	100
90-180	0	0
0-180	2096	100

LUMINANCE	
Average Candela Degrees	Average 0° Luminance
45	33405
55	5548
65	1197
75	667
85	0

*Value are nominal for specular clear reflectors, other may vary.
SC = Spacing Criteria
UGR = Unified Glare Rating

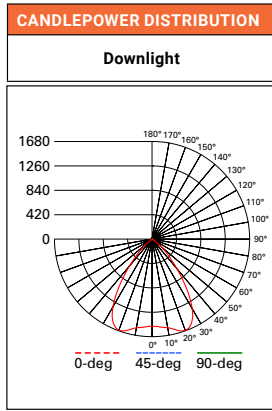
Note: Refer to IES files for more product data.



HALO Commercial **HC4 | HM4 | 41/41PS**

WIDE DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

WIDE (75° BEAM*)	
Test Number	P571730
Housing	HC420D010
Module	HM40525835
Reflector	41WDC
Lumens	2304 Lm
Efficacy	115.2 Lm/W
SC	1.25
UGR	15.7



CONE OF LIGHT				
MH	FC	L	W	
5.5'	49.9	6.8	6.8	
7'	30.8	8.6	8.6	
8'	23.6	9.8	9.8	
9'	18.6	11.2	11.2	
10'	15.1	12.4	12.4	
12'	10.5	14.8	14.8	

CANDELA TABLE	
Degrees Vertical	Candela
0	1509
5	1525
15	1630
25	1603
35	1012
45	369
55	44
65	5
75	1
85	0
90	0

ZONAL LUMEN SUMMARY		
Zone	Lumens	% Fixture
0-30	1334	57.9
0-40	1960	85.1
0-60	2296	99.7
0-90	2304	100
90-180	0	0
0-180	2304	100

LUMINANCE	
Average Candela Degrees	Average 0° Luminance
45	64437
55	9355
65	1576
75	667
85	0

*Value are nominal for specular clear reflectors, other may vary.
SC = Spacing Criteria
UGR = Unified Glare Rating

Photometric Multipliers (Nominal Lumen Values)

500 Lumen	750 Lumen	1000 Lumen	1500 Lumen	2000 Lumen	2500 Lumen	3000 Lumen	3500 Lumen
0.33	0.44	0.54	0.74	1.00	1.24	1.54	1.85

4000 Lumen	4500 Lumen	5000 Lumen	5500 Lumen	6000 Lumen
2.15	2.28	2.44	2.52	2.62

Multipliers for relative lumen values with other series models.

Color Finish Multipliers

Finish code	C	H	W/WB	BB
Finish	Specular Clear	Semi-Specular	Matte White White Baffle	Black Baffle
Multiplier	1.00	0.94	0.88	0.76

Multipliers for relative lumen values with other color finishes.

CCT Multipliers - 80CRI

2700K	3000K	3500K	4000K	5000K
0.89	0.96	1.00	1.03	1.03

Multipliers for relative lumen values with other series color temperatures.

CCT Multipliers - 90CRI

2700K	3000K	3500K	4000K	5000K
0.76	0.85	0.89	0.93	0.93

Multipliers for relative lumen values with other series color temperatures.

Note: Refer to IES files for more product data.

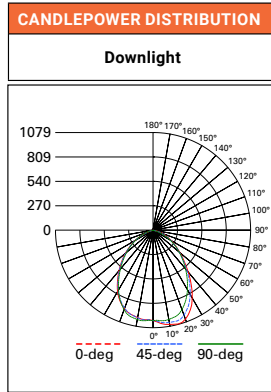


HALO Commercial

HC4 | HM4 | 41/41PS

WALL WASH DISTRIBUTION - SPECULAR CLEAR FINISH, 2000 LUMEN MODEL, 80 CRI, 3500K

WALL WASH	
Test Number	P571729
Housing	HC420D010
Module	HM40525835
Reflector	41RWWC
Lumens	2094 Lm
Efficacy	104.7 Lm/W
SC	1.15



CANDELA TABLE	
Degrees Vertical	Candela
0	1005
5	1041
15	1079
25	980
35	743
45	494
55	312
65	180
75	80
85	10
90	0

ZONAL LUMEN SUMMARY		
Zone	Lumens	% Fixture
0-30	789	37.7
0-40	1221	58.3
0-60	1872	89.4
0-90	2094	100
90-180	0	0
0-180	2094	100

LUMINANCE	
Average Candela Degrees	Average 0° Luminance
45	86207
55	67159
65	52681
75	38173
85	13445

SC = Spacing Criteria, nominal for specular clear reflector, other may vary.

SINGLE UNIT FOOTCANDLES							
2.5' from wall (distance from fixture along wall)							
1	18.7	13.6	6.1	2.3	0.8	0.3	0.1
2	28.4	22.3	12.2	5.7	2.6	1.2	0.6
3	25.9	21.4	13.3	7.2	3.8	2	1.1
4	19.6	16.9	11.6	7	4.1	2.4	1.4
5	13.6	12.3	9.2	6.2	3.9	2.5	1.5
6	9.3	8.6	7	5.1	3.5	2.3	1.6
7	6.4	6.1	5.2	4.1	3	2.1	1.5
8	4.6	4.4	3.9	3.2	2.5	1.8	1.3
9	3.3	3.2	2.9	2.5	2	1.6	1.2
10	2.5	2.4	2.2	2	1.7	1.4	1.1

MULTIPLE UNIT FOOTCANDLES								
2.5' from wall (Distance from fixture along wall)						2.5' from wall (Distance from fixture along wall)		
1	21	18.8	21	19.5	12.1	19.5		
2	34.1	34.1	34.1	31	24.4	31		
3	33.1	34.4	33.1	29.7	26.5	29.7		
4	26.7	28.7	26.7	23.7	23.3	23.7		
5	19.8	21.7	19.8	17.5	18.5	17.5		
6	14.4	15.8	14.4	12.8	14	12.8		
7	10.5	11.4	10.5	9.4	10.4	9.4		
8	7.8	8.3	7.8	7	7.7	7		
9	5.8	6.2	5.8	5.4	5.9	5.4		
10	4.4	4.7	4.4	4.1	4.5	4.1		

Photometric Multipliers (Nominal Lumen Values)

500 Lumen	750 Lumen	1000 Lumen	1500 Lumen	2000 Lumen	2500 Lumen	3000 Lumen	3500 Lumen
0.33	0.44	0.54	0.74	1.00	1.24	1.54	1.85

4000 Lumen	4500 Lumen	5000 Lumen	5500 Lumen	6000 Lumen
2.15	2.28	2.44	2.52	2.62

Multipliers for relative lumen values with other series models.

Color Finish Multipliers

Finish code	C	H	W/WB	BB
Finish	Specular Clear	Semi-Specular	Matte White White Baffle	Black Baffle
Multiplier	1.00	0.94	0.88	0.76

Multipliers for relative lumen values with other color finishes.

CCT Multipliers – 80CRI

2700K	3000K	3500K	4000K	5000K
0.89	0.96	1.00	1.03	1.03

Multipliers for relative lumen values with other series color temperatures.

CCT Multipliers – 90CRI

2700K	3000K	3500K	4000K	5000K
0.76	0.85	0.89	0.93	0.93

Multipliers for relative lumen values with other series color temperatures.

Note: Refer to IES files for more product data.



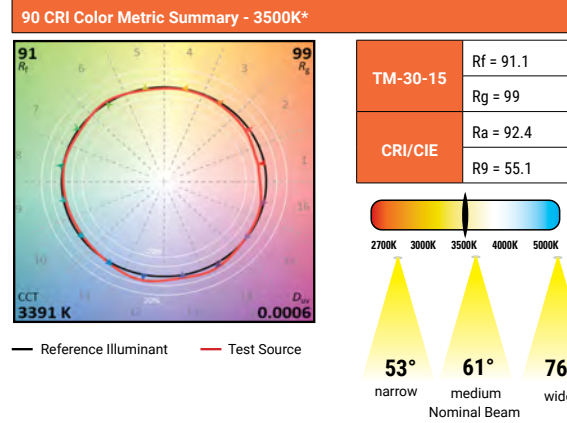
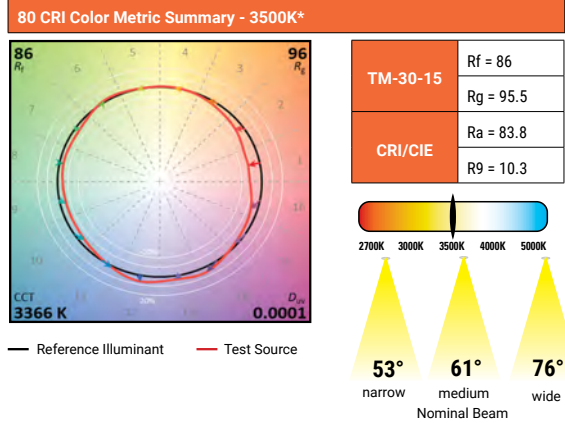


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Energy & Performance Data

COLOR METRICS - TM-30-15 & CRI/CIE (3500K)



* Color values are based on 61WDWB reflector, other finishes and field results may vary.

ENERGY DATA

Series	500 lumen		750 lumen		1000 lumen		1500 lumen		2000 lumen	
	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V
Input Voltage 120-277VAC	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V
Input Current (A)	0.051	0.026	0.067	0.036	0.083	0.039	0.119	0.053	0.171	0.077
Input Power (W)	6.1	6.5	7.9	8.3	10	10.4	14.5	14.5	20.9	20.6
In-rush (A)	1.9	8.4	2	8.4	2.2	8.5	2.7	8.5	2.1	9.7
Inrush duration (µs)	251	135	237	133	250	134	250	139	245	131
THD (%)	6.2	13.5	7.4	8.8	5.4	10.3	10	6.7	6.5	7.9
PF	≥ 0.99	≥ 0.9	≥ 0.98	≥ 0.92	≥ 0.99	≥ 0.95	≥ 0.99	≥ 0.97	≥ 0.99	≥ 0.96

Series	2500 lumen		3000 lumen		3500 lumen		4000 lumen		4500 lumen	
	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V
Input Voltage 120-277VAC	120V	277V	120V	277V	120V	277V	120V	277V	120V	277V
Input Current (A)	0.23	0.103	0.24	0.107	0.292	0.152	0.351	0.159	0.384	0.172
Input Power (W)	27.5	27.5	28.6	28.5	34.6	35.1	42.1	42.1	45.9	45.6
In-rush (A)	2.5	5.6	2.5	11.6	3.4	13.9	3.1	14.7	3.1	14.8
Inrush duration (µs)	232	123	216	111	183	95	200	98	202	100
THD (%)	6.5	8.1	7.8	8.3	5.6	10	4.1	9.5	4.5	8.5
PF	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.93	≥ 0.99	≥ 0.94	≥ 0.99	≥ 0.95

Series	5000 lumen		5500 lumen		6000 lumen	
	120V	277V	120V	277V	120V	277V
Input Voltage 120-277VAC	120V	277V	120V	277V	120V	277V
Input Current (A)	0.419	0.186	0.457	0.201	0.489	0.214
Input Power (W)	50.1	49.5	54.6	53.7	58.4	57.4
In-rush (A)	3.1	15	3.2	14.8	3.4	14.8
Inrush duration (µs)	202	117	196	131	192	121
THD (%)	5.5	7.6	7	7.2	8.1	7.2
PF	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.96	≥ 0.99	≥ 0.97

Minimum starting temperature -30°C (-22°F)*
(Nominal input 120-277VAC & 100% of rated output power)

Sound Rating: Class A standards

Notes:

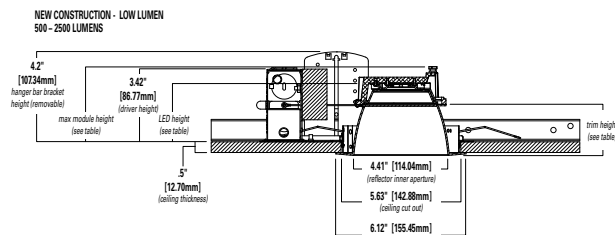
* Emergency Battery packs are rated for a minimum starting temperature of 0°C.



HALO Commercial **HC4 | HM4 | 41/41PS**

Dimensional and Mounting Details

NEW CONSTRUCTIONS - LOW LUMEN 500 – 2500 LUMENS



Low Lumen (500 – 2500 Lumens)*

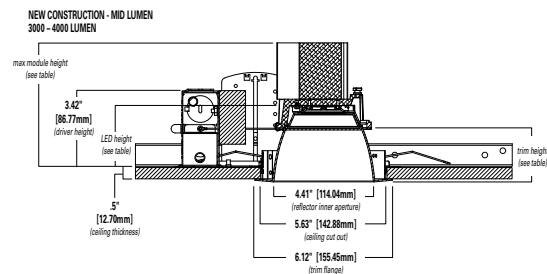
Distribution	Max. Module Height	Trim Height	LED Height
Narrow	3.6"	2.5"	2.7"
Medium	3.7"	2.6"	2.8"
Wide	3.5"	2.4"	2.6"
Baffle	3.1"	2.4"	2.6"



Low Lumen Module

*Max. height w/removable hanger bar bracket 4.2"

NEW CONSTRUCTIONS - MID LUMEN 3000 – 4000 LUMENS



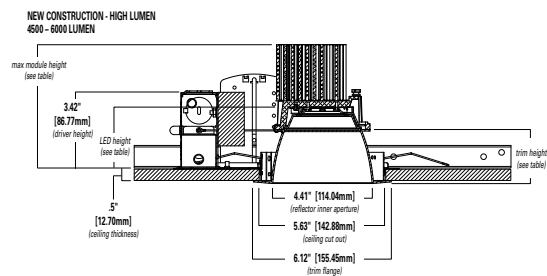
Mid Lumen (3000 – 4000 Lumens)

Distribution	Max. Module Height	Trim Height	LED Height
Narrow	5.6"	2.5"	2.9"
Medium	5.7"	2.6"	3.0"
Wide	5.5"	2.4"	2.8"
Baffle	5.5"	2.4"	2.8"



Mid Lumen Module

NEW CONSTRUCTIONS - HIGH LUMEN 4500 – 6000 LUMENS



High Lumen (4500 – 6000 Lumens)

Distribution	Max. Module Height	Trim Height	LED Height
Narrow	5.9"	2.5"	2.9"
Medium	6.0"	2.6"	3.0"
Wide	5.8"	2.4"	2.8"
Baffle	5.8"	2.4"	2.8"



High Lumen Module



HALO Commercial HC4 | HM4 | 41/41PS

Connected Solutions

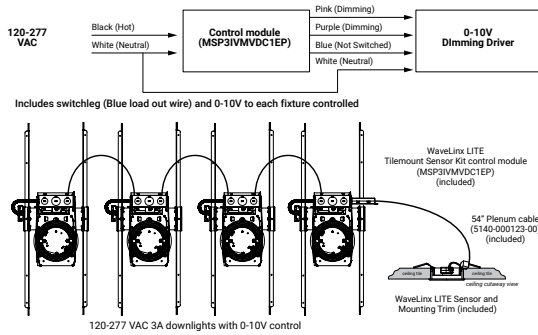
WaveLinX LITE - WTK Tilemount Sensor



- Intuitive Android™ or Apple® iOS® app for basic system code compliant set up and configuration via Bluetooth
- Up to 28 unique areas per project site (WaveLinX LITE Bluetooth network)
- Up to 50 devices for an area, any one of 16 control zones, up to 6 occupancy sets, and custom lighting scenes
- Automatic occupancy or vacancy, sensor sensitivity, daylight dimming, etc. configurable through the app
- Refer to the WaveLinX system specifications for details



WaveLinX LITE WTK Tilemount Wiring Diagram



WaveLinX LITE Bluetooth Enabled System



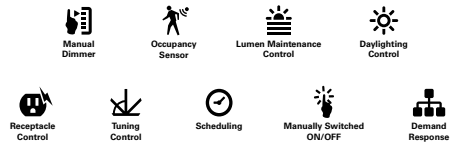
WaveLinX PRO – WTA Tilemount Sensor



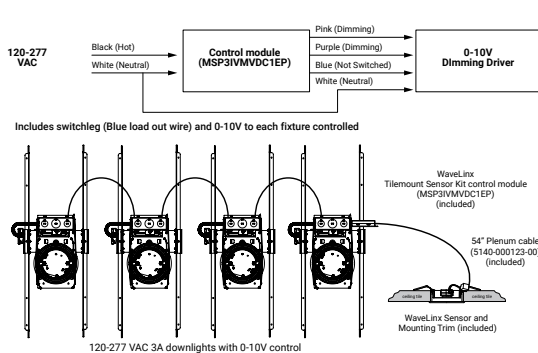
- WaveLinX PRO tilemount functionality configures zones and customizes settings from one secure mobile app
- Automatic code commissioning that meets the strictest codes
- Fixtures and sensors integrate with Wireless Area Controller, Wall Stations, and Control Devices
- Stand-Alone Offices or Entire Building Network Installations



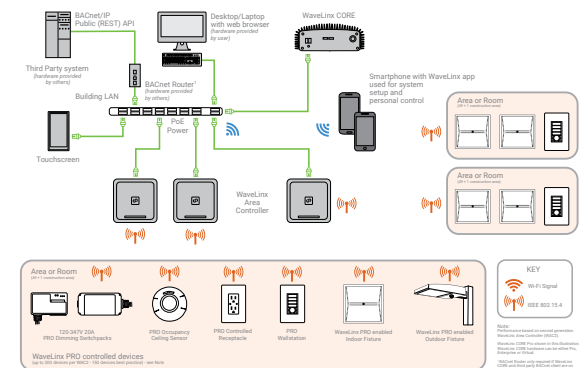
WaveLinX mobile app settings



WaveLinX WTA Tilemount Wiring Diagram



WaveLinX CORE Building Management Integration





HALO Commercial **HC4 | HM4 | 41/41PS**

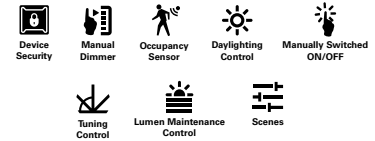
Connected Solutions

WaveLinX LITE Wireless Node - WLN

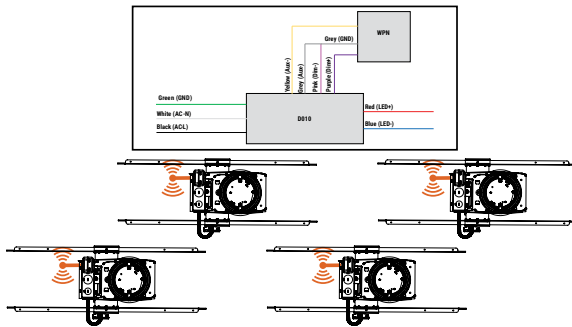
- Intuitive Android™ or Apple® iOS® app for basic system code compliant set up and configuration via Bluetooth
- Up to 28 unique areas per project site (WaveLinX LITE Bluetooth network)
- Up to 50 devices for an area, any one of 16 control zones, up to 6 occupancy sets, and custom lighting scenes
- Refer to the WaveLinX system specifications for details



WaveLinX mobile app settings



WaveLinX LITE Wireless Node (WLN) Wiring Diagram



WaveLinX LITE Bluetooth Enabled System

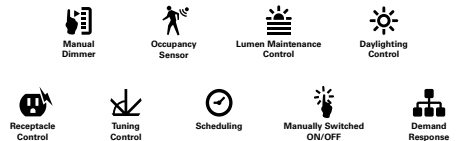


WaveLinX PRO Wireless Node - WPN

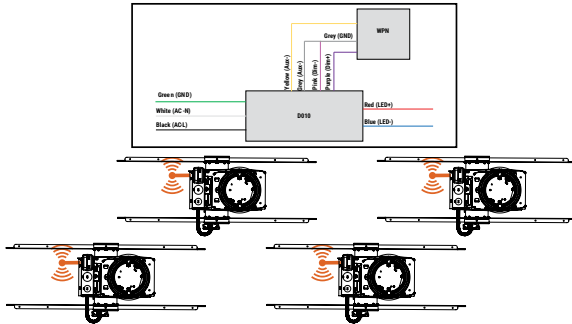
- WaveLinX Wireless functionality configures zones and customizes settings from one secure mobile app
- Automatic code commissioning that meets the strictest codes
- Fixtures and sensors integrate with WaveLinX Area Controller, Wall Stations, and Control Devices
- Stand-Alone Offices or Entire Building Network Installations



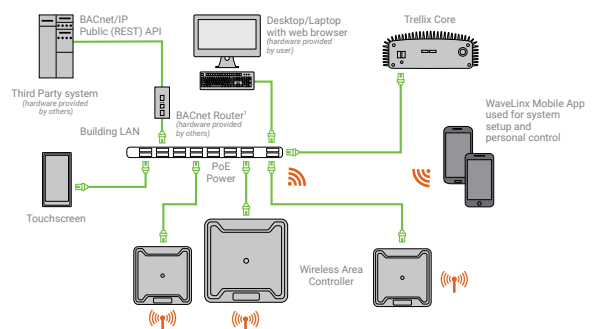
WaveLinX mobile app settings



WaveLinX PRO Wireless Node (WPN) Wiring Diagram



WaveLinX CORE Building Management Integration





Project		Catalog #		Type	
Prepared by		Notes		Date	



Portfolio

LDA3B

3-1/2" Adjustable/slope downlight

Typical Applications

Office • Education • Healthcare • Hospitality • Retail • Code-Compliance Areas • Sports Venues

Interactive Menu

- Order Information page 2
- Product Specifications page 3
- Photometric Data page 4
- Energy Data page 8
- Connected System page 9
- Product Warranty

Product Certification



Product Features



Control Compatibility

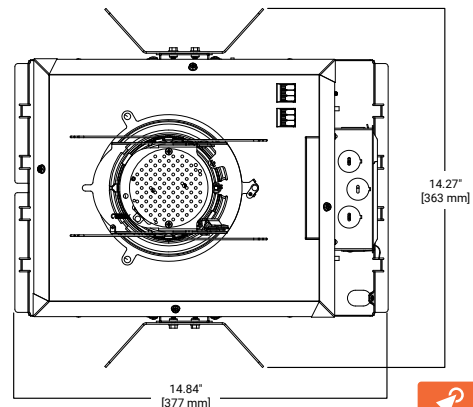
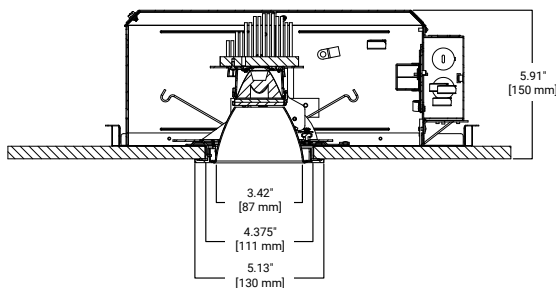


Top Product Features

- Available in 250 to 2,300 lumens; Insulated Ceiling (IC) rated
- Offered in 90 and 97 CRI; Locking 365° rotation and 45° tilt holds any aiming position
- Interchangeable optics in asymmetric and 5° increments from 10°-70°; Media holder accepts two lens media
- 2400K, 2700K, 3000K, 3500K, 4000K, 5000K; D2W™ option from 3000K to 1850K
- W2N tunable white CCT range 2700K to 6500K or 2000K to 5000K

Dimensional and Mounting Details

2 X 6 CONFIGURATION
For 250-1300 lumens



additional product diagrams



Job Name:
South Dade Regional Library Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
LDA3B10R40-90-35-D010
E3AAHSFWF HB26
Notes:

Type:
L3A
LDI24-110942

Portfolio

LDA3B

Order Information

SAMPLE ORDER NUMBER: LDA3B10R309030D010-E3AACKH

Housing	Lumen ⁽¹⁾	Distribution	CRI	Color	Voltage
LDA3B = New construction 3-inch adjustable	02 = 250 lumens ⁽¹⁰⁾	R10 = 10° ⁽⁹⁾	90 = 90 CRI	24 = 2400K	Blank = 120-277V
LDA3BCP = Chicago Plenum new construction 3-inch adjustable	07 = 700 lumens	R15 = 15°	97 = 97 CRI ⁽¹¹⁾	27 = 2700K	3 = 347V ⁽⁶⁾
	10 = 1000 lumens	R20 = 20°		30 = 3000K	
	13 = 1300 lumens	R25 = 25°		35 = 3500K	
	18 = 1800 lumens	R30 = 30°		40 = 4000K	
	23 = 2300 lumens ⁽²⁾	R35 = 35°		50 = 5000K	
	2R2040 = Elliptical 20° x 40°	R40 = 40°		9030D2W = dim to warm ⁽¹⁵⁾	
	2R2050 = Elliptical 20° x 50°	R45 = 45°		W2N902050 = 2000K-5000K ⁽⁵⁾	
	2R2060 = Elliptical 20° x 60°	R50 = 50°		W2N902765 = 2700K-6500K ⁽⁵⁾	
		R55 = 55°			
		R60 = 60°			
		R65 = 65°			
		R70 = 70°			
		2R2040 = Elliptical 20° x 40° optic			
		2R2050 = Elliptical 20° x 50° optic			
		2R2060 = Elliptical 20° x 60° optic			
		Blank = no optic order separately			

Driver	Options ⁽⁸⁾
D010 =0-10V 1% Dimming, 120-277V	EMBOD = Bodine® Emergency Module with Remote Test Switch
D010TR =0-10V or Line Voltage Dimming, 1% to 100%, 120V-277V	EM7 = 7W Emergency Module with Remote Test Switch
DE010 =0-10V Linear Dimming, 0% to 100%, 120V-277V	EM14 = 14W Emergency Module with Remote Test Switch
D5LT =Fifth Light® DALI DT6 Logarithmic Dimming, 0% to 100%, 120V-277V	EMV7 = 7W Low Voltage Emergency Module with Remote Test Switch
DMX =DMX/RDM Logarithmic Dimming, 0% to 100%, 120V-277V ⁽⁷⁾⁽⁸⁾	EMV14 = 14W Low Voltage Emergency Module with Remote Test Switch
DMXC5 =DMX/RDM Logarithmic Dimming, 0% to 100%, 120V-277V, with RJ45 connection ⁽⁷⁾⁽⁸⁾	WPST =Factory installed Wavelinx (includes control module, sensor, cable, tilemount and ceiling mount sensor) ⁽⁹⁾⁽¹⁴⁾⁽¹⁷⁾
DLE =Lutron Ecosystem dimming 1% to 100%, 120V-277V ⁽¹⁸⁾	WLST =Factory installed WaveLinX LITE Sensor Kit ⁽⁹⁾⁽¹⁴⁾⁽¹⁷⁾
DLV =Low voltage dimming driver (1-100%) for use with DLVP system ⁽⁹⁾	WPN = WaveLinX PRO Wireless Node without sensor ⁽²⁰⁾

Reflector	Finish	Trim Ring
E3AA = 3.5° Aperture open angle cut	C = Specular Clear	Blank = Matte white metal trim ring
E3AA20 = 3.5° Aperture open 20° angle cut	H = Semi-specular clear	SE = Self flanged ⁽¹²⁾
E3SLOT = 3.5° Aperture open 20° slot cut	G = Gold	SFWF = Self flanged painted white ⁽¹²⁾
E3AASR = 3.5° Aperture lensed angle cut	WMH = Warm haze	
E3MR = 3.5° Aperture open downlight	WH = Wheat	
E3SR = 3.5° Aperture lensed downlight	WHH = Wheat haze	
E3LWW = 3.5° Aperture lensed wall wash	GP = Graphite	
	GPH = Graphite haze	Painted Finish
	K = Cognac	MW = Matte White
	KH = Cognac haze	W = Gloss white
	CC = Chocolate	BB = Black baffle ⁽¹¹⁾
	CCH = Chocolate haze	WB = White baffle ⁽¹¹⁾
	B = Black	



Pinhole	Flange Style and Finish
E3AASRPIN = 1.75° Aperture lensed pinhole	Blank = Matte white die-cast flange
E3PINL = 1.5° Aperture lensed pinhole with black occlus	W = Matte white aluminum die-cast flange with white occlus ⁽¹³⁾
E3OVAL = 2" oval	

Accessories	Media	Optic
Bar Hangers	L100 lenses - optical lenses	2R15SP = 15°
HB26 = C-channel Bar Hanger, 26" Long, Pair	L110N = Diffuse Sandblasted Lens	2R20 = 20°
HBSU = C-channel Bar Hanger, 30" Long, Pair	L111 = Soft Focus Lens	2R25NFL = 25°
RMB22 = Wood Joist Bar Hanger, 22" Long, Pair	L113 = Prismatic Spread Lens	2R30 = 30°
FMC3 = Flush Mount Collar Accessory ⁽¹⁹⁾	L115 = Linear Spread Lens	2R35 = 35°
PLE3 = Plaster Lip Extender for Up to 2" Thick Ceilings	L100MB = Hex cell louver	2R40FL = 40°
Connected Lighting Systems ⁽⁹⁾		2R45 = 45°
WPST = Field installed WaveLinX sensor Kit ⁽¹⁴⁾		2R2040 = Elliptical 20° x 40°
WLST = Field installed WaveLinX Lite Sensor Kit ⁽¹⁴⁾		2R2050 = Elliptical 20° x 50°
		2R2060 = Elliptical 20° x 60°

- Notes:**
- Nominal lumens will vary depending on selected color, driver and reflector finish.
 - Non-IC
 - Offered up to 1000 lumens, must be specified with housing
 - 97CRI for 2700 and 3000K
 - Choose D5LT or DE010 driver, limited to 1000 lumens
 - 347V with D010 driver
 - DMX fixtures default to full on upon loss of DMX signal.
 - Requires above ceiling access.
 - Refer to system specifications for additional information, features, and benefits. Order either factory installed option accessory.
 - D010TR only
 - Available on E3AA and E3MR.
 - Not available with baffles.
 - E3PINL only.
 - WPST = WaveLinX wireless sensor kit for daylight dimming, PIR motion sensing, and optional RLTS - Real Time Location Services, use with 0-10V only.
 - Limited to 1000 and 1300 lumens
 - WLST = WaveLinX LITE tilemount sensor kit for daylight dimming, PIR motion sensing, use with D010 only (Refer to WaveLinX LITE system specifications)
 - Not available with Chicago Plenum or IC rating.
 - For 1000 lumens and above.
 - Not for use with self flanged reflectors
 - WPN = WaveLinX PRO wireless node provides luminaire-level control with scene and zone configuration without an integrated sensor; Connects wirelessly with daylight dimming sensor and PIR motion sensor if desired. Use with 0-10V driver only.

Job Name:

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

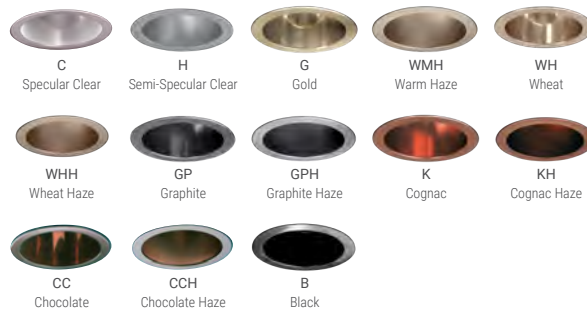
Catalog Number:

LDA3B10R40-90-35-D010
E3AAHSFWF HB26

Notes:

Type:**L3A**

LDI24-110942

Portfolio**LDA3B****Reflector Finishes****Painted Finishes****Flanges****Product Specifications****Lower Shielding Reflector**

- Open or lensed, low brightness 3-1/2" aperture, spun 0.04 high purity aluminum angle cut or slot cut, for flat or sloped ceilings
- Lensed wall wash with neutral color linear glass lens provides smooth vertical illumination with minimal downlight
- Open or lensed, low brightness 3-1/2" aperture, spun 0.04 high purity aluminum reflector providing 50° source and source image cutoff
- Open or lensed die cast round or oval pinhole with angle cut upper reflector
- Pinhole includes black oculus to control glare
- Available in all Portfolio Alzak® finishes
- Metal trim ring can be removed for painting
- Plaster lathing ring accessory offered for flush reflector transition

Trim Retention

- Retained with two torsion springs holding the flange tightly to the finished ceiling

Housing

- Steel housing painted matte black to eliminate stray light
- Top accessible
- Ships with overspray protector installed
- Collar designed for 1-inch ceiling thickness.
- PLE3 plaster lip extender available for up to 2-inch ceiling thickness

Adjustment Mechanism

- Provides smooth 365° rotation and 45° tilt adjustment allowing LED optic to pivot about the center of the aperture at the ceiling line for maximum light output without flashback
- Locks in position with 1/4" Phillips driver
- Aiming scale enables consistent setting across multiple fixtures

Optic

- Interchangeable silicone optic in elliptical and 5° increments from 10°-70° providing smooth beam without color separation
- Elliptical beams
- Media holder fits onto optic holder and holds up to two lens media

Universal Mounting Bracket

- Accepts 1/2" Electric Metallic Tube (EMT), C-channel, T-bar fasteners and bar hangers

Junction Box

- Seven 1/2" trade size pry outs positioned to allow straight conduit runs
- Listed for four #12 AWG (two in, two out) 90°C conductors and feed-through branch wiring for top access units (with top access units only)
- Lever connectors for simple push in wiring

Thermal

- Forged aluminum heat sink conducts heat away from the LED module for optical performance and longer life

LED System

- Contains a plurality of high brightness white LED's combined with TIR optic produces even distribution with no pixilation
- Lumen output shall not decrease by more than 10% over the minimum life of 55,000 hours (L90 > 55,000 hours)
- Color variation within 2-step MacAdam ellipses
- Available in 2400K, 2700K, 3000K, 3500K, 4000K and 5000K correlated color temperature (CCT)
- Available in 90 or 97 color rendering index (CRI)

VividTune™ Color Tuning Solutions

- D2W™ – Dim-to-Warm shifts CCT from 3000K to 1850K as fixture dims, mimicking halogen sources
- W2N – Tunable white CCT range from 2700K to 6500K or 2000K to 5000K; 90 CRI

Driver

- Standard 120-277V 0-10V dimming driver provides flicker-free dimming from 100% to 1%
- Optional 120V leading edge/0-10V 120-277V combination, Fifth Light, DMX or Lutron® Ecosystem
- Standard 0-10V driver and 0-10V leading edge can be serviced from above or through the aperture
- Distributed Low Voltage Power (DLVP) system combines power, lighting and controls with ease of installation.

Connected Lighting System

Two WaveLinx connected solutions to choose from. Refer to WaveLinx system specifications and application guides for details.

WaveLinx PRO Tilemount Sensor Kit

- WaveLinx WPST tilemount sensor kit offers daylight dimming, PIR motion sensing, scene and zone configuration, automatic commissioning; and optional RLTS - Real Time Location Services available.

WaveLinx PRO Wireless Node

- WaveLinx PRO wireless node provides luminaire-level control with scene and zone configuration without an integrated sensor; Connects wirelessly with daylight dimming sensor and PIR motion sensor if desired. Use with 0-10V driver only.

WaveLinx LITE Tilemount Sensor Kit

- WaveLinx LITE WLST tilemount sensor kit offers daylight dimming and PIR motion sensing, scene and grouping configuration.

WaveLinx Tilemount Kits Application

- The WPST and WLST tilemount kits include a control module mounted on the luminaire junction box via 1/2" knock-out, and a tilemount sensor on 54-inch whip; for ceiling installation by direct-mount spring clips or via mounting bracket in octagon ceiling boxes.
- The WPST and WLST tilemount kits may be ordered as factory installed on the luminaire, or ordered separately as a field installed accessory kit.

Compliance

- Thermally protected, IC rated up to 1800 lumens
- cULus Certified to UL 1598 / C22.2 No. 250.0 suitable for wet locations with downlight; damp location with wall wash and hyperbolic with covered ceiling
- Optional City of Chicago environmental environmental air (CCEA) marking for plenum applications
- EMI/RFI emissions per FCC 47CFR Part 18 Class B consumer limits
- Airtight with lensed trims
- RoHS compliant
- Photometric testing completed in accordance with IES LM-79 and TM-30 standards
- LED life testing completed in accordance with IES LM-80 standards
- Can be used for State of California Title 24 high efficacy LED compliance under JA8, reference Modernized Appliance Efficiency Database System (MAEDBS) for 2016 JA8 High Efficacy Lighting
- ENERGY STAR® certified, reference certified light fixtures database

Warranty

- Five year warranty www.cooperlighting.com/legal



Portfolio **LDA3B**

Photometric Data

15°		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CANDELA TABLE	ZONAL LUMEN SUMMARY	LUMINANCE				
Test Number	P410967			Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LDA3B			0	11434	0-30	1278	99.2	35	1947
Module	13R159035D010			5	9613	0-40	1287	100	45	0
Trim	E3MRC			15	1335	0-60	1288	100	55	0
Lumens	1288			25	168	0-90	1288	100	65	0
Efficacy	92 Lm/W			35	10	90-180	0	0	75	0
SC	0.3			45	0	0-180	1288	100		
UGR	NA	55	0							
		65	0							
		75	0							
		85	0							
		90	0							

15° / 30° Tilt		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CONE OF LIGHT																																																																						
Test Number	P407923		Horizontal	Vertical																																																																						
Housing	LDA3B		<table border="1"> <thead> <tr> <th>MH</th> <th>FC</th> <th>L</th> <th>W</th> <th>CB</th> </tr> </thead> <tbody> <tr><td>5.5'</td><td>63.6</td><td>4.6</td><td>2.8</td><td>3.2</td></tr> <tr><td>7'</td><td>39.2</td><td>5.9</td><td>3.4</td><td>4</td></tr> <tr><td>8'</td><td>30</td><td>6.8</td><td>4</td><td>4.6</td></tr> <tr><td>9'</td><td>23.7</td><td>7.6</td><td>4.6</td><td>5.2</td></tr> <tr><td>10'</td><td>19.2</td><td>8.6</td><td>5</td><td>5.8</td></tr> <tr><td>12'</td><td>13.4</td><td>10.3</td><td>6</td><td>6.9</td></tr> </tbody> </table>	MH	FC	L	W	CB	5.5'	63.6	4.6	2.8	3.2	7'	39.2	5.9	3.4	4	8'	30	6.8	4	4.6	9'	23.7	7.6	4.6	5.2	10'	19.2	8.6	5	5.8	12'	13.4	10.3	6	6.9	<table border="1"> <thead> <tr> <th>D</th> <th>FC</th> <th>L</th> <th>W</th> <th>CB</th> </tr> </thead> <tbody> <tr><td>1'</td><td>7300.4</td><td>0.2</td><td>0.2</td><td>1.7</td></tr> <tr><td>2'</td><td>1825.1</td><td>0.6</td><td>0.6</td><td>3.5</td></tr> <tr><td>3'</td><td>811.2</td><td>1</td><td>1</td><td>5.2</td></tr> <tr><td>4'</td><td>456.3</td><td>1.4</td><td>1.2</td><td>6.9</td></tr> <tr><td>5'</td><td>292</td><td>1.8</td><td>1.6</td><td>8.7</td></tr> <tr><td>6'</td><td>202.8</td><td>2.2</td><td>2</td><td>10.4</td></tr> </tbody> </table>	D	FC	L	W	CB	1'	7300.4	0.2	0.2	1.7	2'	1825.1	0.6	0.6	3.5	3'	811.2	1	1	5.2	4'	456.3	1.4	1.2	6.9	5'	292	1.8	1.6	8.7	6'	202.8	2.2	2	10.4
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Efficacy	86.3 Lm/W																																																																									
SC	0.44																																																																									
UGR	NA																																																																									

CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
0	244	0-30	661	54.7	35	1573627
5	587	0-40	1122	92.9	45	154586
15	1803	0-60	1205	99.7	55	6881
25	10191	0-90	1208	100	65	229
35	8001	90-180	0	0	75	0
45	678	0-180	1208	100		
55	24					
65	1					
75	0					
85	0					
90	0					

CCT Multipliers – 90CRI

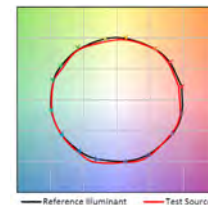
2700K	3000K	3500K	4000K
0.923	0.963	1.00	1.02

Multipliers for relative lumen values with other color temperatures.

Note: Refer to IES files for more product data.

Color Metrics - TM-30-15 & CRI/CIE

TM-30-15	Rf = 91.6
	Rg = 98.6
CRI/CIE	Ra = 94.9
	R9 = 67





Job Name:
 South Dade Regional Library Specifications
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LDA3B10R40-90-35-D010
 E3AAHSFWF HB26
 Notes:

Type:
L3A
 LDI24-110942

Portfolio **LDA3B**

Photometric Data

25°		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CANDELA TABLE	ZONAL LUMEN SUMMARY	LUMINANCE																																																									
Test Number	P411015			<table border="1"> <thead> <tr> <th>Degrees Vertical</th> <th>Candela</th> </tr> </thead> <tbody> <tr><td>0</td><td>6168</td></tr> <tr><td>5</td><td>5730</td></tr> <tr><td>15</td><td>2214</td></tr> <tr><td>25</td><td>233</td></tr> <tr><td>35</td><td>14</td></tr> <tr><td>45</td><td>0</td></tr> <tr><td>55</td><td>0</td></tr> <tr><td>65</td><td>0</td></tr> <tr><td>75</td><td>0</td></tr> <tr><td>85</td><td>0</td></tr> <tr><td>90</td><td>0</td></tr> </tbody> </table>	Degrees Vertical	Candela	0	6168	5	5730	15	2214	25	233	35	14	45	0	55	0	65	0	75	0	85	0	90	0	<table border="1"> <thead> <tr> <th>Zone</th> <th>Lumens</th> <th>% Fixture</th> </tr> </thead> <tbody> <tr><td>0-30</td><td>1248</td><td>98.8</td></tr> <tr><td>0-40</td><td>1262</td><td>99.9</td></tr> <tr><td>0-60</td><td>1263</td><td>100</td></tr> <tr><td>0-90</td><td>1263</td><td>100</td></tr> <tr><td>90-180</td><td>0</td><td>0</td></tr> <tr><td>0-180</td><td>1263</td><td>100</td></tr> </tbody> </table>	Zone	Lumens	% Fixture	0-30	1248	98.8	0-40	1262	99.9	0-60	1263	100	0-90	1263	100	90-180	0	0	0-180	1263	100	<table border="1"> <thead> <tr> <th>Average Candela Degrees</th> <th>Average 0° Luminance</th> </tr> </thead> <tbody> <tr><td>35</td><td>2793</td></tr> <tr><td>45</td><td>0</td></tr> <tr><td>55</td><td>0</td></tr> <tr><td>65</td><td>0</td></tr> <tr><td>75</td><td>0</td></tr> </tbody> </table>	Average Candela Degrees	Average 0° Luminance	35	2793	45	0	55	0	65	0	75	0
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CCT Multipliers – 90CRI

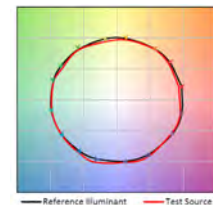
2700K	3000K	3500K	4000K
0.923	0.963	1.00	1.02

Multipliers for relative lumen values with other color temperatures.

Note: Refer to IES files for more product data.

Color Metrics - TM-30-15 & CRI/CIE

TM-30-15	Rf = 91.6
	Rg = 98.6
CRI/CIE	Ra = 94.9
	R9 = 67





Job Name:
 South Dade Regional Library Specifications
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LDA3B10R40-90-35-D010
 E3AAHSFWF HB26
 Notes:

Type:
L3A
 LDI24-110942

Portfolio **LDA3B**

Photometric Data

40°		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CANDELA TABLE	ZONAL LUMEN SUMMARY	LUMINANCE																																																									
Test Number	P411063			<table border="1"> <thead> <tr> <th>Degrees Vertical</th> <th>Candela</th> </tr> </thead> <tbody> <tr><td>0</td><td>3148</td></tr> <tr><td>5</td><td>3152</td></tr> <tr><td>15</td><td>2738</td></tr> <tr><td>25</td><td>584</td></tr> <tr><td>35</td><td>34</td></tr> <tr><td>45</td><td>0</td></tr> <tr><td>55</td><td>0</td></tr> <tr><td>65</td><td>0</td></tr> <tr><td>75</td><td>0</td></tr> <tr><td>85</td><td>0</td></tr> <tr><td>90</td><td>0</td></tr> </tbody> </table>	Degrees Vertical	Candela	0	3148	5	3152	15	2738	25	584	35	34	45	0	55	0	65	0	75	0	85	0	90	0	<table border="1"> <thead> <tr> <th>Zone</th> <th>Lumens</th> <th>% Fixture</th> </tr> </thead> <tbody> <tr><td>0-30</td><td>1318</td><td>98</td></tr> <tr><td>0-40</td><td>1345</td><td>99.9</td></tr> <tr><td>0-60</td><td>1345</td><td>100</td></tr> <tr><td>0-90</td><td>1345</td><td>100</td></tr> <tr><td>90-180</td><td>0</td><td>0</td></tr> <tr><td>0-180</td><td>1345</td><td>100</td></tr> </tbody> </table>	Zone	Lumens	% Fixture	0-30	1318	98	0-40	1345	99.9	0-60	1345	100	0-90	1345	100	90-180	0	0	0-180	1345	100	<table border="1"> <thead> <tr> <th>Average Candela Degrees</th> <th>Average 0° Luminance</th> </tr> </thead> <tbody> <tr><td>35</td><td>6608</td></tr> <tr><td>45</td><td>0</td></tr> <tr><td>55</td><td>0</td></tr> <tr><td>65</td><td>0</td></tr> <tr><td>75</td><td>0</td></tr> </tbody> </table>	Average Candela Degrees	Average 0° Luminance	35	6608	45	0	55	0	65	0	75	0
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CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
0	831	0-30	686	51.6	35	597212
5	995	0-40	1082	81.4	45	469204
15	3035	0-60	1326	99.8	55	67832
25	3294	0-90	1329	100	65	229
35	3037	90-180	0	0	75	0
45	2059	0-180	1329	100		
55	242					
65	1					
75	0					
85	0					
90	0					

CCT Multipliers – 90CRI

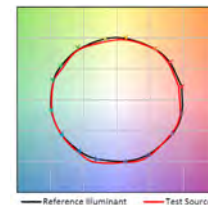
2700K	3000K	3500K	4000K
0.923	0.963	1.00	1.02

Multipliers for relative lumen values with other color temperatures.

Note: Refer to IES files for more product data.

Color Metrics - TM-30-15 & CRI/CIE

TM-30-15	Rf = 91.6
	Rg = 98.6
CRI/CIE	Ra = 94.9
	R9 = 67





Job Name:
 South Dade Regional Library Specifications
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LDA3B10R40-90-35-D010
 E3AAHSFWF HB26
 Notes:

Type:
L3A
 LDI24-110942

Portfolio **LDA3B**

Photometric Data

50°		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CANDELA TABLE	ZONAL LUMEN SUMMARY	LUMINANCE				
Test Number	P411816			Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LDA3B			0	2159	0-30	1186	89.2	35	34890
Module	13R509035D010			5	2060	0-40	1324	99.6	45	273
Trim	E3MRH			15	1806					
Lumens	1329			25	1168	0-60	1329	100	55	169
Efficacy	95 Lm/W			35	177					
SC	0.83			45	1	0-90	1329	100	65	0
UGR	NA			55	1					
				65	0	90-180	0	0	75	0
				75	0					
		85	0	0-180	1329	100	75	0		
		90	0							
		90	0							

50° / 30° Tilt		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CONE OF LIGHT
Test Number	P410652		Horizontal	Vertical
Housing	LDA3B			
Module	13R509035D010			
Trim	E3AAH			
Lumens	1254			
Efficacy	90 Lm/W			
SC	0.52			
UGR	NA			

CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
0	838	0-30	626	50	35	354638
5	1447	0-40	944	75.3	45	274200
15	1968					
25	1978	0-60	1251	99.7	55	219561
35	1803					
45	1204	0-90	1254	100	65	0
55	782					
65	0	90-180	0	0	75	0
75	0					
85	0	0-180	1254	100	75	0
90	0					

CCT Multipliers – 90CRI

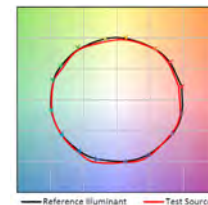
2700K	3000K	3500K	4000K
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Multipliers for relative lumen values with other color temperatures.

Note: Refer to IES files for more product data.

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TM-30-15	Rf = 91.6
	Rg = 98.6
CRI/CIE	Ra = 94.9
	R9 = 67





Portfolio **LDA3B**

Energy Data

250 Lumens		
	120V	277V
Lumen Output	250	250
Input Power (W)	4	4
Input Current(A)	0.042	0.019
THDi(%)	19.6	19.6
PF	0.96	0.93

700 Lumens		
	120V	277V
Lumen Output	700	700
Input Power (W)	8	8
Input Current(A)	0.075	0.034
THDi(%)	15.3	16
PF	0.97	0.92

1000 Lumens		
	120V	277V
Lumen Output	1000	1000
Input Power (W)	11	11
Input Current(A)	0.091	0.04
THDi(%)	16	13.7
PF	0.97	0.95

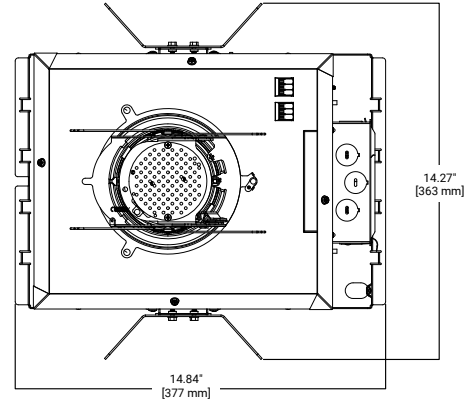
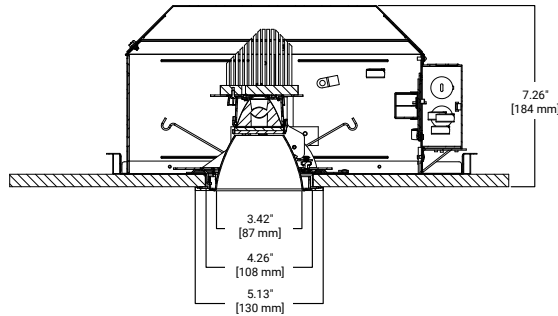
1300 Lumens		
	120V	277V
Lumen Output	1300	1300
Input Power (W)	15	15
Input Current(A)	0.125	0.057
THDi(%)	12.3	11.2
PF	0.98	0.92

1800 Lumens		
	120V	277V
Lumen Output	1800	1800
Input Power (W)	22	22
Input Current(A)	0.181	0.079
THDi(%)	8.8	4.9
PF	0.99	0.96

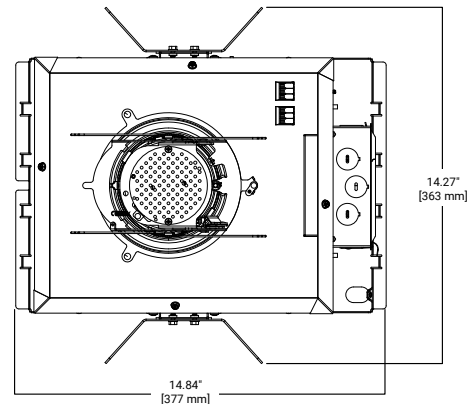
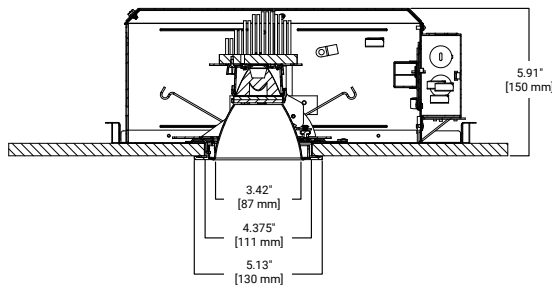
2300 Lumens		
	120V	277V
Lumen Output	2300	2300
Input Power (W)	31	31
Input Current(A)	0.261	0.111
THDi(%)	11.1	4.7
PF	0.98	0.96

Dimensional and Mounting Details

2 X 8 CONFIGURATION
 For 1800 and 2300 lumens



2 X 6 CONFIGURATION
 For 250-1300 lumens



Portfolio **LDA3B**

Connected Solutions

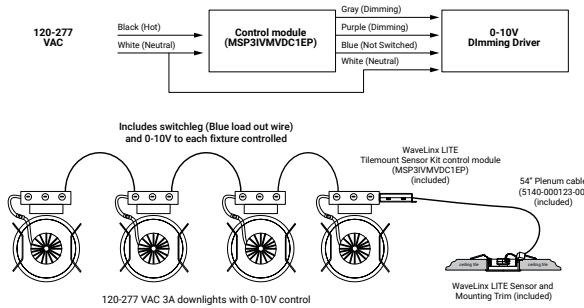
WaveLinx LITE - WLST Tilemount Sensor



- Intuitive Android™ or Apple® iOS® app for basic system code compliant set up and configuration via Bluetooth
- Up to 28 unique areas per project site (WaveLinx LITE Bluetooth network)
- Up to 50 devices for an area, any one of 16 control zones, up to 6 occupancy sets, and custom lighting scenes
- Automatic occupancy or vacancy, sensor sensitivity, daylight dimming, etc. configurable through the app
- Refer to the WaveLinx system specifications for details



WaveLinx LITE WLST Tilemount Wiring Diagram



WaveLinx LITE Bluetooth Enabled System



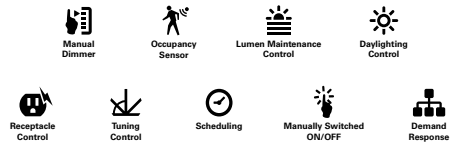
WaveLinx PRO Wireless – WPST Tilemount Sensor



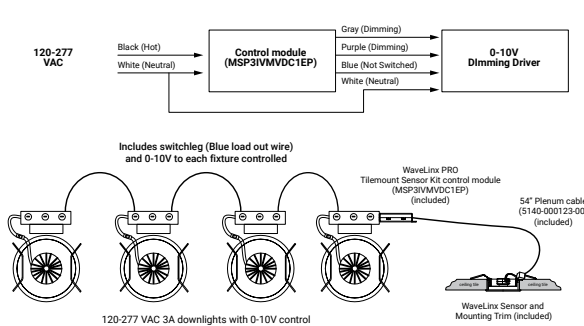
- WaveLinx PRO Wireless functionality configures zones and customizes settings from one secure mobile app
- Automatic code commissioning that meets the strictest codes
- Fixtures and sensors integrate with Wireless Area Controller, Wall Stations, and Control Devices
- Stand-Alone Offices or Entire Building Network Installations



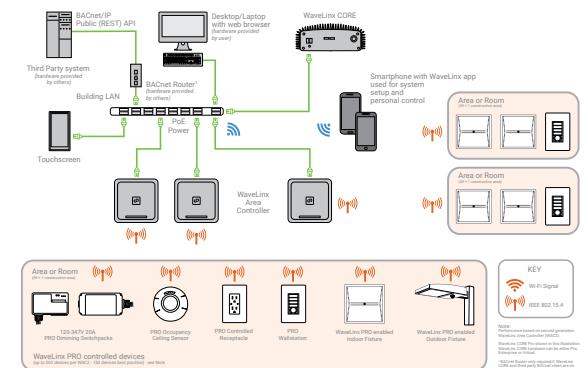
WaveLinx mobile app settings



WaveLinx PRO WPST Tilemount Wiring Diagram



WaveLinx CORE Building Management Integration





Portfolio **LDA3B**

Connected Solutions

WaveLinx PRO Wireless Node - WPN

- WaveLinx Wireless functionality configures zones and customizes settings from one secure mobile app
- Automatic code commissioning that meets the strictest codes
- Fixtures and sensors integrate with WaveLinx Area Controller, Wall Stations, and Control Devices
- Stand-Alone Offices or Entire Building Network Installations

Downlights with wireless communication
Highly efficient LED fixtures

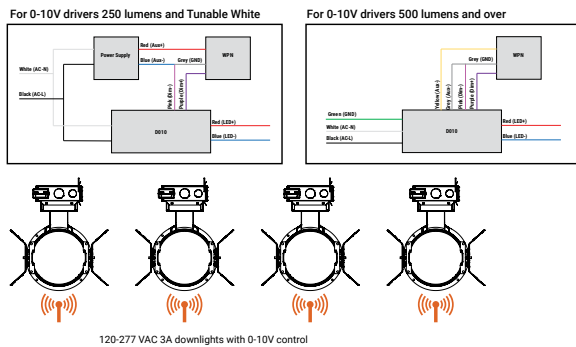
WaveLinx Area Controller
Provides centralized coordination of multiple area control options

Wireless Wall Station/Receptacle
Provides customized wireless control of each area

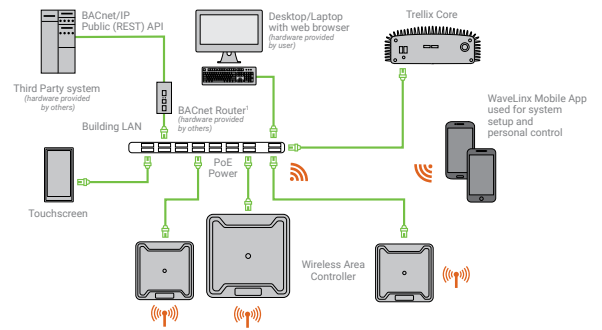
Mobile Applications
Provides personalized, local control from a tablet or smartphone

WaveLinx mobile app settings

WaveLinx PRO Wireless Node (WPN) Wiring Diagram



WaveLinx CORE Building Management Integration





Project		Catalog #		Type	
Prepared by		Notes		Date	



Portfolio

LDA3B

3-1/2" Adjustable/slope downlight

Typical Applications

Office • Education • Healthcare • Hospitality • Retail • Code-Compliance Areas • Sports Venues

Interactive Menu

- Order Information page 2
- Product Specifications page 3
- Photometric Data page 4
- Energy Data page 8
- Connected System page 9
- Product Warranty

Product Certification



Product Features



Control Compatibility

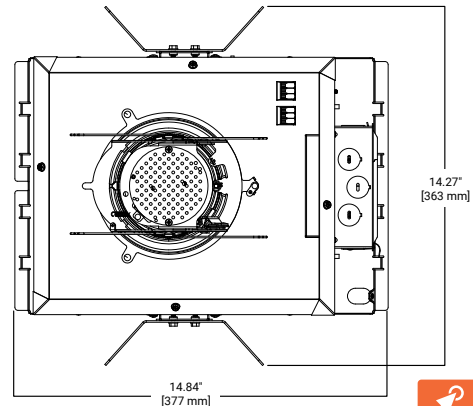
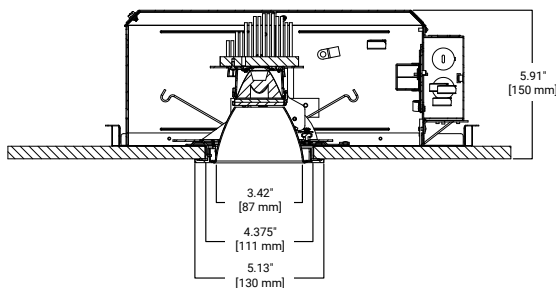


Top Product Features

- Available in 250 to 2,300 lumens; Insulated Ceiling (IC) rated
- Offered in 90 and 97 CRI; Locking 365° rotation and 45° tilt holds any aiming position
- Interchangeable optics in asymmetric and 5° increments from 10°-70°; Media holder accepts two lens media
- 2400K, 2700K, 3000K, 3500K, 4000K, 5000K; D2W™ option from 3000K to 1850K
- W2N tunable white CCT range 2700K to 6500K or 2000K to 5000K

Dimensional and Mounting Details

2 X 6 CONFIGURATION
 For 250-1300 lumens



additional product diagrams



Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
LDA3B10R40-90-35-D010-EM7-
E3AAHSFWF HB26

Notes:

Type:

L3AE

LDI24-110942

Portfolio

LDA3B

Order Information

SAMPLE ORDER NUMBER: LDA3B10R309030D010-E3AACKH

Housing	Lumen ⁽¹⁾	Distribution	CRI	Color	Voltage
LDA3B = New construction 3-inch adjustable	02 = 250 lumens ⁽¹⁰⁾	R10 = 10° ⁽⁹⁾	90 = 90 CRI	24 = 2400K	Blank = 120-277V
LDA3BCP = Chicago Plenum new construction 3-inch adjustable	07 = 700 lumens	R15 = 15°	97 = 97 CRI ⁽¹¹⁾	27 = 2700K	3 = 347V ⁽⁶⁾
	10 = 1000 lumens	R20 = 20°		30 = 3000K	
	13 = 1300 lumens	R25 = 25°		35 = 3500K	
	18 = 1800 lumens	R30 = 30°		40 = 4000K	
	23 = 2300 lumens ⁽²⁾	R35 = 35°		50 = 5000K	
	2R2040 = Elliptical 20° x 40°	R40 = 40°		9030D2W = dim to warm ⁽¹³⁾	
	2R2050 = Elliptical 20° x 50°	R45 = 45°		W2N902050 = 2000K-5000K ⁽⁵⁾	
	2R2060 = Elliptical 20° x 60°	R50 = 50°		W2N902765 = 2700K-6500K ⁽⁵⁾	
		R55 = 55°			
		R60 = 60°			
		R65 = 65°			
		R70 = 70°			
		2R2040 = Elliptical 20° x 40° optic			
		2R2050 = Elliptical 20° x 50° optic			
		2R2060 = Elliptical 20° x 60° optic			
		Blank = no optic order separately			

Driver	Options ⁽⁹⁾
D010 =0-10V 1% Dimming, 120-277V	EMROD = Rodine® Emergency Module with Remote Test Switch
D010TR =0-10V or Line Voltage Dimming, 1% to 100%, 120V-277V	EM7 = 7W Emergency Module with Remote Test Switch
DE010 =0-10V Linear Dimming, 0% to 100%, 120V-277V	EM14 = 14W Emergency Module with Remote Test Switch
D5LT =Fifth Light® DALI DT6 Logarithmic Dimming, 0% to 100%, 120V-277V	EMV7 = 7W Low Voltage Emergency Module with Remote Test Switch
DMX =DMX/RDM Logarithmic Dimming, 0% to 100%, 120V-277V ⁽⁷⁾⁽⁸⁾	EMV14 = 14W Low Voltage Emergency Module with Remote Test Switch
DMXCS =DMX/RDM Logarithmic Dimming, 0% to 100%, 120V-277V, with RJ45 connection ⁽⁷⁾⁽⁸⁾	WPST =Factory installed Wavelinx (includes control module, sensor, cable, tilemount and ceiling mount sensor) ⁽⁹⁾⁽¹⁴⁾⁽¹⁷⁾
DLE =Lutron Ecosystem dimming 1% to 100%, 120V-277V ⁽¹⁸⁾	WLST =Factory installed WaveLinX LITE Sensor Kit ⁽⁹⁾⁽¹⁴⁾⁽¹⁷⁾
DLV =Low voltage dimming driver (1-100%) for use with DLVP system ⁽⁹⁾	WPN = WaveLinX PRO Wireless Node without sensor ⁽²⁰⁾

Reflector	Finish	Trim Ring
E3AA = 3.5° Aperture open angle cut	C = Specular Clear	Blank = Matte white metal trim ring
E3AA20 = 3.5° Aperture open 20° angle cut	H = Semi-specular clear	SE = Self flanged ⁽¹²⁾
E3SLOT = 3.5° Aperture open 20° slot cut	G = Gold	SFWF = Self flanged painted white ⁽¹²⁾
E3AASR = 3.5° Aperture lensed angle cut	WMH = Warm haze	
E3MR = 3.5° Aperture open downlight	WH = Wheat	
E3SR = 3.5° Aperture lensed downlight	WHH = Wheat haze	
E3LWW = 3.5° Aperture lensed wall wash	GP = Graphite	
	GPH = Graphite haze	Painted Finish
	K = Cognac	MW = Matte White
	KH = Cognac haze	W = Gloss white
	CC = Chocolate	BB = Black baffle ⁽¹¹⁾
	CCH = Chocolate haze	WB = White baffle ⁽¹¹⁾
	B = Black	



Pinhole	Flange Style and Finish
E3AASRPIN = 1.75° Aperture lensed pinhole	Blank = Matte white die-cast flange
E3PINL = 1.5° Aperture lensed pinhole with black occlus	W = Matte white aluminum die-cast flange with white occlus ⁽¹³⁾
E3OVAL = 2" oval	

Accessories	Media	Optic
Bar Hangers	L100 lenses - optical lenses	L100 lenses - color filters
HB26 = C-channel Bar Hanger, 26" Long, Pair	L110N = Diffuse Sandblasted Lens	L112 = Red Gel Filter
HB5U = C-channel Bar Hanger, 50" Long, Pair	L111 = Soft Focus Lens	L114 = Ultraviolet, Dichoric Filter
RMB22 = Wood Joist Bar Hanger, 22" Long, Pair	L113 = Prismatic Spread Lens	L120 = Red, Dichoric Filter
FMC3 = Flush Mount Collar Accessory ⁽¹⁹⁾	L115 = Linear Spread Lens	L121 = Amber, Dichoric Filter
PLE3 = Plaster Lip Extender for Up to 2" Thick Ceilings	L100MB = Hex cell louver	L122 = Yellow, Dichoric Filter
Connected Lighting Systems ⁽⁹⁾		L123 = Green, Dichoric Filter
WPST = Field installed WaveLinX sensor Kit ⁽¹⁴⁾		L124 = Daylight Blue, Dichoric Filter
WLST = Field installed WaveLinX Lite Sensor Kit ⁽¹⁴⁾		L125 = Blue, Dichoric Filter
		L127 = Cosmetic (2700K), Dichoric Filter
		L131 = Amber, Gel Filter
		2R15SP = 15°
		2R20 = 20°
		2R25NFL = 25°
		2R30 = 30°
		2R35 = 35°
		2R40FL = 40°
		2R45 = 45°
		2R50 = 50°
		2R55FL = 55°
		2R60 = 60°
		2R65 = 65°
		2R70 = 70°
		2R2040 = Elliptical 20° x 40°
		2R2050 = Elliptical 20° x 50°
		2R2060 = Elliptical 20° x 60°

Notes:

- Nominal lumens will vary depending on selected color, driver and reflector finish.
- Non-IC
- Offered up to 1000 lumens, must be specified with housing
- 97CRI for 2700 and 3000K
- Choose D5LT or DE010 driver, limited to 1000 lumens
- 347V with D010 driver
- DMX fixtures default to full on upon loss of DMX signal.
- Requires above ceiling access.
- Refer to system specifications for additional information, features, and benefits. Order either factory installed option accessory.
- D010TR only
- Available on E3AA and E3MR.
- Not available with baffles.
- E3PINL only.
- WPST = WaveLinX wireless sensor kit for daylight dimming, PIR motion sensing, and optional RLTS - Real Time Location Services, use with 0-10V only.
- Limited to 1000 and 1300 lumens
- WLST = WaveLinX LITE tilemount sensor kit for daylight dimming, PIR motion sensing, use with D010 only (Refer to WaveLinX LITE system specifications)
- Not available with Chicago Plenum or IC rating.
- For 1000 lumens and above.
- Not for use with self flanged reflectors
- WPN = WaveLinX PRO wireless node provides luminaire-level control with scene and zone configuration without an integrated sensor; Connects wirelessly with daylight dimming sensor and PIR motion sensor if desired. Use with 0-10V driver only.

Job Name:

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

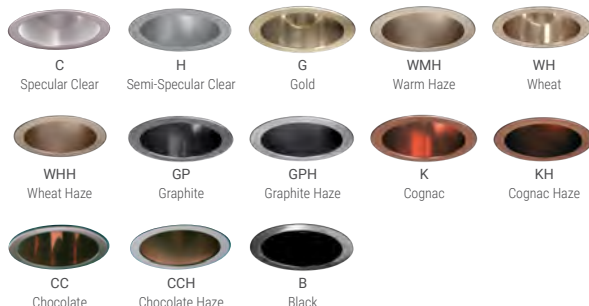
Catalog Number:

LDA3B10R40-90-35-D010-EM7-E3AAHSFWF HB26

Notes:

Type:**L3AE**

LDI24-110942

Portfolio**LDA3B****Reflector Finishes****Painted Finishes****Flanges****Product Specifications****Lower Shielding Reflector**

- Open or lensed, low brightness 3-1/2" aperture, spun 0.04 high purity aluminum angle cut or slot cut, for flat or sloped ceilings
- Lensed wall wash with neutral color linear glass lens provides smooth vertical illumination with minimal downlight
- Open or lensed, low brightness 3-1/2" aperture, spun 0.04 high purity titanium reflector providing 50° source and source image cutoff
- Open or lensed die cast round or oval pinhole with angle cut upper reflector
- Pinhole includes black oculus to control glare
- Available in all Portfolio Alzak® finishes
- Metal trim ring can be removed for painting
- Plaster lathing ring accessory offered for flush reflector transition

Trim Retention

- Retained with two torsion springs holding the flange tightly to the finished ceiling

Housing

- Steel housing painted matte black to eliminate stray light
- Top accessible
- Ships with overspray protector installed
- Collar designed for 1-inch ceiling thickness.
- PLE3 plaster lip extender available for up to 2-inch ceiling thickness

Adjustment Mechanism

- Provides smooth 365° rotation and 45° tilt adjustment allowing LED optic to pivot about the center of the aperture at the ceiling line for maximum light output without flashback
- Locks in position with 1/4" Phillips driver
- Aiming scale enables consistent setting across multiple fixtures

Optic

- Interchangeable silicone optic in elliptical and 5° increments from 10°-70° providing smooth beam without color separation
- Elliptical beams
- Media holder fits onto optic holder and holds up to two lens media

Universal Mounting Bracket

- Accepts 1/2" Electric Metallic Tube (EMT), C-channel, T-bar fasteners and bar hangers

Junction Box

- Seven 1/2" trade size pry outs positioned to allow straight conduit runs
- Listed for four #12 AWG (two in, two out) 90°C conductors and feed-through branch wiring for top access units (with top access units only)
- Lever connectors for simple push in wiring

Thermal

- Forged aluminum heat sink conducts heat away from the LED module for optical performance and longer life

LED System

- Contains a plurality of high brightness white LED's combined with TIR optic produces even distribution with no pixilation
- Lumen output shall not decrease by more than 10% over the minimum life of 55,000 hours (L90 > 55,000 hours)
- Color variation within 2-step MacAdam ellipses
- Available in 2400K, 2700K, 3000K, 3500K, 4000K and 5000K correlated color temperature (CCT)
- Available in 90 or 97 color rendering index (CRI)

VividTune™ Color Tuning Solutions

- D2W™ – Dim-to-Warm shifts CCT from 3000K to 1850K as fixture dims, mimicking halogen sources
- W2N – Tunable white CCT range from 2700K to 6500K or 2000K to 5000K; 90 CRI

Driver

- Standard 120-277V 0-10V dimming driver provides flicker-free dimming from 100% to 1%
- Optional 120V leading edge/0-10V 120-277V combination, Fifth Light, DMX or Lutron® Ecosystem
- Standard 0-10V driver and 0-10V leading edge can be serviced from above or through the aperture
- Distributed Low Voltage Power (DLVP) system combines power, lighting and controls with ease of installation.

Connected Lighting System

Two WaveLinx connected solutions to choose from. Refer to WaveLinx system specifications and application guides for details.

WaveLinx PRO Tilemount Sensor Kit

- WaveLinx WPST tilemount sensor kit offers daylight dimming, PIR motion sensing, scene and zone configuration, automatic commissioning; and optional RLTS - Real Time Location Services available.

WaveLinx PRO Wireless Node

- WaveLinx PRO wireless node provides luminaire-level control with scene and zone configuration without an integrated sensor; Connects wirelessly with daylight dimming sensor and PIR motion sensor if desired. Use with 0-10V driver only.

WaveLinx LITE Tilemount Sensor Kit

- WaveLinx LITE WLST tilemount sensor kit offers daylight dimming and PIR motion sensing, scene and grouping configuration.

WaveLinx Tilemount Kits Application

- The WPST and WLST tilemount kits include a control module mounted on the luminaire junction box via 1/2" knock-out, and a tilemount sensor on 54-inch whip; for ceiling installation by direct-mount spring clips or via mounting bracket in octagon ceiling boxes.
- The WPST and WLST tilemount kits may be ordered as factory installed on the luminaire, or ordered separately as a field installed accessory kit.

Compliance

- Thermally protected, IC rated up to 1800 lumens
- cULus Certified to UL 1598 / C22.2 No. 250.0 suitable for wet locations with downlight; damp location with wall wash and hyperbolic with covered ceiling
- Optional City of Chicago environmental environmental air (CCEA) marking for plenum applications
- EMI/RFI emissions per FCC 47CFR Part 18 Class B consumer limits
- Airtight with lensed trims
- RoHS compliant
- Photometric testing completed in accordance with IES LM-79 and TM-30 standards
- LED life testing completed in accordance with IES LM-80 standards
- Can be used for State of California Title 24 high efficacy LED compliance under JA8, reference Modernized Appliance Efficiency Database System (MAEDBS) for 2016 JA8 High Efficacy Lighting
- ENERGY STAR® certified, reference certified light fixtures database

Warranty

- Five year warranty www.cooperlighting.com/legal



Job Name:
 South Dade Regional Library Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LDA3B10R40-90-35-D010-EM7-E3AAHSFWF HB26

Notes:

Type:

L3AE

LDI24-110942

Portfolio

LDA3B

Photometric Data

25°		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CANDELA TABLE	ZONAL LUMEN SUMMARY	LUMINANCE				
Test Number	P411015			Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LDA3B			0	6168	0-30	1248	98.8	35	2793
Module	13R259035D010			5	5730	0-40	1262	99.9	45	0
Trim	E3MRC			15	2214	0-60	1263	100	55	0
Lumens	1263			25	233	0-90	1263	100	65	0
Efficacy	90 Lm/W			35	14	90-180	0	0	75	0
SC	0.45			45	0	0-180	1263	100		
UGR	NA			55	0					
				65	0					
				75	0					
		85	0							
		90	0							

25° / 30° Tilt		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CONE OF LIGHT
Test Number	P408019		Horizontal	Vertical
Housing	LDA3B			
Module	13R259035D010			
Trim	E3AAC			
Lumens	1301			
Efficacy	93 Lm/W			
SC	0.51			
UGR	NA			

CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
0	249	0-30	655	50.3	35	1165121
5	523	0-40	1137	87.4	45	375723
15	2814	0-60	1298	99.8	55	13285
25	6269	0-90	1301	100	65	0
35	5924	90-180	0	0	75	0
45	1649	0-180	1301	100		
55	47					
65	0					
75	0					
85	0					
90	0					

CCT Multipliers – 90CRI

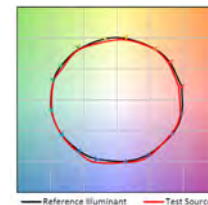
2700K	3000K	3500K	4000K
0.923	0.963	1.00	1.02

Multipliers for relative lumen values with other color temperatures.

Note: Refer to IES files for more product data.

Color Metrics - TM-30-15 & CRI/CIE

TM-30-15	Rf = 91.6
	Rg = 98.6
CRI/CIE	Ra = 94.9
	R9 = 67





Job Name:
South Dade Regional Library Specifications
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
LDA3B10R40-90-35-D010-EM7-
E3AAHSFWF HB26

Notes:

Type:

L3AE

LDI24-110942

Portfolio

LDA3B

Photometric Data

40°		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CANDELA TABLE	ZONAL LUMEN SUMMARY	LUMINANCE				
Test Number	P411063			Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LDA3B			0	3148	0-30	1318	98	35	6608
Module	13R409035D010			5	3152	0-40	1345	99.9	45	0
Trim	E3MRC			15	2738					
Lumens	1345			25	584	0-60	1345	100	55	0
Efficacy	96 Lm/W			35	34					
SC	0.7			45	0	0-90	1345	100	65	0
UGR	NA			55	0					
		65	0	90-180	0	0	75	0		
		75	0							
		85	0	0-180	1345	100				
		90	0							
		90	0							

40° / 30° Tilt		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CONE OF LIGHT
Test Number	P408115		Horizontal	Vertical
Housing	LDA3B			
Module	13R409035D010			
Trim	E3AAC			
Lumens	1329			
Efficacy	95 Lm/W			
SC	0.28			
UGR	NA			

CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
0	831	0-30	686	51.6	35	597212
5	995	0-40	1082	81.4	45	469204
15	3035					
25	3294	0-60	1326	99.8	55	67832
35	3037					
45	2059	0-90	1329	100	65	229
55	242					
65	1	90-180	0	0	75	0
75	0					
85	0	0-180	1329	100		
90	0					

CCT Multipliers – 90CRI

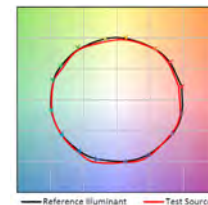
2700K	3000K	3500K	4000K
0.923	0.963	1.00	1.02

Multipliers for relative lumen values with other color temperatures.

Note: Refer to IES files for more product data.

Color Metrics - TM-30-15 & CRI/CIE

TM-30-15	Rf = 91.6
	Rg = 98.6
CRI/CIE	Ra = 94.9
	R9 = 67





Job Name:
 South Dade Regional Library Specifications
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LDA3B10R40-90-35-D010-EM7-
 E3AAHSFWF HB26

Notes:

Type:

L3AE

LDI24-110942

Portfolio

LDA3B

Photometric Data

50°		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CANDELA TABLE	ZONAL LUMEN SUMMARY	LUMINANCE				
Test Number	P411816			Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LDA3B			0	2159	0-30	1186	89.2	35	34890
Module	13R509035D010			5	2060	0-40	1324	99.6	45	273
Trim	E3MRH			15	1806	0-60	1329	100	55	169
Lumens	1329			25	1168	0-90	1329	100	65	0
Efficacy	95 Lm/W			35	177	90-180	0	0	75	0
SC	0.83			45	1	0-180	1329	100		
UGR	NA			55	1					
				65	0					
				75	0					
		85	0							
		90	0							

50° / 30° Tilt		CANDLEPOWER DISTRIBUTION	CONE OF LIGHT	CONE OF LIGHT
Test Number	P410652		Horizontal	Vertical
Housing	LDA3B			
Module	13R509035D010			
Trim	E3AAH			
Lumens	1254			
Efficacy	90 Lm/W			
SC	0.52			
UGR	NA			

CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
0	838	0-30	626	50	35	354638
5	1447	0-40	944	75.3	45	274200
15	1968	0-60	1251	99.7	55	219561
25	1978	0-90	1254	100	65	0
35	1803	90-180	0	0	75	0
45	1204	0-180	1254	100		
55	782					
65	0					
75	0					
85	0					
90	0					

CCT Multipliers – 90CRI

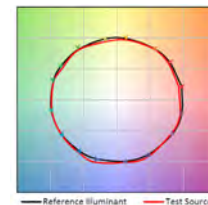
2700K	3000K	3500K	4000K
0.923	0.963	1.00	1.02

Multipliers for relative lumen values with other color temperatures.

Note: Refer to IES files for more product data.

Color Metrics - TM-30-15 & CRI/CIE

TM-30-15	Rf = 91.6
	Rg = 98.6
CRI/CIE	Ra = 94.9
	R9 = 67





Portfolio **LDA3B**

Energy Data

250 Lumens		
	120V	277V
Lumen Output	250	250
Input Power (W)	4	4
Input Current(A)	0.042	0.019
THDi(%)	19.6	19.6
PF	0.96	0.93

700 Lumens		
	120V	277V
Lumen Output	700	700
Input Power (W)	8	8
Input Current(A)	0.075	0.034
THDi(%)	15.3	16
PF	0.97	0.92

1000 Lumens		
	120V	277V
Lumen Output	1000	1000
Input Power (W)	11	11
Input Current(A)	0.091	0.04
THDi(%)	16	13.7
PF	0.97	0.95

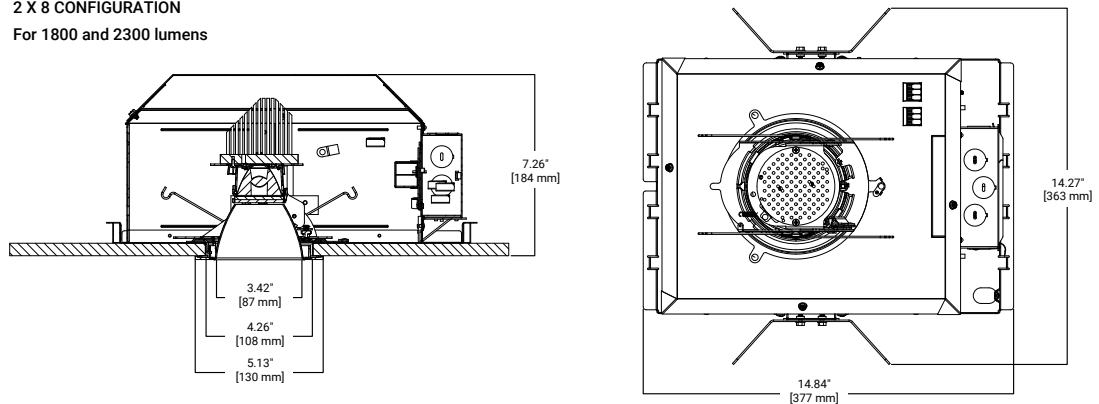
1300 Lumens		
	120V	277V
Lumen Output	1300	1300
Input Power (W)	15	15
Input Current(A)	0.125	0.057
THDi(%)	12.3	11.2
PF	0.98	0.92

1800 Lumens		
	120V	277V
Lumen Output	1800	1800
Input Power (W)	22	22
Input Current(A)	0.181	0.079
THDi(%)	8.8	4.9
PF	0.99	0.96

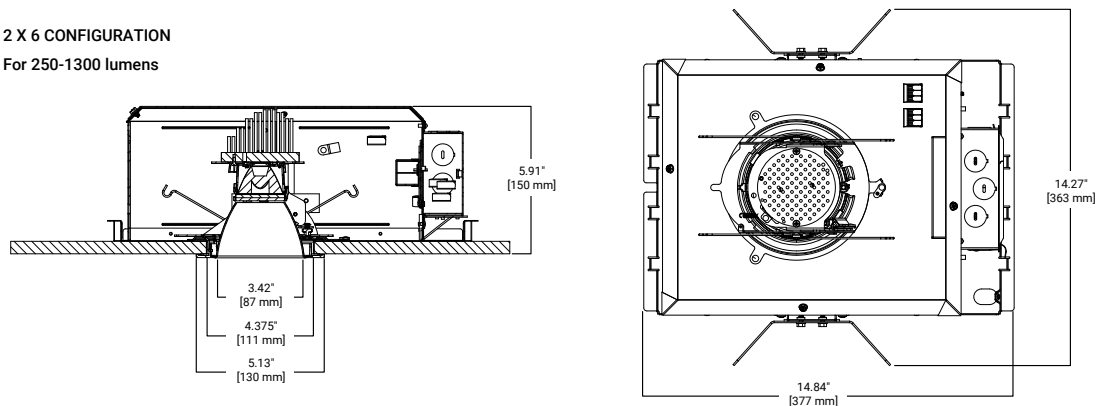
2300 Lumens		
	120V	277V
Lumen Output	2300	2300
Input Power (W)	31	31
Input Current(A)	0.261	0.111
THDi(%)	11.1	4.7
PF	0.98	0.96

Dimensional and Mounting Details

2 X 8 CONFIGURATION
 For 1800 and 2300 lumens



2 X 6 CONFIGURATION
 For 250-1300 lumens





Portfolio **LDA3B**

Connected Solutions

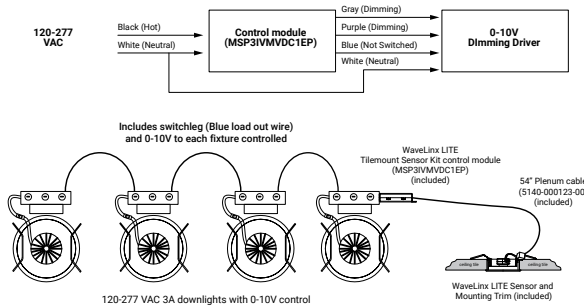


WaveLinX LITE - WLST Tilemount Sensor

- Intuitive Android™ or Apple® iOS® app for basic system code compliant set up and configuration via Bluetooth
- Up to 28 unique areas per project site (WaveLinX LITE Bluetooth network)
- Up to 50 devices for an area, any one of 16 control zones, up to 6 occupancy sets, and custom lighting scenes
- Automatic occupancy or vacancy, sensor sensitivity, daylight dimming, etc. configurable through the app
- Refer to the WaveLinX system specifications for details



WaveLinX LITE WLST Tilemount Wiring Diagram



WaveLinX LITE Bluetooth Enabled System



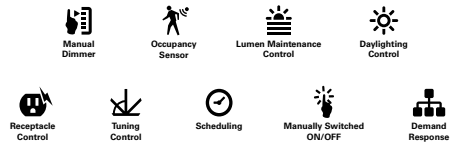
WaveLinX PRO Wireless – WPST Tilemount Sensor



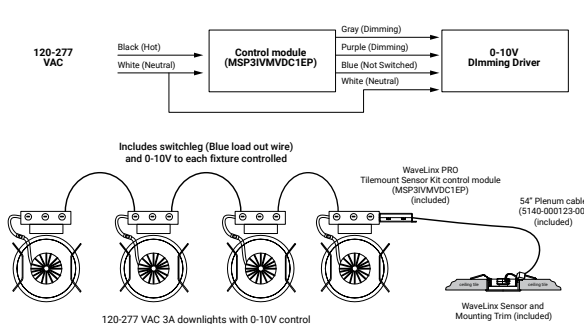
- WaveLinX PRO Wireless functionality configures zones and customizes settings from one secure mobile app
- Automatic code commissioning that meets the strictest codes
- Fixtures and sensors integrate with Wireless Area Controller, Wall Stations, and Control Devices
- Stand-Alone Offices or Entire Building Network Installations



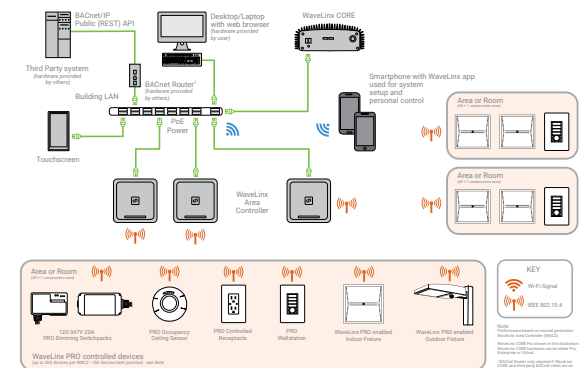
WaveLinX mobile app settings



WaveLinX PRO WPST Tilemount Wiring Diagram



WaveLinX CORE Building Management Integration





Portfolio **LDA3B**

Connected Solutions

WaveLinx PRO Wireless Node - WPN

- WaveLinx Wireless functionality configures zones and customizes settings from one secure mobile app
- Automatic code commissioning that meets the strictest codes
- Fixtures and sensors integrate with WaveLinx Area Controller, Wall Stations, and Control Devices
- Stand-Alone Offices or Entire Building Network Installations

Downlights with wireless communication
Highly efficient LED fixtures

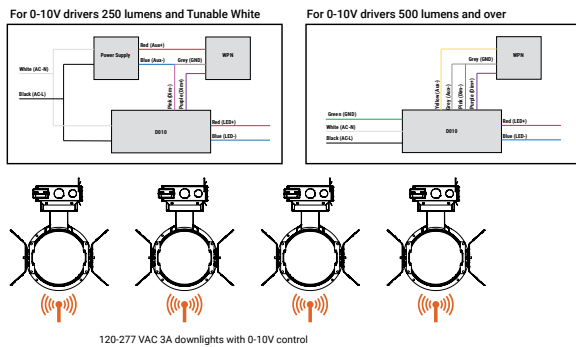
WaveLinx Area Controller
Provides centralized coordination of multiple area control options

Wireless Wall Station/Receptacle
Provides customized wireless control of each area

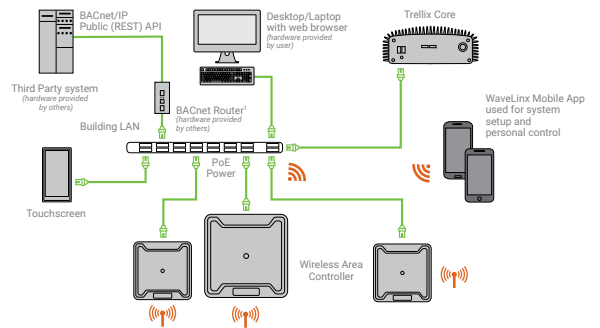
Mobile Applications
Provides personalized, local control from a tablet or smartphone

WaveLinx mobile app settings

WaveLinx PRO Wireless Node (WPN) Wiring Diagram



WaveLinx CORE Building Management Integration





Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 C1003-24-LN-35K-CLV-MV-WM-PMW-90CRI
 Notes:

Type:
L4
 LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Metal Side Walls
- Flat White Acrylic Bottom Lens
- Overlay Options

Dimensions and Lamping:

C1003-18 18" A x 5" C.....Weight: 9 lbs.
 LN LED: Nominal 35W, 2000 Delivered Lumens
 LH LED: Nominal 40W, 2250 Delivered Lumens

C1003-24 24" A x 5" C.....Weight: 14 lbs.
 LN LED: Nominal 55W, 4000 Delivered Lumens
 LH LED: Nominal 85W, 5600 Delivered Lumens

C1003-36 36" A x 5" C.....Weight: 29 lbs.
 LN LED: Nominal 150W, 11800 Delivered Lumens

C1003-42 42" A x 5" C.....Weight: 39 lbs.
 LN LED: Nominal 235W, 18500 Delivered Lumens

C1003-48 48" A x 5" C.....Weight: 42 lbs.
 LN LED: Nominal 240W, 21000 Delivered Lumens

LED Color Temperature:

90 CRI

30K 3000K **35K 3500K** 40K 4000K

Control:

CLV: Integral Power Supply, 0-10V Dimming to 1%

Voltage:

1 120V 2 277V **MV Multi-Volt**

Diffusers:

WA Gloss White Acrylic

WM Matte White Acrylic

Standard Finishes:

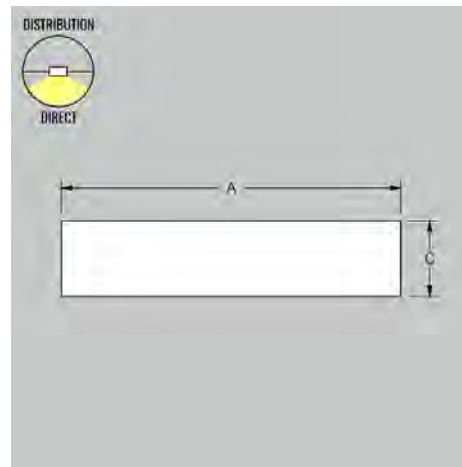
PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Overlay Options:

OCO Cherry Overlay (Opaque) **OTBD** Overlay TBD
OMO Maple Overlay (Opaque)
OWO Walnut Overlay (Opaque)

Other Options:

REM Remote Emergency Power Supply (18" & 24" Sizes)
IEM Integral Emergency Power Supply (36", 42" & 48" Sizes)



Notes:

- Custom sizes and finishes available upon request.
- Camman reserves the right to make design changes without prior notice.
- Mounting is to a 4 inch octagonal junction box.
- Photometric information is available at cammanlighting.com



**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

C1003-24-LN-35K-CLV-MV-WM-PMW-90CRI

Notes:

Type:**L4**

LDI24-110942

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard 90CRI Available
L70 (Projected):	>72,000 hours

Warranty	5 years
	(electrical components retain the component manufacturer warranty).

Camman Plus Customizations

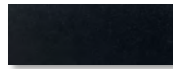
Camman **Standard Plus** products provide an extra degree of freedom to customize most standard products, including dimensions, finish, performance, and adding or removing details. Visit www.cammanlighting.com/plus to learn more about the Plus program, and visit this fixture to see what specific options might be available.

Standard Finishes**MODERN**

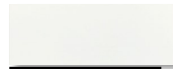
PAL Aluminum



PNL Nickel



PSB Satin Black



PMW Matte White

NEUTRAL

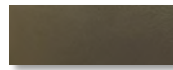
PAB Antique Brass



PBB Brushed Brass



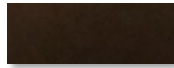
PSG Satin Gold



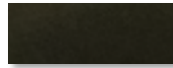
PLB Light Bronze



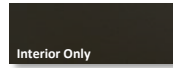
PMB Medium Bronze



PBR Bronze



PDB Dark Bronze

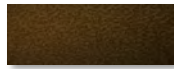


Interior Only

PRB Oil Rubbed Bronze

TEXTURES

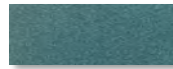
PHS Hammered Silver



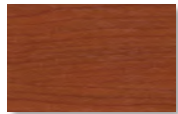
PHB Hammered Bronze



PHC Hammered Copper



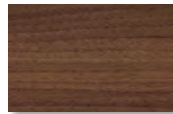
PPA Patina

COLORSPRD Traffic Red
(RAL 3020)POR Pure Orange
(RAL 2004)PYL Traffic Yellow
(RAL 1023)PGR Emerald Green
(RAL 6001)PBL Signal Blue
(RAL 5005)**Opaque Overlays**

OCO Cherry



OMO Maple



OWO Walnut

- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.





Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 C1003-24-LN-35K-CLV-MV-WM-PMW-REM-90CRI
 Notes:

Type:
L4E
 LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Metal Side Walls
- Flat White Acrylic Bottom Lens
- Overlay Options

Dimensions and Lamping:

C1003-18 18" A x 5" C.....Weight: 9 lbs.
 LN LED: Nominal 35W, 2000 Delivered Lumens
 LH LED: Nominal 40W, 2250 Delivered Lumens

C1003-24 24" A x 5" C.....Weight: 14 lbs.
 LN LED: Nominal 55W, 4000 Delivered Lumens
 LH LED: Nominal 85W, 5600 Delivered Lumens

C1003-36 36" A x 5" C.....Weight: 29 lbs.
 LN LED: Nominal 150W, 11800 Delivered Lumens

C1003-42 42" A x 5" C.....Weight: 39 lbs.
 LN LED: Nominal 235W, 18500 Delivered Lumens

C1003-48 48" A x 5" C.....Weight: 42 lbs.
 LN LED: Nominal 240W, 21000 Delivered Lumens

LED Color Temperature:

90 CRI

30K 3000K **35K 3500K** 40K 4000K

Control:

CLV: Integral Power Supply, 0-10V Dimming to 1%

Voltage:

1 120V 2 277V **MV Multi-Volt**

Diffusers:

WA Gloss White Acrylic

WM Matte White Acrylic

Standard Finishes:

PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

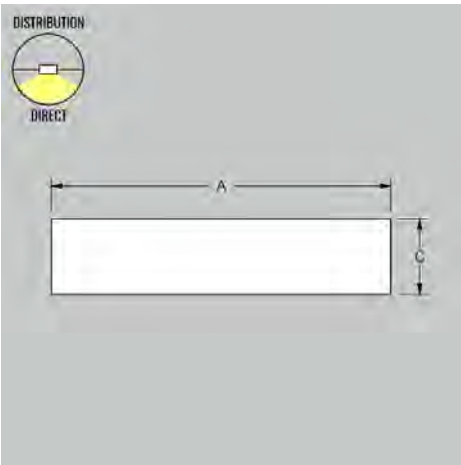
Overlay Options:

OCO Cherry Overlay (Opaque) **OTBD** Overlay TBD
OMO Maple Overlay (Opaque)
OWO Walnut Overlay (Opaque)

Other Options:

REM Remote Emergency Power Supply (18" & 24" Sizes)

IEM Integral Emergency Power Supply (36", 42" & 48" Sizes)



Notes:

- Custom sizes and finishes available upon request.
- Camman reserves the right to make design changes without prior notice.
- Mounting is to a 4 inch octagonal junction box.
- Photometric information is available at cammanlighting.com



**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

C1003-24-LN-35K-CLV-MV-WM-
PMW-REM-90CRI

Notes:

Type:**L4E**

LDI24-110942

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard 90CRI Available
L70 (Projected):	>72,000 hours

Warranty	5 years
	(electrical components retain the component manufacturer warranty).

Camman Plus Customizations

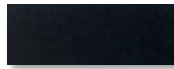
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Standard Finishes**MODERN**

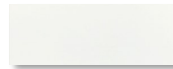
PAL Aluminum



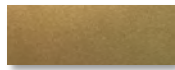
PNL Nickel



PSB Satin Black

**PMW** Matte White**NEUTRAL**

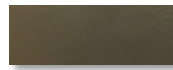
PAB Antique Brass



PBB Brushed Brass



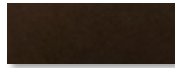
PSG Satin Gold



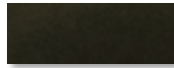
PLB Light Bronze



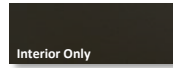
PMB Medium Bronze



PBR Bronze



PDB Dark Bronze

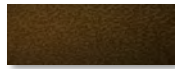


Interior Only

PRB Oil Rubbed Bronze

TEXTURES

PHS Hammered Silver



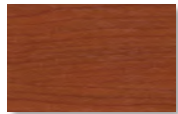
PHB Hammered Bronze



PHC Hammered Copper



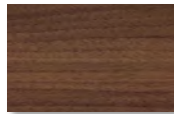
PPA Patina

COLORSPRD Traffic Red
(RAL 3020)POR Pure Orange
(RAL 2004)PYL Traffic Yellow
(RAL 1023)PGR Emerald Green
(RAL 6001)PBL Signal Blue
(RAL 5005)**Opaque Overlays**

OCO Cherry



OMO Maple



OWO Walnut

- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.





Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 C1003-48-LN-35K-CLV-MV-WM-PMW-90CRI
 Notes:

Type:
L5
 LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Metal Side Walls
- Flat White Acrylic Bottom Lens
- Overlay Options

Dimensions and Lamping:

C1003-18	18" A x 5" C.....Weight: 9 lbs.
LN	LED: Nominal 35W, 2000 Delivered Lumens
LH	LED: Nominal 40W, 2250 Delivered Lumens
C1003-24	24" A x 5" C.....Weight: 14 lbs.
LN	LED: Nominal 55W, 4000 Delivered Lumens
LH	LED: Nominal 85W, 5600 Delivered Lumens
C1003-36	36" A x 5" C.....Weight: 29 lbs.
LN	LED: Nominal 150W, 11800 Delivered Lumens
C1003-42	42" A x 5" C.....Weight: 39 lbs.
LN	LED: Nominal 235W, 18500 Delivered Lumens
C1003-48	48" A x 5" C.....Weight: 42 lbs.
LN	LED: Nominal 240W, 21000 Delivered Lumens

LED Color Temperature:

90 CRI

30K 3000K **35K 3500K** 40K 4000K

Control:

CLV: Integral Power Supply, 0-10V Dimming to 1%

Voltage:

1 120V 2 277V **MV Multi-Volt**

Diffusers:

WA Gloss White Acrylic
WM Matte White Acrylic

Standard Finishes:

PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

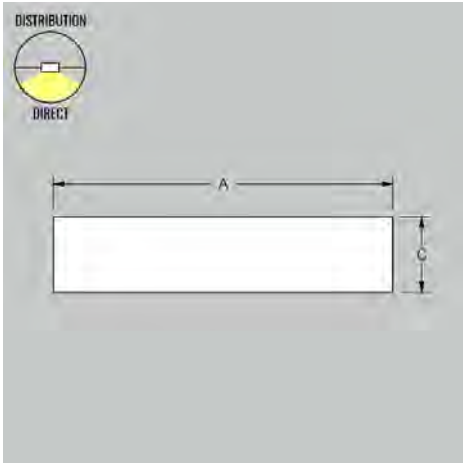
Overlay Options:

OCO Cherry Overlay (Opaque) **OTBD** Overlay TBD
OMO Maple Overlay (Opaque)
OWO Walnut Overlay (Opaque)

Other Options:

REM Remote Emergency Power Supply (18" & 24" Sizes)
IEM Integral Emergency Power Supply (36", 42" & 48" Sizes)

C1003 | Heinz



Notes:

- Custom sizes and finishes available upon request.
- Camman reserves the right to make design changes without prior notice.
- Mounting is to a 4 inch octagonal junction box.
- Photometric information is available at cammanlighting.com



**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

C1003-48-LN-35K-CLV-MV-WM-PMW-90CRI

Notes:

Type:**L5**

LDI24-110942

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard 90CRI Available
L70 (Projected):	>72,000 hours

Warranty	5 years
	(electrical components retain the component manufacturer warranty).

Camman Plus Customizations

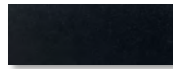
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Standard Finishes**MODERN**

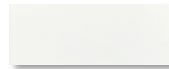
PAL Aluminum



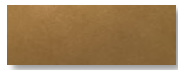
PNL Nickel



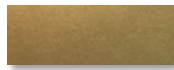
PSB Satin Black



PMW Matte White

NEUTRAL

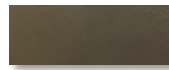
PAB Antique Brass



PBB Brushed Brass



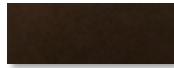
PSG Satin Gold



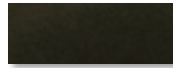
PLB Light Bronze



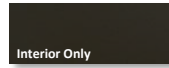
PMB Medium Bronze



PBR Bronze



PDB Dark Bronze

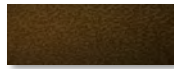


Interior Only

PRB Oil Rubbed Bronze

TEXTURES

PHS Hammered Silver



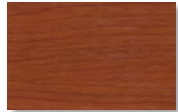
PHB Hammered Bronze



PHC Hammered Copper



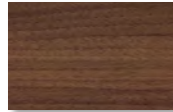
PPA Patina

COLORSPRD Traffic Red
(RAL 3020)POR Pure Orange
(RAL 2004)PYL Traffic Yellow
(RAL 1023)PGR Emerald Green
(RAL 6001)PBL Signal Blue
(RAL 5005)**Opaque Overlays**

OCO Cherry



OMO Maple



OWO Walnut

- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.





Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 C1003-48-LN-35K-CLV-MV-WM-PMW-IEM-90CRI
 Notes:

Type:
L5E
 LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Metal Side Walls
- Flat White Acrylic Bottom Lens
- Overlay Options

Dimensions and Lamping:

C1003-18	18" A x 5" C.....Weight: 9 lbs.
LN	LED: Nominal 35W, 2000 Delivered Lumens
LH	LED: Nominal 40W, 2250 Delivered Lumens
C1003-24	24" A x 5" C.....Weight: 14 lbs.
LN	LED: Nominal 55W, 4000 Delivered Lumens
LH	LED: Nominal 85W, 5600 Delivered Lumens
C1003-36	36" A x 5" C.....Weight: 29 lbs.
LN	LED: Nominal 150W, 11800 Delivered Lumens
C1003-42	42" A x 5" C.....Weight: 39 lbs.
LN	LED: Nominal 235W, 18500 Delivered Lumens
C1003-48	48" A x 5" C.....Weight: 42 lbs.
LN	LED: Nominal 240W, 21000 Delivered Lumens

LED Color Temperature:

90 CRI

30K 3000K **35K 3500K** 40K 4000K

Control:

CLV: Integral Power Supply, 0-10V Dimming to 1%

Voltage:

1 120V 2 277V **MV Multi-Volt**

Diffusers:

WA Gloss White Acrylic
WM Matte White Acrylic

Standard Finishes:

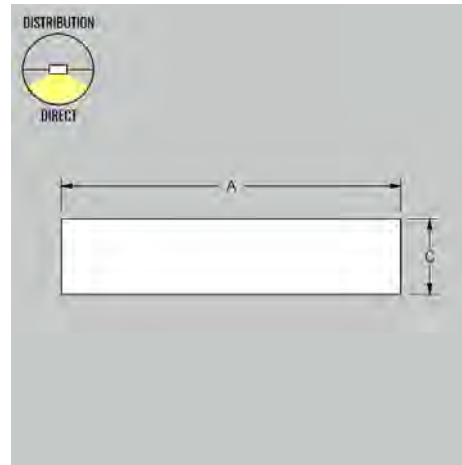
PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Overlay Options:

OCO Cherry Overlay (Opaque) **OTBD** Overlay TBD
OMO Maple Overlay (Opaque)
OWO Walnut Overlay (Opaque)

Other Options:

REM Remote Emergency Power Supply (18" & 24" Sizes)
IEM Integral Emergency Power Supply (36", 42" & 48" Sizes)



Notes:

- Custom sizes and finishes available upon request.
- Camman reserves the right to make design changes without prior notice.
- Mounting is to a 4 inch octagonal junction box.
- Photometric information is available at cammanlighting.com



**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

C1003-48-LN-35K-CLV-MV-WM-PMW-IEM-90CRI

Notes:

Type:**L5E**

LDI24-110942

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard 90CRI Available
L70 (Projected):	>72,000 hours

Warranty	5 years
	(electrical components retain the component manufacturer warranty).

Camman Plus Customizations

Camman **Standard Plus** products provide an extra degree of freedom to customize most standard products, including dimensions, finish, performance, and adding or removing details. Visit www.cammanlighting.com/plus to learn more about the Plus program, and visit this fixture to see what specific options might be available.

Standard Finishes**MODERN**

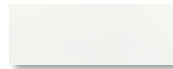
PAL Aluminum



PNL Nickel



PSB Satin Black



PMW Matte White

COLORSPRD Traffic Red
(RAL 3020)POR Pure Orange
(RAL 2004)**NEUTRAL**

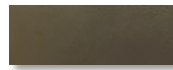
PAB Antique Brass



PBB Brushed Brass



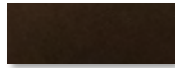
PSG Satin Gold



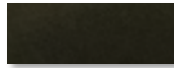
PLB Light Bronze

PYL Traffic Yellow
(RAL 1023)PGR Emerald Green
(RAL 6001)

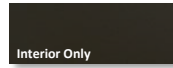
PMB Medium Bronze



PBR Bronze



PDB Dark Bronze

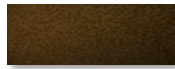


Interior Only

PRB Oil Rubbed Bronze

PBL Signal Blue
(RAL 5005)**TEXTURES**

PHS Hammered Silver



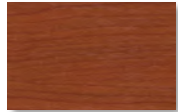
PHB Hammered Bronze



PHC Hammered Copper



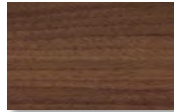
PPA Patina

Opaque Overlays

OCO Cherry



OMO Maple



OWO Walnut

- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.





Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1003-48-LH-35K-CLV-MV-WM-PMW-ST-90CRI
 Notes:

Type:
L6
 LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Metal Side Walls
- Flat White Acrylic Bottom Lens
- Aircraft Cable or Stem Hanging Options
- Overlay Options

Dimensions and Lamping:

P1003-18	18" A x 18" B x 5" CWeight: 11 lbs.
LN	LED: Nominal 45W, 3000 Delivered Lumens
LH	LED: Nominal 60W, 4000 Delivered Lumens
P1003-24	24" A x 24" B x 5" CWeight: 15 lbs.
LN	LED: Nominal 70W, 5450 Delivered Lumens
LH	LED: Nominal 95W, 7300 Delivered Lumens
P1003-36	36" A x 36" B x 5" CWeight 31 lbs.
LN	LED: Nominal 175W, 15150 Delivered Lumens
LH	LED: Nominal 220W, 18300 Delivered Lumens
P1003-42	42" A x 42" B x 5" CWeight 39 lbs.
LN	LED: Nominal 220W, 19700 Delivered Lumens
LH	LED: Nominal 310W, 26250 Delivered Lumens

P1003-48	48" A x 48" B x 5" CWeight 42 lbs.
LN	LED: Nominal 250W, 24350 Delivered Lumens
LH	LED: Nominal 390W, 35250 Delivered Lumens

P1003-60	60" A x 60" B x 5" CWeight 90 lbs.*
LN	LED: Nominal 355W, 35750 Delivered Lumens
LH	LED: Nominal 555W, 52750 Delivered Lumens

** Structural support independent of the junction box is required.*

P1003-72	72" A x 72" B x 5" CWeight 120 lbs.*
LN	LED: Nominal 445W, 46950 Delivered Lumens
LH	LED: Nominal 695W, 69600 Delivered Lumens

** Structural support independent of the junction box is required.*

LED Color Temperature:

30K	3000K	35K	3500K	40K	4000K
-----	-------	------------	-------	-----	-------

Control:
CLV Integral Power Supply, 0-10V Dimming to 1%

Voltage:

1	120V	2	277V	MV	Multi-Volt
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Diffusers:

WM	Matte White Acrylic
WA	Gloss White Acrylic

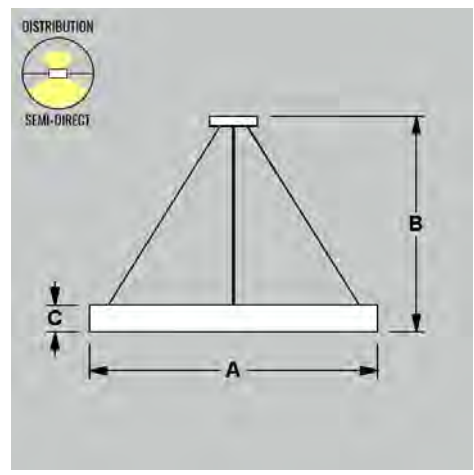
Standard Finishes:

PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Overlay Options (Opaque):

OCO Cherry Overlay	OWO Walnut Overlay
OMO Maple Overlay	OTBD To Be Determined

P1003 | Heinz



- Notes:**
- Custom sizes and finishes available upon request.
 - Camman reserves the right to make design changes without prior notice.
 - Mounting is to a 4 inch octagonal junction box.
 - Photometric information is available at cammanlighting.com.





Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1003-48-LH-35K-CLV-MV-WM-
 PMW-ST-90CRI
 Notes:

Type:
L6
 LDI24-110942

Hanging Options:

ST Stem & (4) Aircraft Cables to Canopy
(Not Available in 60" and 72" Sizes)

AC (4) Aircraft Cables with Power Cord

Other Options:

OAH Overall Height (Specify in Comments)
REM Remote Emergency Power Supply (18" & 24" Sizes)
IEM Integral Emergency Power Supply (36" & Larger Sizes)

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard 90CRI Available
L70 (Projected):	>72,000 hours

Warranty	5 years (electrical components retain the component manufacturer warranty).
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Camman Plus Customizations

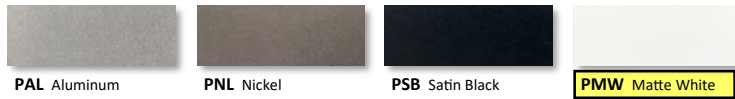


Camman **Standard Plus** products provide an extra degree of freedom to customize most standard products, including dimensions, finish, performance, and adding or removing details.

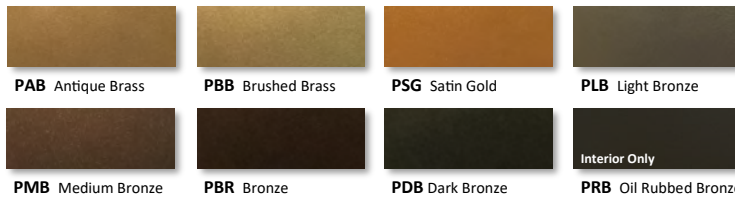
Visit www.cammanlighting.com/plus to learn more about the Plus program, and visit this fixture to see what specific options might be available.

Standard Finishes

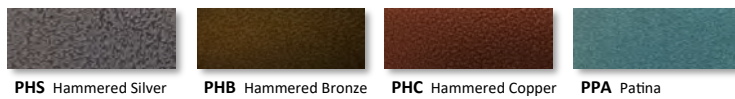
MODERN



NEUTRAL



TEXTURES



COLORS



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Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1003-48-LH-35K-CLV-MV-WM-PMW-IEM-ST-90CRI

Notes:

Type:

L6E

LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Metal Side Walls
- Flat White Acrylic Bottom Lens
- Aircraft Cable or Stem Hanging Options
- Overlay Options

Dimensions and Lamping:

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LN	LED: Nominal 250W, 24350 Delivered Lumens
LH	LED: Nominal 390W, 35250 Delivered Lumens

P1003-60	60" A x 60" B x 5" CWeight 90 lbs.*
LN	LED: Nominal 355W, 35750 Delivered Lumens
LH	LED: Nominal 555W, 52750 Delivered Lumens

** Structural support independent of the junction box is required.*

P1003-72	72" A x 72" B x 5" CWeight 120 lbs.*
LN	LED: Nominal 445W, 46950 Delivered Lumens
LH	LED: Nominal 695W, 69600 Delivered Lumens

** Structural support independent of the junction box is required.*

LED Color Temperature:

90 CRI

30K	3000K	35K	3500K	40K	4000K
-----	-------	------------	-------	-----	-------

Control:

CLV Integral Power Supply, 0-10V Dimming to 1%

Voltage:

1	120V	2	277V	MV	Multi-Volt
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Diffusers:

WM Matte White Acrylic
 WA Gloss White Acrylic

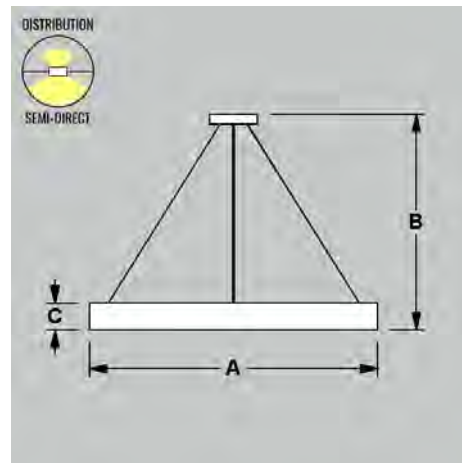
Standard Finishes:

PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Overlay Options (Opaque):

OCO Cherry Overlay	OWO Walnut Overlay
OMO Maple Overlay	OTBD To Be Determined

P1003 | Heinz



Notes:

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- Camman reserves the right to make design changes without prior notice.
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- Photometric information is available at cammanlighting.com.





Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1003-48-LH-35K-CLV-MV-WM-
 PMW-IEM-ST-90CRI
 Notes:

Type:
L6E
 LDI24-110942

Hanging Options:

ST Stem & (4) Aircraft Cables to Canopy
(Not Available in 60" and 72" Sizes)

AC (4) Aircraft Cables with Power Cord

Other Options:

OAH Overall Height (Specify in Comments)
REM Remote Emergency Power Supply (18" & 24" Sizes)
IEM Integral Emergency Power Supply (36" & Larger Sizes)

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
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3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard 90CRI Available
L70 (Projected):	>72,000 hours

Warranty	5 years
	(electrical components retain the component manufacturer warranty).

Camman Plus Customizations

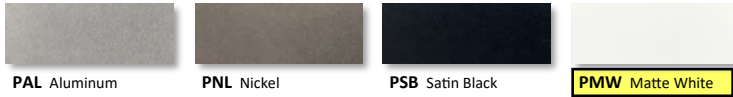


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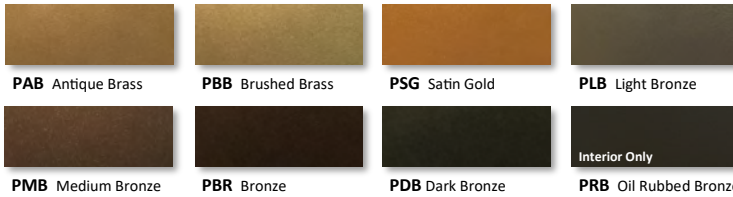
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Standard Finishes

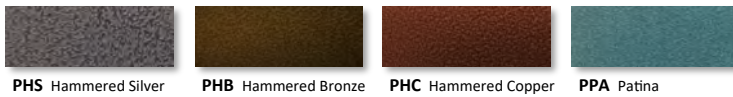
MODERN



NEUTRAL



TEXTURES



COLORS

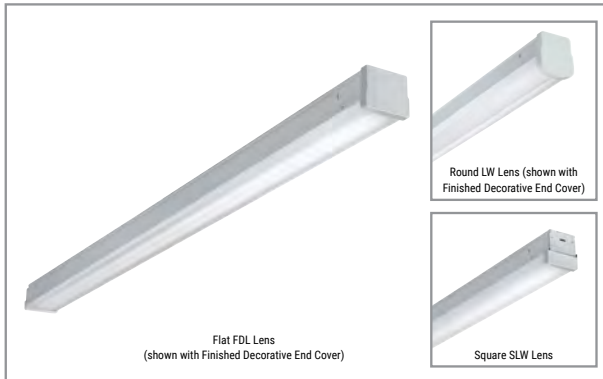


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- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.





Project		Catalog #		Type	
Prepared by		Notes		Date	



Metalux

SNX Lensed

Flat, Round and Square Lens
Linear LED Striplight

Typical Applications

Commercial • Cove • Warehouse/Distribution • Retail • Industrial • General Aisle
or Open Areas • Utility/Storage Rooms

Interactive Menu

- Order Information page 2
- Photometrics page 4
- Energy and Performance Data page 5
- Product Warranty

Top Product Features

- Standard (SL) and High lumen/High Efficacy (HL) packages
- Three (3) CCT and Lumen selectable options available
- Up to 21,000 lumen and 174 LPW
- General, Narrow or Wide distributions
- Decorative end cover and multiple finishes provide a polished look
- Integral factory installed controls option allows more energy savings
- Captive lens, electrical, and channel cover assembly
- Tool-less channel cover and electrical assembly
- Options to meet Buy American and other domestic preference requirements

Product Certification

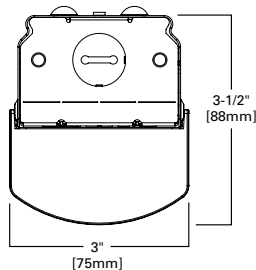


Product Features

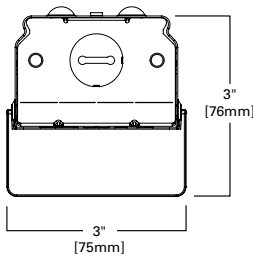


Dimensional Details

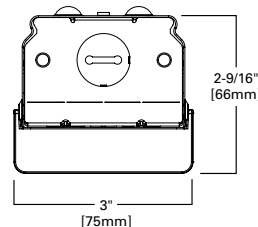
End View - Round Lens



End View - Square Lens

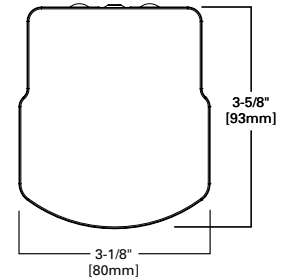


End View - Flat Lens



Finished Decorative End Covers

End View - Round Lens



[additional product diagrams](#)



Job Name:
South Dade Regional Library Specifications
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
4SNX-45SL-LW-UNV-L935-CD1-U

Type:
L7

Notes:

LDI24-110942

Metalux

SNX Lensed

Order Information

SAMPLE ORDER NUMBERS: **4SNX-48SL-LN-UNV-L835-CD1-U** or **8TSNX-180HL-SLW-UNV-EL7W-L840-CD2-U**

Domestic Preferences ⁽¹⁾	Length			Series
[Blank]=Standard	2=2 ft.	4=4 ft.	8T=8 ft.	SNX=Commercial LED Striplight ⁽²⁾
BAA=Buy American Act				
TAA=Trade Agreements Act				

Standard Nominal Lumen Packages ⁽³⁾				Lens	Voltage ⁽⁴⁾	Color Temp / CCT	Drive Type ⁽⁷⁾	No. of Drivers																																																				
<table border="1"> <thead> <tr> <th>2 ft</th> <th>4 ft</th> <th colspan="2">8 ft</th> </tr> </thead> <tbody> <tr> <td>SL3</td> <td>SL3</td> <td>60SL</td> <td>SL3 ⁽⁵⁾ 114SL ⁽⁵⁾</td> </tr> <tr> <td>19SL</td> <td>20SL</td> <td>63SL</td> <td>40SL 120SL ⁽⁵⁾</td> </tr> <tr> <td>23SL</td> <td>22SL</td> <td>67SL</td> <td>44SL 126SL ⁽⁵⁾</td> </tr> <tr> <td>25SL</td> <td>26SL</td> <td>74HL</td> <td>52SL 134SL ⁽⁵⁾</td> </tr> <tr> <td>30SL</td> <td>31SL</td> <td>81HL</td> <td>62SL 148HL ⁽⁵⁾</td> </tr> <tr> <td>40HL</td> <td>33SL</td> <td>84HL</td> <td>66SL 162HL ⁽⁵⁾</td> </tr> <tr> <td>44HL</td> <td>37SL</td> <td>87HL</td> <td>74SL 168HL ⁽⁵⁾</td> </tr> <tr> <td>47HL</td> <td>41SL</td> <td>90HL</td> <td>82SL 174HL ⁽⁵⁾</td> </tr> <tr> <td></td> <td>45SL</td> <td>93HL</td> <td>90SL 180HL ⁽⁵⁾</td> </tr> <tr> <td></td> <td>48SL</td> <td>100HL</td> <td>96SL 186HL ⁽⁵⁾</td> </tr> <tr> <td></td> <td>51SL</td> <td>104HL</td> <td>102SL ⁽⁵⁾ 200HL ⁽⁵⁾</td> </tr> <tr> <td></td> <td>57SL</td> <td></td> <td></td> </tr> </tbody> </table>				2 ft	4 ft	8 ft		SL3	SL3	60SL	SL3 ⁽⁵⁾ 114SL ⁽⁵⁾	19SL	20SL	63SL	40SL 120SL ⁽⁵⁾	23SL	22SL	67SL	44SL 126SL ⁽⁵⁾	25SL	26SL	74HL	52SL 134SL ⁽⁵⁾	30SL	31SL	81HL	62SL 148HL ⁽⁵⁾	40HL	33SL	84HL	66SL 162HL ⁽⁵⁾	44HL	37SL	87HL	74SL 168HL ⁽⁵⁾	47HL	41SL	90HL	82SL 174HL ⁽⁵⁾		45SL	93HL	90SL 180HL ⁽⁵⁾		48SL	100HL	96SL 186HL ⁽⁵⁾		51SL	104HL	102SL ⁽⁵⁾ 200HL ⁽⁵⁾		57SL			Round LC=Clear Lens LN=Semi-Frost Lens - Narrow LW=Full Frost Lens - Wide Square SLW=Square / Frost Lens - Wide Flat FDL=Flat Frost / Diffuse Lens	UNV-Universal Voltage 120-277 347=347V 480=480V ⁽⁶⁾	CCT Select ⁽⁵⁾ CC83=Switchable CCT, 80CRI, 35/4/5000K CC93=Switchable CCT, 90CRI 35/4/5000K CCT/CRI L830=3000K, 80 CRI L835=3500K, 80 CRI L840=4000K, 80 CRI L850=5000K, 80 CRI L930=3000K, 90 CRI L935=3500K, 90 CRI L940=4000K, 90 CRI L950=5000K, 90 CRI	CD=0-10V Dimming Driver (10%-100% Dimming) HCD=0-10V Dimming Driver (1%-100% Dimming) SD=Step-dim (Bi Level) 5LTD=5th Light (DALI) Driver ⁽⁸⁾ LH=Lutron HiLume (LDE1 series) 1%-100% EcoSystem Driver with Soft-on Fade to Black dimming ⁽²⁴⁾	1=1 Driver 2=2 Drivers ⁽⁹⁾
2 ft	4 ft	8 ft																																																										
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SL denotes standard lumen output. HL denotes high lumen output. Additional LEDs to obtain lumen package.
SL3=Low/Med/High output (see performance table for lumen package).

Options			Knockouts	Paint Finish	Packaging
Emergency ^{(9),(10)} EL7W=7-watt 120V-277V emergency battery pack ⁽¹¹⁾ EL10W=10-watt 120V-277V emergency battery pack ⁽¹¹⁾ EL14W=14-watt 120V-277V emergency battery pack ⁽¹¹⁾ EL10WSD=10W emergency battery pack with self-diagnostic installed ^{(11),(12)} EL14WSD=14W emergency battery pack with self-diagnostic installed ^{(11),(12)} GTR2=Bodine Generator Transfer Relay ⁽¹³⁾ ETRD=Emergency Transfer Relay with dimming control ⁽¹³⁾	Wiring ^{(14),(15)} PI/CPI=Plug in and cross over plug in options ⁽²²⁾ PC6/120=(NEMA 5-15P) 6 ft. Cord with NEMA Straight Plug PC6/277=(NEMA L7-15P) 6 ft. Cord with NEMA Twist Plug C6(1)=1 Circuit, 6 ft. Cord no Plug C3(1)=1 Circuit, 3 ft. Cord no Plug	Sensor ⁽¹⁰⁾ [Blank]=No Sensor WAB=WaveLinx Wireless Integrated Sensor ⁽¹⁶⁾ WAB=WaveLinx Lite Wireless Integrated Sensor ⁽⁶⁾ SVPD2=Integrated occupancy and daylight dimming sensor, 900 sq. ft. coverage ⁽⁵⁾ SVPD3=Integrated occupancy and daylight dimming sensor, 1200 sq. ft. coverage ⁽⁵⁾ ZW-SVPD3=Integrated WaveLinx Wireless Sensor, 1200 sqft. coverage ^{(21),(23),(6)} WLSA=WaveLinx Lite Wireless Integrated Sensor, 15'-40' Mounting Height ^{(21),(23),(6)} Sensor Location MID=Mid-row	[Blank]=Clean Channel FKO=Full Side KUS	[Blank]=Standard White PAF=Painted after fab. (White) BLK=PAF Black ⁽¹⁷⁾ GRY=PAF Gray ⁽¹⁷⁾	U=Unit Pack

Accessories (Order Separately) ⁽¹⁸⁾				
AJC-CHAIN/SET-U=(2) 36" Chain Hanger (Use 1 set per fixture) SCF=Fixed Stem Set (Specify Length) ⁽¹⁹⁾ SCS=Swivel Stem Set (Specify Length) ⁽¹⁹⁾ SCA=Adjustable 48" Stem Set ⁽¹⁹⁾ EYE-CHAIN/SET-B=Eye Bolt Chain (Use 1 set per fixture) WG-SNX/SN-2FT-B=2 ft Wire Guard WG-SNX/SN-4FT-B=4 ft Wire Guard A-1-B/SPACER-B=Spacer 1-1/2" to 2-1/2" from ceiling (Use 2 per fixture) ⁽¹⁹⁾ TOGGLE=Single Toggle No. 2 (Specify Length) ⁽¹⁹⁾ Y-Toggle-10-2PK=(2) Y-Toggle Cable Kits at 10FT Long GRP-SNF-U=Gripper Hanger CLC-SNLED-EXT-B=SN/SNX Long Row Aligner Extension ISHH-D1=Integrated SVPDx Sensor Programming Remote	Round Replacement Lenses SNX-LENS-LW-2FT-U= Replacement Lens 2 ft, Full Frost SNX-LENS-LN-2FT-U= Replacement Lens 2 ft, Semi Frost SNX-LENS-LC-2FT-U= Replacement Lens 2 ft, Clear SNX-LENS-LW-4FT-U= Replacement Lens 4 ft, Full Frost SNX-LENS-LN-4FT-U= Replacement Lens 4 ft, Semi Frost SNX-LENS-LC-4FT-U= Replacement Lens 4 ft, Clear	Square Replacement Lenses SNX-SQLENS-SLW-2FT-U= Replacement Lens 2 ft, Full Frost SNX-SQLENS-SLW-4FT-U= Replacement Lens 4 ft, Full Frost	Flat Replacement Lenses SNX-Flat Lens-FDL-2FT-U= Replacement Lens 2 ft, Full Frost SNX-Flat Lens-FDL-4FT-U= Replacement Lens 4 ft, Full Frost	Finished End Cover ⁽²⁰⁾ DECOEND-RND PK=(2) Full end caps, SNX w/ Round Lens DECOEND-FDL PK=(2) Full end caps, SNX w/ Flat FDL Lens DECOEND-SLW PK=(2) Full end caps, SNX w/ Square Lens

Notes: (1) Only product configurations with these designated prefixes are built to be compliant with the Buy American Act of 1933 (BAA) or Trade Agreements Act of 1979 (TAA), respectively. Please refer to DOMESTIC PREFERENCES website for more information. Components shipped separately may be separately analyzed under domestic preference requirements. (2) Designlights Consortium® Qualified and classified for both DLC Standard and DLC Premium, refer to www.designlights.org for details. (3) Nominal lumen values. See table for value and fixture length. (4) 347/480V max ambient temp 40C. (5) Requires two drivers. (6) SL3 to be ordered in conjunction w/CCT Select. (7) 2ft with Sensor limited to CD and HCD drivers only. (8) For a complete listing of Fifth Light products, visit www.cooperlighting.com (9) 4 ft and 8 ft only. (10) When ordering sensor or EBP option, specify UNV (for 120 or 277V), 347 or 480V. (11) Factory installed with integral test switch/indicator/laser test. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 7=700 lumens). IES-format photometry for luminaire under emergency operation available. (12) EL10WSD and EL14WSD not available with 347V. (13) Used to bypass local control during outage. Must be used in conjunction with UL 1000 device (provided by others). GTR2 include 2 relays on fixtures with dimming drivers. ETRD option only requires one relay when used on a dimming fixture. Must specify voltage as 120 or 277V when ordering GTR2. (14) Consult tech support on numerous options for this feature. (15) Most common G&P shown. Must specify location for cord. All "end" locations will be on the end with sensor installed. (16) Integral Mid-Row sensor does not apply for ZW-SVPD3. (17) Black or gray fixture and lens ends. Refer to Finish multiplier table for performance. (18) Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information. (19) Order 2 per fixture. (20) Finished Deco end cover cannot be used with W end mount sensor or over any end mount fitting. (21) WLSs provided in separate enclosure. (22) For more information on PI/CPI options, refer to 022341_pi_tilt (cooperlighting.com) (23) Not available in Mid-Row Configuration. (24) Consult MarketPlace Options- Lutron system pages for additional details and compatibility. Compatible only with driver series shown, and may require two or more drivers. Requires field commissioning to operate or dim. Contact Lutron at www.lutron.com. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (A) Consult WaveLinx system pages for additional details and compatibility. (B) WaveLinx Lite devices are not currently compatible with the WaveLinx Wireless Area Controller. Consult WaveLinx Lite system pages for additional details and compatibility. (C) Consult SVPD series system pages for additional details and compatibility.

Stock is available in the following catalog numbers:

Catalog Number	Description	Replaces Up To	Selectable CCT	Voltage	Selectable Lumens	Watts	UPC	DLC Product ID
4SNX-SL3-LW-UNV-CC83-CD1-U	4' Single Lens	2-T8 32W, 1-T5HO 54W	3500K-5000K	120-277V	2000-6100	17/33/51	080083265107	S-Z5CGBY
8TSNX-SL3-LW-UNV-CC83-CD2-U	8' Single Lens	4-T8 32W, 2-T12 75W	3500K-5000K	120-277V	4100-12000	34/67/101	080083265114	S-V503E2



Job Name:

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

4SNX-45SL-LW-UNV-L935-CD1-U

Notes:**Type:****L7**

LDI24-110942

Metalux**SNX Lensed****Product Specifications****Construction**

- Die-formed cold rolled steel channel and cover
- Convertible end plate for continuous row alignment
- Tool-less channel/wireway cover and captive electrical assembly
- Groove for Tong Hanger
- Surface, pendant or stem mount capable. See available mounting options.

Controls

- Standard with 0-10V dimming driver (10% standard, 1% optional)
- WaveLinx wireless sensor compatible for standalone, controlled, connected, and IoT capability
- SVPD sensor compatible for out-of-the-box functionality
- DALI 2.0 and step-dimming available
- Combine with energy-saving products like occupancy sensors, daylighting controls and lighting relay panels to maximize energy savings
- For motion control, reference sensor locations for both end and middle of the row applications

Emergency Battery Pack Option

- Optional 120V-277V integral emergency battery pack available in 7W or 14W
- 90-minute backup period for code compliance
- Generator transfer options available

Electrical

- Long-life LED system with electrical driver for optimal performance
- LED's available in 3000K, 3500K, 4000K or 5000K with CRI of 80 standard or optional 90 CRI
- Three CCT select option available for 80 or 90CRI in warm to cool color temps, see ordering logic
- Lumen select option available in full, medium or low brightness, see performance table and ordering logic
- Electronic drivers available for 120-277V, 347V and 480 applications
- Operating temperature of -20°C to 50°C

Finish

- Standard baked white enamel finish with multi-stage, iron phosphate pretreatment. Baked white enamel finish is standard
- PAF option for added rust protection
- Other paint finishes available: Black (BLK) and GRAY (GR)

Shielding

- Offered with acrylic lens and molded lens cap
- Flat lens with LED diffuse blend (FDL) for general distribution is recommended option
- Round lens offered in three distributions: Clear with linear ribs (LC), semi-frost for narrow distribution, and frost for wide distribution (LW)
- Square frost lens option for wide distribution (SLW) is available

Compliance

- cULus Listed for damp locations
- RoHS compliant
- Complies with IESNA LM-79 and LM-80 standards
- NEMA 410 compliant (drivers)
- State of California Title 24 high efficacy luminaire
- DesignLights Consortium® Qualified and classified for DLC Standard and DLC Premium (refer to www.designlights.org)
- Suitable for closet use when installed to NEC 410.16 spacings standards

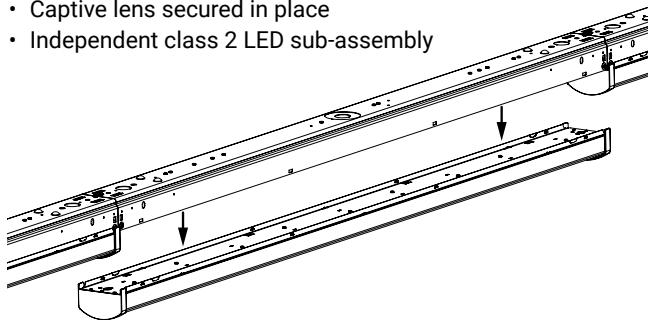
Limited Warranty

- Five year limited warranty

WaveLinx Lite devices are not currently compatible with the WaveLinx Pro Wireless Area Controller

Captive Light Channel Assembly

- Tool-less removal for easy install
- Captive lens secured in place
- Independent class 2 LED sub-assembly



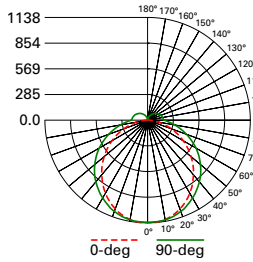


Metalux

SNX Lensed

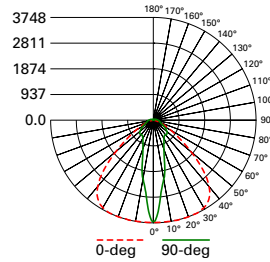
Photometric Data

[View IES files](#)



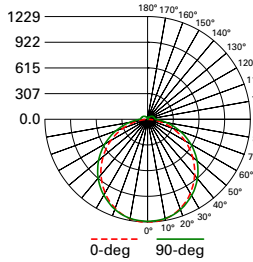
4SNX-41SL-LW-UNV-L850-CD1-U

Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.23 x mounting height, (L) 1.31 x mounting height
Lumens: 4027
Input Watts: 26.3W
Efficacy: 153 LPW
Test Report: 4SNX-41SL-LW-UNV-L850-CD.IES



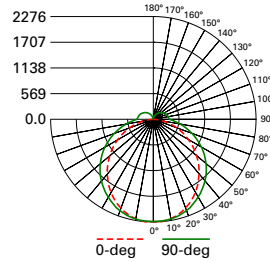
4SNX-41SL-LC-UNV-L850-CD1-U

Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.45 x mounting height, (L) 0.43 x mounting height
Lumens: 4557
Input Watts: 26.3W
Efficacy: 173 LPW
Test Report: 4SNX-41SL-LC-UNV-L850-CD.IES



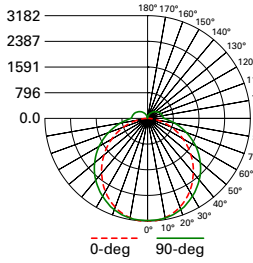
4SNX-41SL-FDL-UNV-L850-CD1-U

Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.24 x mounting height, (L) 1.28 x mounting height
Lumens: 3877
Input Watts: 26.3W
Efficacy: 147 LPW
Test Report: 4SNX-41SL-FDL-UNV-L850-CD.IES



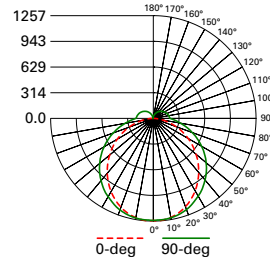
8TSNX-82SL-LW-UNV-L850-CD1-U

Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.23 x mounting height, (L) 1.31 x mounting height
Lumens: 8053
Input Watts: 52.6W
Efficacy: 153 LPW
Test Report: 8SNX-82SL-LW-UNV-L850-CD.IES



8TSNX-104SL-LW-UNV-L850-CD1-U

Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.23 x mounting height, (L) 1.31 x mounting height
Lumens: 11260
Input Watts: 79.4W
Efficacy: 142 LPW
Test Report: 8SNX-104SL-LW-UNV-L850-CD.IES



2SNX-47HL-LW-UNV-L850-CD1-U

Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.24 x mounting height, (L) 1.28 x mounting height
Lumens: 4494
Input Watts: 33.7W
Efficacy: 133 LPW
Test Report: 2SNX-47HL-LW-UNV-L850-CD.IES

Additional Data

CCT Table

Approximate Color Temperature Multiplier	
2700K	.93
3000K	.98
3500K	1.0
4000K	1.02
5000K	1.02

Shipping Data

Length	Wt.
2 ft.	4.3 lbs.
4 ft.	8.2 lbs.
8 ft.	15.1 lbs.

CRI

Lumen multiplier (80CRI to 90CRI)			
3000K	3500K	4000K	5000K
0.805	0.840	0.846	0.901

Lumen Maintenance

Product Model ⁽¹⁾	Ambient Temperature	TM-21 Lumen Maintenance (60,000 hours)	Theoretical L90 (Hours)	Theoretical L70 (Hours)
SNX-SL	25C	89	53,000	175,000
	40C and higher	89	49,000	163,000
SNX-HL	25C	89	55,000	180,000
	40C and higher	87	46,000	155,000

Notes: (1) 4ft and 8ft TM-21 data are equivalent.



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 4SNX-45SL-LW-UNV-L935-CD1-U

Notes:

Type:

L7

LDI24-110942

Metalux

SNX Lensed

Energy and Performance Data - Fixed Output

Lumen Package		Delivered Lumens					Wattage	Efficacy lm/W				
2 ft		LC	LN	LW	SLW	FDL		LC	LN	LW	SLW	FDL
19	SL	2006	1939	1773	1755	1707	12.0	167.2	161.6	147.8	146.3	142.3
23	SL	2429	2347	2146	2124	2066	14.9	163.0	157.5	144.0	142.6	138.7
25	SL	2718	2626	2401	2377	2312	17.5	155.3	150.1	137.2	135.8	132.1
30	SL	3204	3096	2831	2802	2726	21.0	152.6	147.4	134.8	133.4	129.8
40	HL	4347	4200	3727	3689	3725	27.6	157.5	152.2	135.0	133.7	135.0
44	HL	4683	4525	4015	3975	4013	31.1	150.6	145.5	129.1	127.8	129.0
47	HL	5009	4840	4295	4251	4292	33.7	148.6	143.6	127.4	126.1	127.4

Lumen Package		Delivered Lumens					Wattage	Efficacy lm/W				
4 ft		LC	LN	LW	SLW	FDL		LC	LN	LW	SLW	FDL
20	SL	2100	2029	1855	1836	1786	12.1	173.6	167.7	153.3	151.7	147.6
22	SL	2391	2311	2113	2091	2034	13.8	173.3	167.5	153.1	151.5	147.4
26	SL	2823	2728	2494	2469	2401	16.4	172.1	166.3	152.1	150.5	146.4
31	SL	3318	3206	2932	2902	2823	19.5	170.2	164.4	150.4	148.8	144.8
33	SL	3563	3443	3148	3116	3031	21.1	168.9	163.2	149.2	147.7	143.6
37	SL	4013	3877	3545	3509	3413	24.0	167.2	161.5	147.7	146.2	142.2
41	SL	4356	4209	3848	3809	3705	26.3	165.6	160.0	146.3	144.8	140.9
45	SL	4857	4693	4292	4248	4132	29.8	163.0	157.5	144.0	142.6	138.7
48	SL	5191	5015	4586	4540	4416	32.1	161.7	156.2	142.9	141.4	137.6
51	SL	5435	5252	4803	4754	4624	35.0	155.3	150.1	137.2	135.8	132.1
57	SL	6090	5884	5381	5326	5181	39.7	153.4	148.2	135.5	134.2	130.5
60	SL	6408	6192	5662	5605	5452	42.0	152.6	147.4	134.8	133.5	129.8
63	SL	6727	6500	5944	5883	5723	44.4	151.5	146.4	133.9	132.5	128.9
67	SL	7191	6948	6354	6289	6117	47.9	150.1	145.1	132.7	131.3	127.7
74	HL	8015	7745	6873	6803	6669	51.8	154.7	149.5	132.7	131.3	132.6
81	HL	8693	8400	7454	7378	7450	55.1	157.8	152.5	135.3	133.9	135.2
84	HL	9084	8777	7789	7710	7785	57.9	156.9	151.6	134.5	133.2	134.5
87	HL	9366	9050	8031	7949	8026	62.2	150.6	145.5	129.1	127.8	129.0
90	HL	9701	9373	8318	8233	8313	64.4	150.6	145.5	129.2	127.8	129.1
93	HL	10018	9680	8590	8502	8585	67.4	148.6	143.6	127.4	126.1	127.4
100	HL	10765	10402	9231	9137	9226	72.5	148.5	143.5	127.3	126.0	127.3
104	HL	11162	10786	9571	9474	9566	75.5	147.8	142.9	126.8	125.5	126.7



Metalux **SNX Lensed**

Energy and Performance Data - Fixed Output

Lumen Package		Delivered Lumens					Wattage	Efficacy lm/W				
8 ft		LC	LN	LW	SLW	FDL		LC	LN	LW	SLW	FDL
40	SL	4200	4058	3711	3673	3573	24.2	173.6	167.7	153.3	151.8	147.6
44	SL	4782	4621	4226	4183	4068	27.6	173.3	167.4	153.1	151.6	147.4
52	SL	5646	5455	4989	4938	4803	32.8	172.1	166.3	152.1	150.5	146.4
62	SL	6637	6413	5864	5805	5646	39.0	170.2	164.4	150.4	148.8	144.8
66	SL	7126	6885	6296	6232	6062	42.2	168.9	163.2	149.2	147.7	143.6
74	SL	8025	7754	7091	7019	6827	48.0	167.2	161.5	147.7	146.2	142.2
82	SL	8711	8417	7697	7619	7410	52.6	165.6	160.0	146.3	144.8	140.9
90	SL	9714	9386	8583	8496	8264	59.6	163.0	157.5	144.0	142.6	138.7
96	SL	10381	10031	9173	9079	8831	64.2	161.7	156.2	142.9	141.4	137.6
102	SL	10871	10504	9605	9507	9248	70.0	155.3	150.1	137.2	135.8	132.1
114	SL	12180	11769	10762	10652	10361	79.4	153.4	148.2	135.5	134.2	130.5
120	SL	12817	12384	11325	11209	10903	84.0	152.6	147.4	134.8	133.4	129.8
126	SL	13454	13000	11888	11767	11445	88.8	151.5	146.4	133.9	132.5	128.9
134	SL	14382	13897	12708	12578	12235	95.8	150.1	145.1	132.7	131.3	127.7
148	HL	16031	15490	13746	13606	13738	103.6	154.7	149.5	132.7	131.3	132.6
162	HL	17386	16800	14908	14757	14900	110.2	157.8	152.5	135.3	133.9	135.2
168	HL	18168	17555	15579	15420	15570	115.8	156.9	151.6	134.5	133.2	134.5
174	HL	18731	18099	16062	15898	16053	124.4	150.6	145.5	129.1	127.8	129.0
180	HL	19401	18747	16636	16467	16627	128.8	150.6	145.6	129.2	127.8	129.1
186	HL	20035	19359	17179	17005	17170	134.8	148.6	143.6	127.4	126.1	127.4
200	HL	21531	20804	18462	18274	18452	145.0	148.5	143.5	127.3	126.0	127.3

Energy and Performance Data - Selectable Output

Lens Type	CRI	Length	Lumen Select	Delivered Lumens			Wattage			Efficacy lm/W		
			CCT Select	3500K	4000K	5000K	3500K	4000K	5000K	3500K	4000K	5000K
LC	80	2 ft.	Low	1026	1066	1099	6.9	6.6	6.7	148.7	161.5	164.0
			Med	1990	2198	2133	13.9	13.3	13.2	143.2	165.3	161.6
			High	3016	3232	3331	21	20	20.2	143.6	161.6	164.9
		4 ft.	Low	2275	2405	2270	16.7	16.1	16.9	136.2	149.4	134.3
			Med	4665	4551	4800	33.5	32.3	33.7	139.3	140.9	142.4
			High	6957	7289	6880	50.7	48.9	51.1	137.2	149.1	134.6
	8 ft.	Low	4453	4693	4655	33.5	32.3	33.7	132.9	145.3	138.1	
		Med	9383	8909	9364	66.9	64.5	67.5	140.3	138.1	138.7	
		High	14575	14220	13468	101.4	97.8	102.2	143.7	145.4	131.8	
	90	2 ft.	Low	842	903	904	6.9	6.6	6.7	122.0	136.8	134.9
			Med	1737	1805	1809	13.9	13.3	13.2	125.0	135.7	137.0
			High	2553	2819	2825	21	20.2	20.2	121.6	139.6	139.9
4 ft.		Low	1944	2036	1926	16.7	16.1	16.9	116.4	126.5	114.0	
		Med	3949	3852	4072	33.5	32.3	33.7	117.9	119.3	120.8	
		High	5889	6169	5836	50.7	48.9	51.1	116.2	126.2	114.2	
8 ft.	Low	3770	3972	3949	33.5	32.3	33.7	112.5	123.0	117.2		
	Med	7704	7540	7943	66.9	64.5	67.5	115.2	116.9	117.7		
	High	12338	12035	11425	101.4	97.8	102.2	121.7	123.1	111.8		



Metalux **SNX Lensed**

Energy and Performance Data - Selectable Output

Lens Type	CRI	Length	Lumen Select	Delivered Lumens			Wattage			Efficacy lm/W		
			CCT Select	3500K	4000K	5000K	3500K	4000K	5000K	3500K	4000K	5000K
LN	80	2 ft.	Low	991	1030	1062	6.9	6.6	6.7	143.6	156.1	158.5
			Med	1983	2124	2061	13.9	13.3	13.2	142.7	159.7	156.1
			High	2914	3122	3218	21	20	20.2	138.8	156.1	159.3
		4 ft.	Low	2218	2324	2194	16.7	16.1	16.9	132.8	144.3	129.8
			Med	4508	4398	4638	33.5	32.3	33.7	134.6	136.2	137.6
			High	6722	7043	6648	50.7	48.9	51.1	132.6	144.0	130.1
	8 ft.	Low	4647	4534	4498	33.5	32.3	33.7	138.7	140.4	133.5	
		Med	8793	8608	9048	66.9	64.5	67.5	131.4	133.5	134.0	
		High	14083	13740	13013	101.4	97.8	102.2	138.9	140.5	127.3	
	90	2 ft.	Low	814	899	874	6.9	6.7	6.7	118.0	134.2	130.4
			Med	1679	1744	1748	13.9	13.3	13.2	120.8	131.1	132.4
			High	2467	2724	2730	21	20.2	20.2	117.5	134.9	135.1
4 ft.		Low	1878	1967	1861	16.7	16.1	16.9	112.5	122.2	110.1	
		Med	3816	3722	3934	33.5	32.3	33.7	113.9	115.2	116.7	
		High	5691	5782	5639	50.7	48.9	51.1	112.2	118.2	110.4	
8 ft.	Low	3934	3838	3816	33.5	32.3	33.7	117.4	118.8	113.2		
	Med	7444	7286	7675	66.9	64.5	67.5	111.3	113.0	113.7		
	High	11922	11629	11039	101.4	97.8	102.2	117.6	118.9	108.0		

Lens Type	CRI	Length	Lumen Select	Delivered Lumens			Wattage			Efficacy lm/W		
			CCT Select	3500K	4000K	5000K	3500K	4000K	5000K	3500K	4000K	5000K
LW	80	2 ft.	Low	907	914	971	6.9	6.6	6.7	131.4	138.5	144.9
			Med	1813	1942	1829	13.9	13.3	13.2	130.4	146.0	138.6
			High	2586	2771	2943	21	20	20.2	123.1	138.6	145.7
		4 ft.	Low	2028	2125	1947	16.7	16.1	16.9	121.4	132.0	115.2
			Med	4000	4058	4241	33.5	32.3	33.7	119.4	125.6	125.8
			High	6147	6062	5900	50.7	48.9	51.1	121.2	124.0	115.5
	8 ft.	Low	4250	4146	4137	33.5	32.3	33.7	126.9	128.4	122.8	
		Med	7803	7639	8273	66.9	64.5	67.5	116.6	118.4	122.6	
		High	12878	11826	11548	101.4	97.8	102.2	127.0	120.9	113.0	
	90	2 ft.	Low	722	822	824	6.9	6.7	6.6	104.6	122.7	124.8
			Med	1535	1547	1551	13.9	13.3	13.2	110.4	116.3	117.5
			High	2189	2491	2497	21	20.2	20.2	104.2	123.3	123.6
4 ft.		Low	1717	1799	1652	16.7	16.1	16.9	102.8	111.7	97.8	
		Med	3386	3434	3598	33.5	32.3	33.7	101.1	106.3	106.8	
		High	5204	5131	5005	50.7	48.9	51.1	102.6	104.9	97.9	
8 ft.	Low	3598	3509	3509	33.5	32.3	33.7	107.4	108.6	104.1		
	Med	6606	7195	7018	66.9	64.5	67.5	98.7	111.6	104.0		
	High	10902	10009	9796	101.4	97.8	102.2	107.5	102.3	95.9		



Metalux

SNX Lensed

Energy and Performance Data - Selectable Output

Lens Type	CRI	Length	Lumen Select	Delivered Lumens			Wattage			Efficacy		
			CCT Select	3500K	4000K	5000K	3500K	4000K	5000K	3500K	4000K	5000K
SLW	80	2 ft.	Low	845	905	905	6.9	6.6	6.7	122.5	137.1	135.1
			Med	1795	1923	1810	13.9	13.3	13.2	129.1	144.6	137.1
			High	2560	2743	2913	21	20	20.2	121.9	137.2	144.2
		4 ft.	Low	2008	1980	1927	16.7	16.1	16.9	120.2	123.0	114.0
			Med	3959	4017	4198	33.5	32.3	33.7	118.2	124.4	124.6
			High	6084	6000	5840	50.7	48.9	51.1	120.0	122.7	114.3
	8 ft.	Low	4206	4104	4095	33.5	32.3	33.7	125.6	127.1	121.5	
		Med	7724	8415	8189	66.9	64.5	67.5	115.5	130.5	121.3	
		High	12747	11706	11431	101.4	97.8	102.2	125.7	119.7	111.8	
	90	2 ft.	Low	715	814	816	6.9	6.7	6.6	103.6	121.5	123.6
			Med	1519	1532	1536	13.9	13.3	13.2	109.3	115.2	116.4
			High	2167	2465	2326	21	20.2	20.2	103.2	122.0	115.1
4 ft.		Low	1700	1676	1635	16.7	16.1	16.9	101.8	104.1	96.7	
		Med	3352	3400	3561	33.5	32.3	33.7	100.1	105.3	105.7	
		High	5151	5079	5151	50.7	48.9	51.1	101.6	103.9	100.8	
8 ft.	Low	3561	3269	3473	33.5	32.3	33.7	106.3	101.2	103.1		
	Med	6539	7122	6947	66.9	64.5	67.5	97.7	110.4	102.9		
	High	10791	9907	9697	101.4	97.8	102.2	106.4	101.3	94.9		

Lens Type	CRI	Length	Lumen Select	Delivered Lumens			Wattage			Efficacy		
			CCT Select	3500K	4000K	5000K	3500K	4000K	5000K	3500K	4000K	5000K
FDL	80	2 ft.	Low	853	914	914	6.9	6.6	6.7	123.6	138.5	136.4
			Med	1746	1870	1828	13.9	13.3	13.2	125.6	140.6	138.5
			High	2584	2833	2833	21	20.2	20.2	123.0	140.2	140.2
		4 ft.	Low	1953	1999	1946	16.7	16.1	16.9	116.9	124.2	115.1
			Med	3998	3907	4083	33.5	32.3	33.7	119.3	121.0	121.2
			High	5918	6059	5906	50.7	48.9	51.1	116.7	123.9	115.6
	8 ft.	Low	4092	3900	3892	33.5	32.3	33.7	122.1	120.7	115.5	
		Med	7799	8185	7966	66.9	64.5	67.5	116.6	126.9	118.0	
		High	12399	11820	12373	101.4	97.8	102.2	122.3	120.9	121.1	
	90	2 ft.	Low	722	791	793	6.9	6.7	6.6	104.6	118.1	120.2
			Med	1478	1547	1586	13.9	13.3	13.3	106.3	116.3	119.2
			High	2188	2398	2349	21	20.2	20.2	104.2	118.7	116.3
4 ft.		Low	1653	1692	1651	16.7	16.1	16.9	99.0	105.1	97.7	
		Med	3384	3307	3384	33.5	32.3	33.7	101.0	102.4	100.4	
		High	5010	5128	5010	50.7	48.9	51.1	98.8	104.9	98.0	
8 ft.	Low	3464	3301	3301	33.5	32.3	33.7	103.4	102.2	98.0		
	Med	6602	6927	6757	66.9	64.5	67.5	98.7	107.4	100.1		
	High	10496	10004	10496	101.4	97.8	102.2	103.5	102.3	102.7		

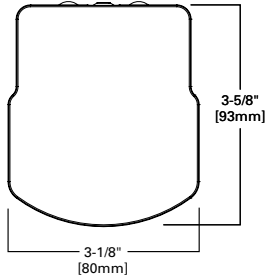


Metalux

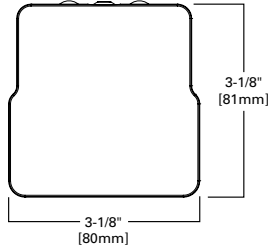
SNX Lensed

Finished Decorative End Covers

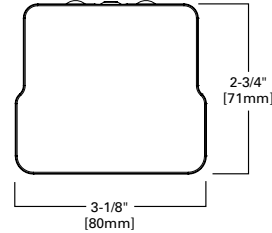
End View - Round Lens



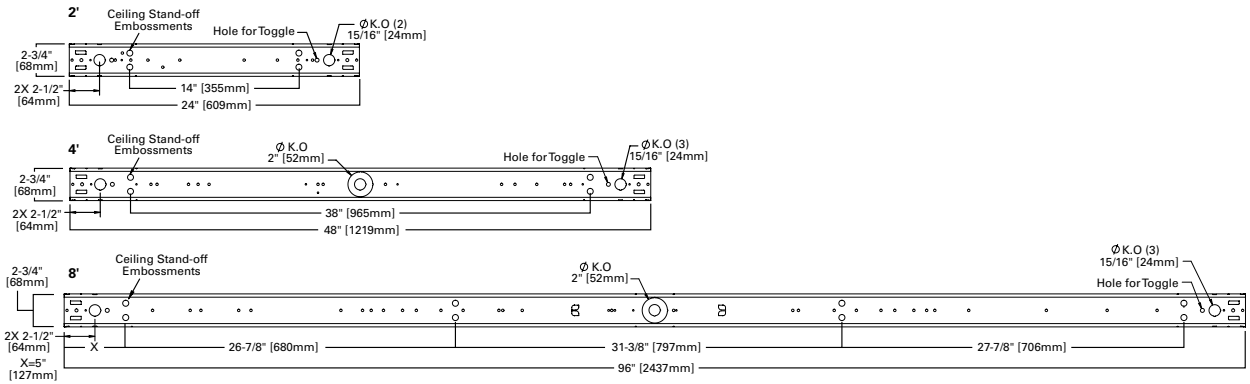
End View - Square Lens



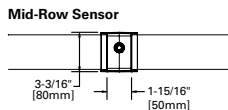
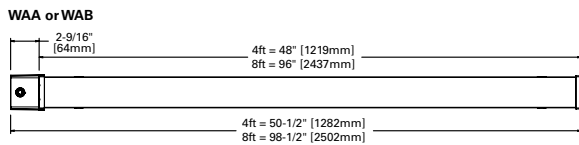
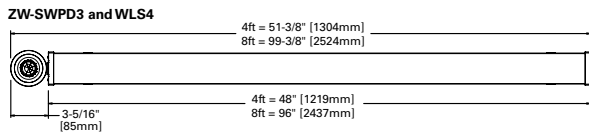
End View - Flat Lens



Dimensional and Mounting Details



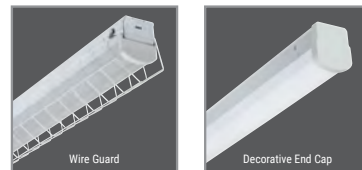
Fixture Size with Sensor



Options

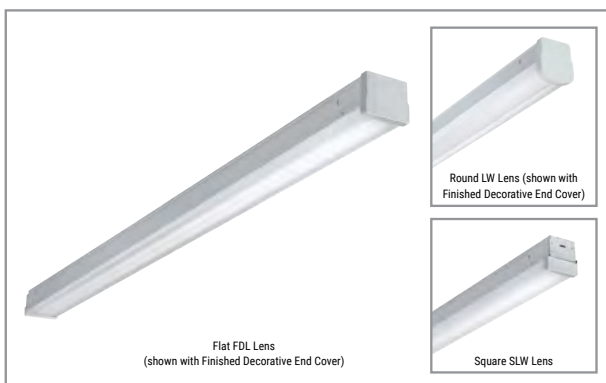


Accessories





Project		Catalog #		Type	
Prepared by		Notes		Date	



Metalux

SNX Lensed

Flat, Round and Square Lens
Linear LED Striplight

Typical Applications

Commercial • Cove • Warehouse/Distribution • Retail • Industrial • General Aisle or Open Areas • Utility/Storage Rooms

Interactive Menu

- Order Information page 2
- Photometrics page 4
- Energy and Performance Data page 5
- Product Warranty

Top Product Features

- Standard (SL) and High lumen/High Efficacy (HL) packages
- Three (3) CCT and Lumen selectable options available
- Up to 21,000 lumen and 174 LPW
- General, Narrow or Wide distributions
- Decorative end cover and multiple finishes provide a polished look
- Integral factory installed controls option allows more energy savings
- Captive lens, electrical, and channel cover assembly
- Tool-less channel cover and electrical assembly
- Options to meet Buy American and other domestic preference requirements

Product Certification

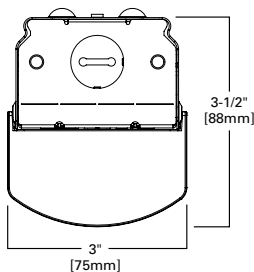


Product Features

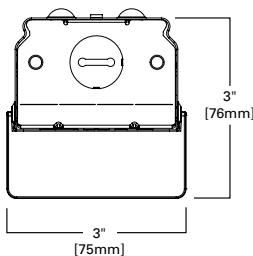


Dimensional Details

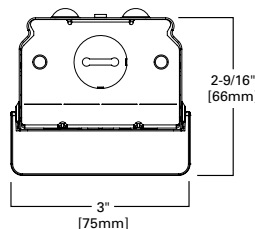
End View - Round Lens



End View - Square Lens

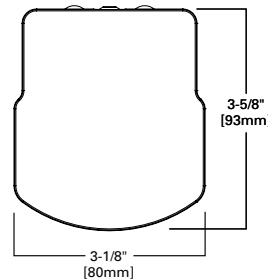


End View - Flat Lens



Finished Decorative End Covers

End View - Round Lens



[additional product diagrams](#)



Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
4SNX-45SL-LW-UNV-L935-CD1-
EL7W-FKO-U

Notes:

Type:

L7E

LDI24-110942

Metalux

SNX Lensed

Order Information

SAMPLE ORDER NUMBERS: **4SNX-48SL-LN-UNV-L835-CD1-U** or **8TSNX-180HL-SLW-UNV-EL7W-L840-CD2-U**

Domestic Preferences ⁽¹⁾	Length			Series
[Blank]=Standard	2=2 ft.	4=4 ft.	8T=8 ft.	SNX=Commercial LED Striplight ⁽²⁾
BAA=Buy American Act				
TAA=Trade Agreements Act				

Standard Nominal Lumen Packages ⁽³⁾				Lens	Voltage ⁽⁴⁾	Color Temp / CCT	Drive Type ⁽⁷⁾	No. of Drivers																																																				
<table border="1"> <thead> <tr> <th>2 ft</th> <th>4 ft</th> <th>8 ft</th> <th></th> </tr> </thead> <tbody> <tr> <td>SL3</td> <td>SL3</td> <td>60SL</td> <td>SL3 ⁽⁵⁾</td> </tr> <tr> <td>19SL</td> <td>20SL</td> <td>63SL</td> <td>40SL</td> </tr> <tr> <td>23SL</td> <td>22SL</td> <td>67SL</td> <td>44SL</td> </tr> <tr> <td>25SL</td> <td>26SL</td> <td>74HL</td> <td>52SL</td> </tr> <tr> <td>30SL</td> <td>31SL</td> <td>81HL</td> <td>62SL</td> </tr> <tr> <td>40HL</td> <td>33SL</td> <td>84HL</td> <td>66SL</td> </tr> <tr> <td>44HL</td> <td>37SL</td> <td>87HL</td> <td>74SL</td> </tr> <tr> <td>47HL</td> <td>41SL</td> <td>90HL</td> <td>82SL</td> </tr> <tr> <td></td> <td>45SL</td> <td>93HL</td> <td>90SL</td> </tr> <tr> <td></td> <td>48SL</td> <td>100HL</td> <td>96SL</td> </tr> <tr> <td></td> <td>51SL</td> <td>104HL</td> <td>102SL ⁽⁵⁾</td> </tr> <tr> <td></td> <td>57SL</td> <td></td> <td>200HL ⁽⁵⁾</td> </tr> </tbody> </table>				2 ft	4 ft	8 ft		SL3	SL3	60SL	SL3 ⁽⁵⁾	19SL	20SL	63SL	40SL	23SL	22SL	67SL	44SL	25SL	26SL	74HL	52SL	30SL	31SL	81HL	62SL	40HL	33SL	84HL	66SL	44HL	37SL	87HL	74SL	47HL	41SL	90HL	82SL		45SL	93HL	90SL		48SL	100HL	96SL		51SL	104HL	102SL ⁽⁵⁾		57SL		200HL ⁽⁵⁾	Round LC=Clear Lens LN=Semi-Frost Lens - Narrow LW=Full Frost Lens - Wide Square SLW=Square / Frost Lens - Wide Flat FDL=Flat Frost / Diffuse Lens	UNV=Universal Voltage 120-277 347=347V 480=480V ⁽⁶⁾	CCT Select ⁽⁸⁾ CC83=Switchable CCT, 80CRI, 35/4/5000K CC93=Switchable CCT, 90CRI 35/4/5000K CCT/CRI L830=3000K, 80 CRI L835=3500K, 80 CRI L840=4000K, 80 CRI L850=5000K, 80 CRI L930=3000K, 90 CRI L935=3500K, 90 CRI L940=4000K, 90 CRI L950=5000K, 90 CRI	CD=0-10V Dimming Driver (10%-100% Dimming) HCD=0-10V Dimming Driver (1%-100% Dimming) SD=Step-dim (Bi Level) 5LTD=5th Light (DALI) Driver ⁽⁹⁾ LH=Lutron HiLume (LDE1 series) 1%-100% EcoSystem Driver with Soft-on Fade to Black dimming ⁽²⁴⁾	1=1 Driver 2=2 Drivers ⁽¹⁰⁾
2 ft	4 ft	8 ft																																																										
SL3	SL3	60SL	SL3 ⁽⁵⁾																																																									
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	57SL		200HL ⁽⁵⁾																																																									

SL denotes standard lumen output. HL denotes high lumen output. Additional LEDs to obtain lumen package.
SL3=Low/Med/High output (see performance table for lumen package).

Options			Knockouts	Paint Finish	Packaging
Emergency ^{(9),(10)} EL7W=7-watt 120V-277V emergency battery pack ⁽¹¹⁾ EL10W=10-watt 120V-277V emergency battery pack ⁽¹¹⁾ EL14W=14-watt 120V-277V emergency battery pack ⁽¹¹⁾ EL10WSD=10W emergency battery pack with self-diagnostic installed ^{(11),(12)} EL14WSD=14W emergency battery pack with self-diagnostic installed ^{(11),(12)} GTR2=Bodine Generator Transfer Relay ⁽¹³⁾ ETRD=Emergency Transfer Relay with dimming control ⁽¹³⁾	Wiring ^{(14),(15)} PI/CP1=Plug in and cross over plug in options ⁽²²⁾ PC6/120=(NEMA 5-15P) 6 ft. Cord with NEMA Straight Plug PC6/277=(NEMA L7-15P) 6 ft. Cord with NEMA Twist Plug C6(1)=1 Circuit, 6 ft. Cord no Plug C3(1)=1 Circuit, 3 ft. Cord no Plug	Sensor ⁽¹⁶⁾ [Blank]=No Sensor WAA=WaveLinX Wireless Integrated Sensor ^(A) WAB=WaveLinX Lite Wireless Integrated Sensor ^(B) SVPD2=Integrated occupancy and daylight dimming sensor, 900 sq. ft. coverage ⁽²⁾ SVPD3=Integrated occupancy and daylight dimming sensor, 1200 sq. ft. coverage ⁽²⁾ ZW-SVPD3=Integrated WaveLinX Wireless Sensor, 1200 sqft. coverage ^{(21),(23),(6)} WLSA=WaveLinX Lite Wireless Integrated Sensor, 15'-40' Mounting Height ^{(21),(23),(6)} Sensor Location MID=Mid-row	[Blank]=Clean Channel FKO=Full Side KOs	[Blank]=Standard White PAF=Painted after fab. (White) BLK=PAF Black ⁽¹⁷⁾ GRY=PAF Gray ⁽¹⁷⁾	U=Unit Pack

Accessories (Order Separately) ⁽¹⁸⁾				
AYC-CHAIN/SET-U=(2) 36" Chain Hanger (Use 1 set per fixture) SCF=Fixed Stem Set (Specify Length) ⁽¹⁹⁾ SCS=Swivel Stem Set (Specify Length) ⁽¹⁹⁾ SCA=Adjustable 48" Stem Set ⁽¹⁹⁾ EYE-CHAIN/SET-B=Eye Bolt Chain (Use 1 set per fixture) WG-SNX/SN-2FT-B=2 ft Wire Guard WG-SNX/SN-4FT-B=4 ft Wire Guard A-1-B/SPACER-B=Spacer 1-1/2" to 2-1/2" from ceiling (Use 2 per fixture) ⁽¹⁹⁾ TOGGLE=Single Toggle No. 2 (Specify Length) ⁽¹⁹⁾ Y-Toggle-10-2PK=(2) Y-Toggle Cable Kits at 10FT Long GRP-SNF-U=Gripper Hanger CLC-SNLED-EXT-B-SN/SNX Long Row Aligner Extension ISHH-01=Integrated SVPDx Sensor Programming Remote	Round Replacement Lenses SNX-LENS-LW-2FT-U=Replacement Lens 2 ft, Full Frost SNX-LENS-LN-2FT-U=Replacement Lens 2 ft, Semi Frost SNX-LENS-LC-2FT-U=Replacement Lens 2 ft, Clear SNX-LENS-LW-4FT-U=Replacement Lens 4 ft, Full Frost SNX-LENS-LN-4FT-U=Replacement Lens 4 ft, Semi Frost SNX-LENS-LC-4FT-U=Replacement Lens 4 ft, Clear	Square Replacement Lenses SNX-SQLENS-SLW-2FT-U=Replacement Lens 2 ft, Full Frost SNX-SQLENS-SLW-4FT-U=Replacement Lens 4 ft, Full Frost	Flat Replacement Lenses SNX-Flat Lens-FDL-2FT-U=Replacement Lens 2 ft, Full Frost SNX-Flat Lens-FDL-4FT-U=Replacement Lens 4 ft, Full Frost	Finished End Cover ⁽²⁰⁾ DECOEND-RND PK=(2) Full end caps, SNX w/ Round Lens DECOEND-FDL PK=(2) Full end caps, SNX w/ Flat FDL Lens DECOEND-SLW PK=(2) Full end caps, SNX w/ Square Lens

Notes: (1) Only product configurations with these designated prefixes are built to be compliant with the Buy American Act of 1933 (BAA) or Trade Agreements Act of 1979 (TAA), respectively. Please refer to DOMESTIC PREFERENCES website for more information. Components shipped separately may be separately analyzed under domestic preference requirements. (2) Designlights Consortium® Qualified and classified for both DLC Standard and DLC Premium, refer to www.designlights.org for details. (3) Nominal lumen values. See table for value and fixture length. (4) 347/480V max ambient temp 40C. (5) Requires two drivers. (6) SL3 to be ordered in conjunction w/CCT Select. (7) 2ft with Sensor limited to CD and HCD drivers only. (8) For a complete listing of Fifth Light products, visit www.cooperlighting.com (9) 4 ft and 8 ft only. (10) When ordering sensor or EBP option, specify UNV (for 120 or 277V), 347 or 480V. (11) Factory installed with integral test switch/indicator/laser test. For approximate delivered lumens multiply the lumens per watt of the desired fixture by the wattage of the emergency battery pack (100 lm/W x 7=700 lumens). IES-format photometry for luminaire under emergency operation available. (12) EL10WSD and EL14WSD not available with 347V. (13) Used to bypass local control during outage. Must be used in conjunction with UL 1000 device (provided by others). GTR2 include 2 relays on fixtures with dimming drivers. ETRD option only requires one relay when used on a dimming fixture. Must specify voltage as 120 or 277V when ordering GTR2. (14) Consult tech support on numerous options for this feature. (15) Most common G&P shown. Must specify location for cord. All "end" locations will be on the end with sensor installed. (16) Integral Mid-Row sensor does not apply for ZW-SVPD3. (17) Black or gray fixture and lens ends. Refer to Finish multiplier table for performance. (18) Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information. (19) Order 2 per fixture. (20) Finished Deco end cover cannot be used with W2 end mount sensor or over any end mount fitting. (21) WLSs provided in separate enclosure. (22) For more information on PI/CP1 options, refer to 022341_pi_tiltw.cooperlighting.com (23) Not available in Mid-Row Configuration. (24) Consult MarketPlace Options- Lutron system pages for additional details and compatibility. Compatible only with driver series shown, and may require two or more drivers. Requires field commissioning to operate or dim. Contact Lutron at www.lutron.com. Integrated options must be used in conjunction with the associated system and may not be compatible with other options or accessories. Please refer to the following: (A) Consult WaveLinX system pages for additional details and compatibility. (B) WaveLinX Lite devices are not currently compatible with the WaveLinX Wireless Area Controller. Consult WaveLinX Lite system pages for additional details and compatibility. (C) Consult SVPD series system pages for additional details and compatibility.

Stock is available in the following catalog numbers:

Catalog Number	Description	Replaces Up To	Selectable CCT	Voltage	Selectable Lumens	Watts	UPC	DLC Product ID
4SNX-SL3-LW-UNV-CC83-CD1-U	4' Single Lens	2-T8 32W, 1-T5HO 54W	3500K-5000K	120-277V	2000-6100	17/33/51	080083265107	S-Z5CGBY
8TSNX-SL3-LW-UNV-CC83-CD2-U	8' Single Lens	4-T8 32W, 2-T12 75W	3500K-5000K	120-277V	4100-12000	34/67/101	080083265114	S-V503E2



Job Name:

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

4SNX-45SL-LW-UNV-L935-CD1-EL7W-FKO-U

Notes:

Type:**L7E**

LDI24-110942

Metalux**SNX Lensed****Product Specifications****Construction**

- Die-formed cold rolled steel channel and cover
- Convertible end plate for continuous row alignment
- Tool-less channel/wireway cover and captive electrical assembly
- Groove for Tong Hanger
- Surface, pendant or stem mount capable. See available mounting options.

Controls

- Standard with 0-10V dimming driver (10% standard, 1% optional)
- WaveLinx wireless sensor compatible for standalone, controlled, connected, and IoT capability
- SVPD sensor compatible for out-of-the-box functionality
- DALI 2.0 and step-dimming available
- Combine with energy-saving products like occupancy sensors, daylighting controls and lighting relay panels to maximize energy savings
- For motion control, reference sensor locations for both end and middle of the row applications

Emergency Battery Pack Option

- Optional 120V-277V integral emergency battery pack available in 7W or 14W
- 90-minute backup period for code compliance
- Generator transfer options available

Electrical

- Long-life LED system with electrical driver for optimal performance
- LED's available in 3000K, 3500K, 4000K or 5000K with CRI of 80 standard or optional 90 CRI
- Three CCT select option available for 80 or 90CRI in warm to cool color temps, see ordering logic
- Lumen select option available in full, medium or low brightness, see performance table and ordering logic
- Electronic drivers available for 120-277V, 347V and 480 applications
- Operating temperature of -20°C to 50°C

Finish

- Standard baked white enamel finish with multi-stage, iron phosphate pretreatment. Baked white enamel finish is standard
- PAF option for added rust protection
- Other paint finishes available: Black (BLK) and GRAY (GR)

Shielding

- Offered with acrylic lens and molded lens cap
- Flat lens with LED diffuse blend (FDL) for general distribution is recommended option
- Round lens offered in three distributions: Clear with linear ribs (LC), semi-frost for narrow distribution, and frost for wide distribution (LW)
- Square frost lens option for wide distribution (SLW) is available

Compliance

- cULus Listed for damp locations
- RoHS compliant
- Complies with IESNA LM-79 and LM-80 standards
- NEMA 410 compliant (drivers)
- State of California Title 24 high efficacy luminaire
- DesignLights Consortium® Qualified and classified for DLC Standard and DLC Premium (refer to www.designlights.org)
- Suitable for closet use when installed to NEC 410.16 spacings standards

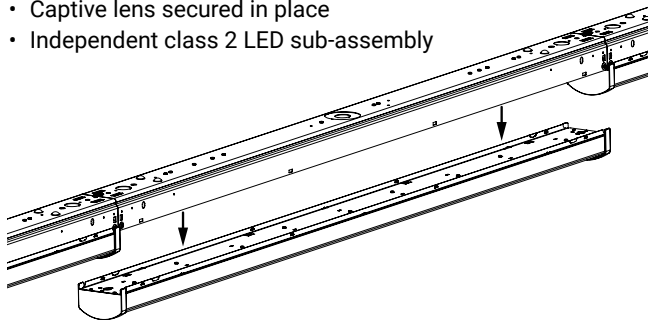
Limited Warranty

- Five year limited warranty

WaveLinx Lite devices are not currently compatible with the WaveLinx Pro Wireless Area Controller

Captive Light Channel Assembly

- Tool-less removal for easy install
- Captive lens secured in place
- Independent class 2 LED sub-assembly

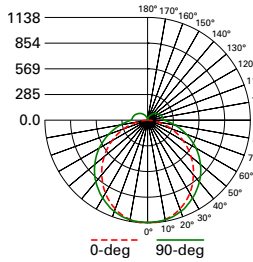




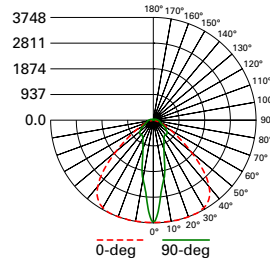
Metalux **SNX Lensed**

Photometric Data

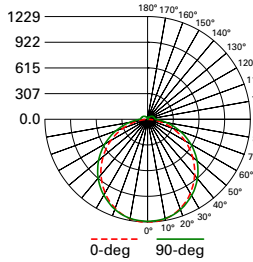
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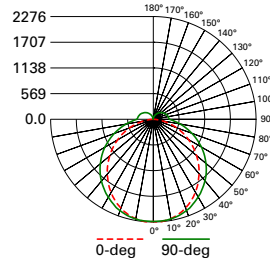
4SNX-41SL-LW-UNV-L850-CD1-U
Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.23 x mounting height, (L) 1.31 x mounting height
Lumens: 4027
Input Watts: 26.3W
Efficacy: 153 LPW
Test Report: 4SNX-41SL-LW-UNV-L850-CD.IES



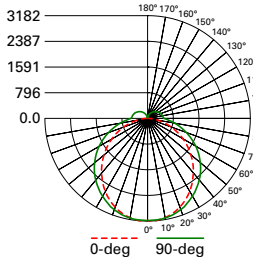
4SNX-41SL-LC-UNV-L850-CD1-U
Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.45 x mounting height, (L) 0.43 x mounting height
Lumens: 4557
Input Watts: 26.3W
Efficacy: 173 LPW
Test Report: 4SNX-41SL-LC-UNV-L850-CD.IES



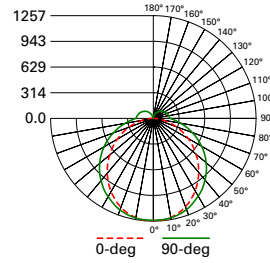
4SNX-41SL-FDL-UNV-L850-CD1-U
Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.24 x mounting height, (L) 1.28 x mounting height
Lumens: 3877
Input Watts: 26.3W
Efficacy: 147 LPW
Test Report: 4SNX-41SL-FDL-UNV-L850-CD.IES



8TSNX-82SL-LW-UNV-L850-CD1-U
Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.23 x mounting height, (L) 1.31 x mounting height
Lumens: 8053
Input Watts: 52.6W
Efficacy: 153 LPW
Test Report: 8SNX-82SL-LW-UNV-L850-CD.IES



8TSNX-104SL-LW-UNV-L850-CD1-U
Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.23 x mounting height, (L) 1.31 x mounting height
Lumens: 11260
Input Watts: 79.4W
Efficacy: 142 LPW
Test Report: 8SNX-104SL-LW-UNV-L850-CD.IES



2SNX-47HL-LW-UNV-L850-CD1-U
Electronic Driver
Linear LED 5000K
Spacing criterion: (II) 1.24 x mounting height, (L) 1.28 x mounting height
Lumens: 4494
Input Watts: 33.7W
Efficacy: 133 LPW
Test Report: 2SNX-47HL-LW-UNV-L850-CD.IES

Additional Data

CCT Table

Approximate Color Temperature Multiplier	
2700K	.93
3000K	.98
3500K	1.0
4000K	1.02
5000K	1.02

CRI

Lumen multiplier (80CRI to 90CRI)			
3000K	3500K	4000K	5000K
0.805	0.840	0.846	0.901

Lumen Maintenance

Product Model ⁽¹⁾	Ambient Temperature	TM-21 Lumen Maintenance (60,000 hours)	Theoretical L90 (Hours)	Theoretical L70 (Hours)
SNX-SL	25C	89	53,000	175,000
	40C and higher	89	49,000	163,000
SNX-HL	25C	89	55,000	180,000
	40C and higher	87	46,000	155,000

Notes: (1) 4ft and 8ft TM-21 data are equivalent.

Shipping Data

Length	Wt.
2 ft.	4.3 lbs.
4 ft.	8.2 lbs.
8 ft.	15.1 lbs.



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 4SNX-45SL-LW-UNV-L935-CD1-
 EL7W-FKO-U
 Notes:

Type:
L7E
 LDI24-110942

Metalux **SNX Lensed**

Energy and Performance Data - Fixed Output

Lumen Package		Delivered Lumens					Wattage	Efficacy lm/W				
2 ft		LC	LN	LW	SLW	FDL		LC	LN	LW	SLW	FDL
19	SL	2006	1939	1773	1755	1707	12.0	167.2	161.6	147.8	146.3	142.3
23	SL	2429	2347	2146	2124	2066	14.9	163.0	157.5	144.0	142.6	138.7
25	SL	2718	2626	2401	2377	2312	17.5	155.3	150.1	137.2	135.8	132.1
30	SL	3204	3096	2831	2802	2726	21.0	152.6	147.4	134.8	133.4	129.8
40	HL	4347	4200	3727	3689	3725	27.6	157.5	152.2	135.0	133.7	135.0
44	HL	4683	4525	4015	3975	4013	31.1	150.6	145.5	129.1	127.8	129.0
47	HL	5009	4840	4295	4251	4292	33.7	148.6	143.6	127.4	126.1	127.4

Lumen Package		Delivered Lumens					Wattage	Efficacy lm/W				
4 ft		LC	LN	LW	SLW	FDL		LC	LN	LW	SLW	FDL
20	SL	2100	2029	1855	1836	1786	12.1	173.6	167.7	153.3	151.7	147.6
22	SL	2391	2311	2113	2091	2034	13.8	173.3	167.5	153.1	151.5	147.4
26	SL	2823	2728	2494	2469	2401	16.4	172.1	166.3	152.1	150.5	146.4
31	SL	3318	3206	2932	2902	2823	19.5	170.2	164.4	150.4	148.8	144.8
33	SL	3563	3443	3148	3116	3031	21.1	168.9	163.2	149.2	147.7	143.6
37	SL	4013	3877	3545	3509	3413	24.0	167.2	161.5	147.7	146.2	142.2
41	SL	4356	4209	3848	3809	3705	26.3	165.6	160.0	146.3	144.8	140.9
45	SL	4857	4693	4292	4248	4132	29.8	163.0	157.5	144.0	142.6	138.7
48	SL	5191	5015	4586	4540	4416	32.1	161.7	156.2	142.9	141.4	137.6
51	SL	5435	5252	4803	4754	4624	35.0	155.3	150.1	137.2	135.8	132.1
57	SL	6090	5884	5381	5326	5181	39.7	153.4	148.2	135.5	134.2	130.5
60	SL	6408	6192	5662	5605	5452	42.0	152.6	147.4	134.8	133.5	129.8
63	SL	6727	6500	5944	5883	5723	44.4	151.5	146.4	133.9	132.5	128.9
67	SL	7191	6948	6354	6289	6117	47.9	150.1	145.1	132.7	131.3	127.7
74	HL	8015	7745	6873	6803	6669	51.8	154.7	149.5	132.7	131.3	132.6
81	HL	8693	8400	7454	7378	7450	55.1	157.8	152.5	135.3	133.9	135.2
84	HL	9084	8777	7789	7710	7785	57.9	156.9	151.6	134.5	133.2	134.5
87	HL	9366	9050	8031	7949	8026	62.2	150.6	145.5	129.1	127.8	129.0
90	HL	9701	9373	8318	8233	8313	64.4	150.6	145.5	129.2	127.8	129.1
93	HL	10018	9680	8590	8502	8585	67.4	148.6	143.6	127.4	126.1	127.4
100	HL	10765	10402	9231	9137	9226	72.5	148.5	143.5	127.3	126.0	127.3
104	HL	11162	10786	9571	9474	9566	75.5	147.8	142.9	126.8	125.5	126.7



Metalux **SNX Lensed**

Energy and Performance Data - Fixed Output

Lumen Package		Delivered Lumens					Wattage	Efficacy lm/W				
8 ft		LC	LN	LW	SLW	FDL		LC	LN	LW	SLW	FDL
40	SL	4200	4058	3711	3673	3573	24.2	173.6	167.7	153.3	151.8	147.6
44	SL	4782	4621	4226	4183	4068	27.6	173.3	167.4	153.1	151.6	147.4
52	SL	5646	5455	4989	4938	4803	32.8	172.1	166.3	152.1	150.5	146.4
62	SL	6637	6413	5864	5805	5646	39.0	170.2	164.4	150.4	148.8	144.8
66	SL	7126	6885	6296	6232	6062	42.2	168.9	163.2	149.2	147.7	143.6
74	SL	8025	7754	7091	7019	6827	48.0	167.2	161.5	147.7	146.2	142.2
82	SL	8711	8417	7697	7619	7410	52.6	165.6	160.0	146.3	144.8	140.9
90	SL	9714	9386	8583	8496	8264	59.6	163.0	157.5	144.0	142.6	138.7
96	SL	10381	10031	9173	9079	8831	64.2	161.7	156.2	142.9	141.4	137.6
102	SL	10871	10504	9605	9507	9248	70.0	155.3	150.1	137.2	135.8	132.1
114	SL	12180	11769	10762	10652	10361	79.4	153.4	148.2	135.5	134.2	130.5
120	SL	12817	12384	11325	11209	10903	84.0	152.6	147.4	134.8	133.4	129.8
126	SL	13454	13000	11888	11767	11445	88.8	151.5	146.4	133.9	132.5	128.9
134	SL	14382	13897	12708	12578	12235	95.8	150.1	145.1	132.7	131.3	127.7
148	HL	16031	15490	13746	13606	13738	103.6	154.7	149.5	132.7	131.3	132.6
162	HL	17386	16800	14908	14757	14900	110.2	157.8	152.5	135.3	133.9	135.2
168	HL	18168	17555	15579	15420	15570	115.8	156.9	151.6	134.5	133.2	134.5
174	HL	18731	18099	16062	15898	16053	124.4	150.6	145.5	129.1	127.8	129.0
180	HL	19401	18747	16636	16467	16627	128.8	150.6	145.6	129.2	127.8	129.1
186	HL	20035	19359	17179	17005	17170	134.8	148.6	143.6	127.4	126.1	127.4
200	HL	21531	20804	18462	18274	18452	145.0	148.5	143.5	127.3	126.0	127.3

Energy and Performance Data - Selectable Output

Lens Type	CRI	Length	Lumen Select	Delivered Lumens			Wattage			Efficacy lm/W		
			CCT Select	3500K	4000K	5000K	3500K	4000K	5000K	3500K	4000K	5000K
LC	80	2 ft.	Low	1026	1066	1099	6.9	6.6	6.7	148.7	161.5	164.0
			Med	1990	2198	2133	13.9	13.3	13.2	143.2	165.3	161.6
			High	3016	3232	3331	21	20	20.2	143.6	161.6	164.9
		4 ft.	Low	2275	2405	2270	16.7	16.1	16.9	136.2	149.4	134.3
			Med	4665	4551	4800	33.5	32.3	33.7	139.3	140.9	142.4
			High	6957	7289	6880	50.7	48.9	51.1	137.2	149.1	134.6
	8 ft.	Low	4453	4693	4655	33.5	32.3	33.7	132.9	145.3	138.1	
		Med	9383	8909	9364	66.9	64.5	67.5	140.3	138.1	138.7	
		High	14575	14220	13468	101.4	97.8	102.2	143.7	145.4	131.8	
	90	2 ft.	Low	842	903	904	6.9	6.6	6.7	122.0	136.8	134.9
			Med	1737	1805	1809	13.9	13.3	13.2	125.0	135.7	137.0
			High	2553	2819	2825	21	20.2	20.2	121.6	139.6	139.9
4 ft.		Low	1944	2036	1926	16.7	16.1	16.9	116.4	126.5	114.0	
		Med	3949	3852	4072	33.5	32.3	33.7	117.9	119.3	120.8	
		High	5889	6169	5836	50.7	48.9	51.1	116.2	126.2	114.2	
8 ft.	Low	3770	3972	3949	33.5	32.3	33.7	112.5	123.0	117.2		
	Med	7704	7540	7943	66.9	64.5	67.5	115.2	116.9	117.7		
	High	12338	12035	11425	101.4	97.8	102.2	121.7	123.1	111.8		



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 4SNX-45SL-LW-UNV-L935-CD1-
 EL7W-FKO-U
 Notes:

Type:
L7E
 LDI24-110942

Metalux **SNX Lensed**

Energy and Performance Data - Selectable Output

Lens Type	CRI	Length	Lumen Select	Delivered Lumens			Wattage			Efficacy lm/W		
			CCT Select	3500K	4000K	5000K	3500K	4000K	5000K	3500K	4000K	5000K
LN	80	2 ft.	Low	991	1030	1062	6.9	6.6	6.7	143.6	156.1	158.5
			Med	1983	2124	2061	13.9	13.3	13.2	142.7	159.7	156.1
			High	2914	3122	3218	21	20	20.2	138.8	156.1	159.3
		4 ft.	Low	2218	2324	2194	16.7	16.1	16.9	132.8	144.3	129.8
			Med	4508	4398	4638	33.5	32.3	33.7	134.6	136.2	137.6
			High	6722	7043	6648	50.7	48.9	51.1	132.6	144.0	130.1
	8 ft.	Low	4647	4534	4498	33.5	32.3	33.7	138.7	140.4	133.5	
		Med	8793	8608	9048	66.9	64.5	67.5	131.4	133.5	134.0	
		High	14083	13740	13013	101.4	97.8	102.2	138.9	140.5	127.3	
	90	2 ft.	Low	814	899	874	6.9	6.7	6.7	118.0	134.2	130.4
			Med	1679	1744	1748	13.9	13.3	13.2	120.8	131.1	132.4
			High	2467	2724	2730	21	20.2	20.2	117.5	134.9	135.1
4 ft.		Low	1878	1967	1861	16.7	16.1	16.9	112.5	122.2	110.1	
		Med	3816	3722	3934	33.5	32.3	33.7	113.9	115.2	116.7	
		High	5691	5782	5639	50.7	48.9	51.1	112.2	118.2	110.4	
8 ft.	Low	3934	3838	3816	33.5	32.3	33.7	117.4	118.8	113.2		
	Med	7444	7286	7675	66.9	64.5	67.5	111.3	113.0	113.7		
	High	11922	11629	11039	101.4	97.8	102.2	117.6	118.9	108.0		

Lens Type	CRI	Length	Lumen Select	Delivered Lumens			Wattage			Efficacy lm/W		
			CCT Select	3500K	4000K	5000K	3500K	4000K	5000K	3500K	4000K	5000K
LW	80	2 ft.	Low	907	914	971	6.9	6.6	6.7	131.4	138.5	144.9
			Med	1813	1942	1829	13.9	13.3	13.2	130.4	146.0	138.6
			High	2586	2771	2943	21	20	20.2	123.1	138.6	145.7
		4 ft.	Low	2028	2125	1947	16.7	16.1	16.9	121.4	132.0	115.2
			Med	4000	4058	4241	33.5	32.3	33.7	119.4	125.6	125.8
			High	6147	6062	5900	50.7	48.9	51.1	121.2	124.0	115.5
	8 ft.	Low	4250	4146	4137	33.5	32.3	33.7	126.9	128.4	122.8	
		Med	7803	7639	8273	66.9	64.5	67.5	116.6	118.4	122.6	
		High	12878	11826	11548	101.4	97.8	102.2	127.0	120.9	113.0	
	90	2 ft.	Low	722	822	824	6.9	6.7	6.6	104.6	122.7	124.8
			Med	1535	1547	1551	13.9	13.3	13.2	110.4	116.3	117.5
			High	2189	2491	2497	21	20.2	20.2	104.2	123.3	123.6
4 ft.		Low	1717	1799	1652	16.7	16.1	16.9	102.8	111.7	97.8	
		Med	3386	3434	3598	33.5	32.3	33.7	101.1	106.3	106.8	
		High	5204	5131	5005	50.7	48.9	51.1	102.6	104.9	97.9	
8 ft.	Low	3598	3509	3509	33.5	32.3	33.7	107.4	108.6	104.1		
	Med	6606	7195	7018	66.9	64.5	67.5	98.7	111.6	104.0		
	High	10902	10009	9796	101.4	97.8	102.2	107.5	102.3	95.9		



Metalux **SNX Lensed**

Energy and Performance Data - Selectable Output

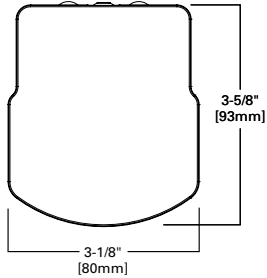
Lens Type	CRI	Length	Lumen Select	Delivered Lumens			Wattage			Efficacy		
			CCT Select	3500K	4000K	5000K	3500K	4000K	5000K	3500K	4000K	5000K
SLW	80	2 ft.	Low	845	905	905	6.9	6.6	6.7	122.5	137.1	135.1
			Med	1795	1923	1810	13.9	13.3	13.2	129.1	144.6	137.1
			High	2560	2743	2913	21	20	20.2	121.9	137.2	144.2
		4 ft.	Low	2008	1980	1927	16.7	16.1	16.9	120.2	123.0	114.0
			Med	3959	4017	4198	33.5	32.3	33.7	118.2	124.4	124.6
			High	6084	6000	5840	50.7	48.9	51.1	120.0	122.7	114.3
	8 ft.	Low	4206	4104	4095	33.5	32.3	33.7	125.6	127.1	121.5	
		Med	7724	8415	8189	66.9	64.5	67.5	115.5	130.5	121.3	
		High	12747	11706	11431	101.4	97.8	102.2	125.7	119.7	111.8	
	90	2 ft.	Low	715	814	816	6.9	6.7	6.6	103.6	121.5	123.6
			Med	1519	1532	1536	13.9	13.3	13.2	109.3	115.2	116.4
			High	2167	2465	2326	21	20.2	20.2	103.2	122.0	115.1
4 ft.		Low	1700	1676	1635	16.7	16.1	16.9	101.8	104.1	96.7	
		Med	3352	3400	3561	33.5	32.3	33.7	100.1	105.3	105.7	
		High	5151	5079	5151	50.7	48.9	51.1	101.6	103.9	100.8	
8 ft.	Low	3561	3269	3473	33.5	32.3	33.7	106.3	101.2	103.1		
	Med	6539	7122	6947	66.9	64.5	67.5	97.7	110.4	102.9		
	High	10791	9907	9697	101.4	97.8	102.2	106.4	101.3	94.9		

Lens Type	CRI	Length	Lumen Select	Delivered Lumens			Wattage			Efficacy		
			CCT Select	3500K	4000K	5000K	3500K	4000K	5000K	3500K	4000K	5000K
FDL	80	2 ft.	Low	853	914	914	6.9	6.6	6.7	123.6	138.5	136.4
			Med	1746	1870	1828	13.9	13.3	13.2	125.6	140.6	138.5
			High	2584	2833	2833	21	20.2	20.2	123.0	140.2	140.2
		4 ft.	Low	1953	1999	1946	16.7	16.1	16.9	116.9	124.2	115.1
			Med	3998	3907	4083	33.5	32.3	33.7	119.3	121.0	121.2
			High	5918	6059	5906	50.7	48.9	51.1	116.7	123.9	115.6
	8 ft.	Low	4092	3900	3892	33.5	32.3	33.7	122.1	120.7	115.5	
		Med	7799	8185	7966	66.9	64.5	67.5	116.6	126.9	118.0	
		High	12399	11820	12373	101.4	97.8	102.2	122.3	120.9	121.1	
	90	2 ft.	Low	722	791	793	6.9	6.7	6.6	104.6	118.1	120.2
			Med	1478	1547	1586	13.9	13.3	13.3	106.3	116.3	119.2
			High	2188	2398	2349	21	20.2	20.2	104.2	118.7	116.3
4 ft.		Low	1653	1692	1651	16.7	16.1	16.9	99.0	105.1	97.7	
		Med	3384	3307	3384	33.5	32.3	33.7	101.0	102.4	100.4	
		High	5010	5128	5010	50.7	48.9	51.1	98.8	104.9	98.0	
8 ft.	Low	3464	3301	3301	33.5	32.3	33.7	103.4	102.2	98.0		
	Med	6602	6927	6757	66.9	64.5	67.5	98.7	107.4	100.1		
	High	10496	10004	10496	101.4	97.8	102.2	103.5	102.3	102.7		

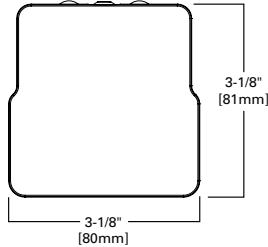
Metalux **SNX Lensed**

Finished Decorative End Covers

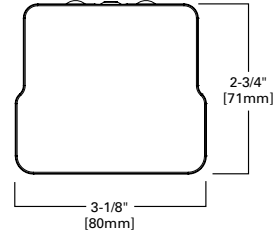
End View - Round Lens



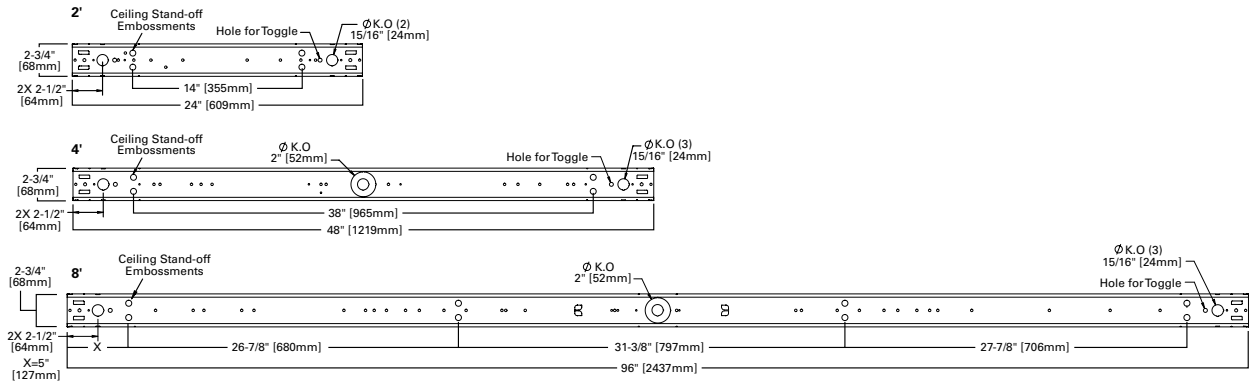
End View - Square Lens



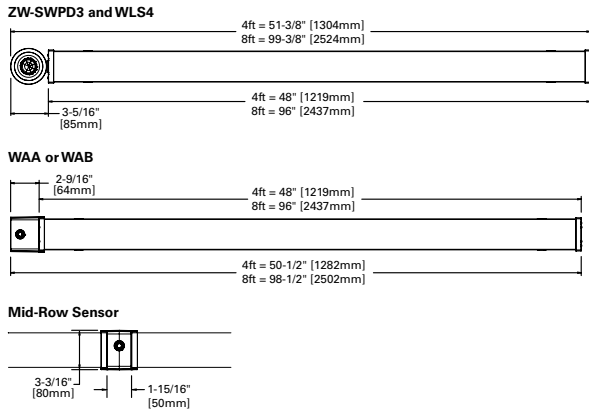
End View - Flat Lens



Dimensional and Mounting Details



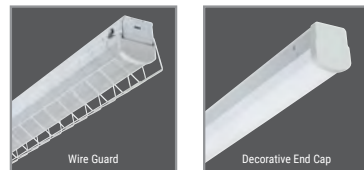
Fixture Size with Sensor



Options



Accessories





Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 C1003-24-35K-LN-CLV-MV-WM-
 PMW-OTBD
 Notes:

Type:
L8
 LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Metal Side Walls
- Flat White Acrylic Bottom Lens
- Overlay Options

Dimensions and Lamping:

C1003-18	18" A x 5" C.....Weight: 9 lbs.
LN	LED: Nominal 35W, 2000 Delivered Lumens
LH	LED: Nominal 40W, 2250 Delivered Lumens
C1003-24	24" A x 5" C.....Weight: 14 lbs.
LN	LED: Nominal 55W, 4000 Delivered Lumens
LH	LED: Nominal 85W, 5600 Delivered Lumens
C1003-36	36" A x 5" C.....Weight: 29 lbs.
LN	LED: Nominal 150W, 11800 Delivered Lumens
C1003-42	42" A x 5" C.....Weight: 39 lbs.
LN	LED: Nominal 235W, 18500 Delivered Lumens
C1003-48	48" A x 5" C.....Weight: 42 lbs.
LN	LED: Nominal 240W, 21000 Delivered Lumens

LED Color Temperature:

90 CRI

30K 3000K **35K 3500K** 40K 4000K

Control:

CLV: Integral Power Supply, 0-10V Dimming to 1%

Voltage:

1 120V 2 277V **MV Multi-Volt**

Diffusers:

WA Gloss White Acrylic
WM Matte White Acrylic

Standard Finishes:

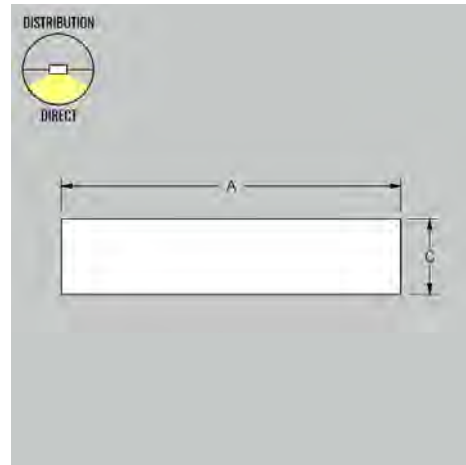
PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Overlay Options:

OCO Cherry Overlay (Opaque) **OTBD** Overlay TBD
OMO Maple Overlay (Opaque)
OWO Walnut Overlay (Opaque)

Other Options:

REM Remote Emergency Power Supply (18" & 24" Sizes)
IEM Integral Emergency Power Supply (36", 42" & 48" Sizes)



Notes:

- Custom sizes and finishes available upon request.
- Camman reserves the right to make design changes without prior notice.
- Mounting is to a 4 inch octagonal junction box.
- Photometric information is available at cammanlighting.com



**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

C1003-24-35K-LN-CLV-MV-WM-PMW-OTBD

Notes:

Type:**L8**

LDI24-110942

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard 90CRI Available
L70 (Projected):	>72,000 hours

Warranty	5 years
	(electrical components retain the component manufacturer warranty).

Camman Plus Customizations

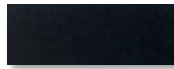
Camman **Standard Plus** products provide an extra degree of freedom to customize most standard products, including dimensions, finish, performance, and adding or removing details. Visit www.cammanlighting.com/plus to learn more about the Plus program, and visit this fixture to see what specific options might be available.

Standard Finishes**MODERN**

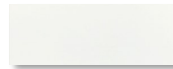
PAL Aluminum



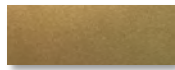
PNL Nickel



PSB Satin Black

**PMW** Matte White**NEUTRAL**

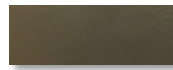
PAB Antique Brass



PBB Brushed Brass



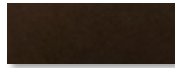
PSG Satin Gold



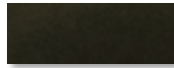
PLB Light Bronze



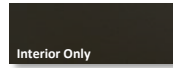
PMB Medium Bronze



PBR Bronze



PDB Dark Bronze

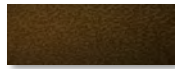


Interior Only

PRB Oil Rubbed Bronze

TEXTURES

PHS Hammered Silver



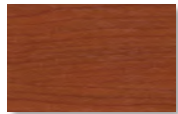
PHB Hammered Bronze



PHC Hammered Copper



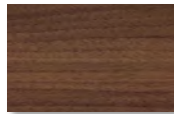
PPA Patina

COLORSPRD Traffic Red
(RAL 3020)POR Pure Orange
(RAL 2004)PYL Traffic Yellow
(RAL 1023)PGR Emerald Green
(RAL 6001)PBL Signal Blue
(RAL 5005)**Opaque Overlays**

OCO Cherry



OMO Maple



OWO Walnut

- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.





Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 C1003-24-35K-LN-CLV-MV-WM-
 PMW-OTBD-IEM-90CRI
 Notes:

Type:
L8E
 LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Metal Side Walls
- Flat White Acrylic Bottom Lens
- Overlay Options

Dimensions and Lamping:

C1003-18 18" A x 5" C.....Weight: 9 lbs.
 LN LED: Nominal 35W, 2000 Delivered Lumens
 LH LED: Nominal 40W, 2250 Delivered Lumens

C1003-24 24" A x 5" C.....Weight: 14 lbs.
 LN LED: Nominal 55W, 4000 Delivered Lumens
 LH LED: Nominal 85W, 5600 Delivered Lumens

C1003-36 36" A x 5" C.....Weight: 29 lbs.
 LN LED: Nominal 150W, 11800 Delivered Lumens

C1003-42 42" A x 5" C.....Weight: 39 lbs.
 LN LED: Nominal 235W, 18500 Delivered Lumens

C1003-48 48" A x 5" C.....Weight: 42 lbs.
 LN LED: Nominal 240W, 21000 Delivered Lumens

LED Color Temperature:

90 CRI

30K 3000K **35K 3500K** 40K 4000K

Control:

CLV: Integral Power Supply, 0-10V Dimming to 1%

Voltage:

1 120V 2 277V **MV Multi-Volt**

Diffusers:

WA Gloss White Acrylic
WM Matte White Acrylic

Standard Finishes:

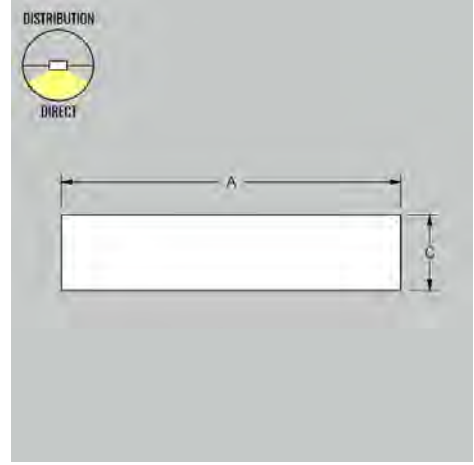
PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Overlay Options:

OCO Cherry Overlay (Opaque) **OTBD** Overlay TBD
OMO Maple Overlay (Opaque)
OWO Walnut Overlay (Opaque)

Other Options:

REM Remote Emergency Power Supply (18" & 24" Sizes)
IEM Integral Emergency Power Supply (36", 42" & 48" Sizes)



Notes:

- Custom sizes and finishes available upon request.
- Camman reserves the right to make design changes without prior notice.
- Mounting is to a 4 inch octagonal junction box.
- Photometric information is available at cammanlighting.com



**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

C1003-24-35K-LN-CLV-MV-WM-PMW-OTBD-IEM-90CRI

Notes:

Type:**L8E**

LDI24-110942

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard 90CRI Available
L70 (Projected):	>72,000 hours

Warranty	5 years
	(electrical components retain the component manufacturer warranty).

Camman Plus Customizations

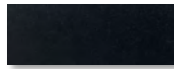
Camman **Standard Plus** products provide an extra degree of freedom to customize most standard products, including dimensions, finish, performance, and adding or removing details. Visit www.cammanlighting.com/plus to learn more about the Plus program, and visit this fixture to see what specific options might be available.

Standard Finishes**MODERN**

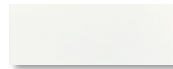
PAL Aluminum



PNL Nickel



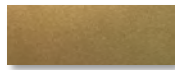
PSB Satin Black



PMW Matte White

COLORSPRD Traffic Red
(RAL 3020)POR Pure Orange
(RAL 2004)**NEUTRAL**

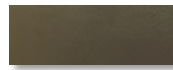
PAB Antique Brass



PBB Brushed Brass



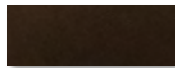
PSG Satin Gold



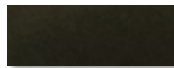
PLB Light Bronze

PYL Traffic Yellow
(RAL 1023)PGR Emerald Green
(RAL 6001)

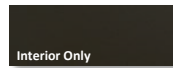
PMB Medium Bronze



PBR Bronze



PDB Dark Bronze

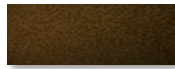


Interior Only

PRB Oil Rubbed Bronze

PBL Signal Blue
(RAL 5005)**TEXTURES**

PHS Hammered Silver



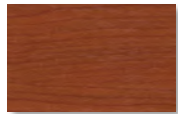
PHB Hammered Bronze



PHC Hammered Copper



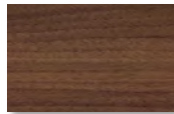
PPA Patina

Opaque Overlays

OCO Cherry



OMO Maple



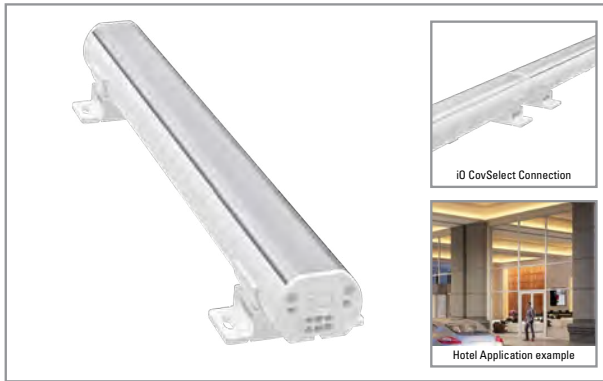
OWO Walnut

- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.





Project		Catalog #		Type	
Prepared by		Notes		Date	



iO LED CovSelect

LED
Interior Architectural Cove
Integral Driver

Typical Applications

Commercial Office Spaces • Schools • Hospitals
• Retail • Residential • Hotels • Restaurants

Interactive Menu

- [Completing An Order](#) page 2
- [Catalog Number Details](#) page 3
- [Product Specifications](#) page 4
- [Photometric Data](#) page 5
- [Mounting and Installation](#) page 7
- [Run Layout Guidelines](#) page 9

Product Certification



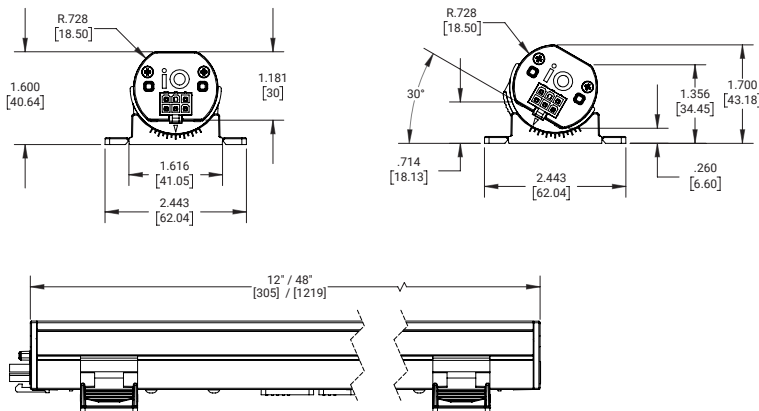
Product Features



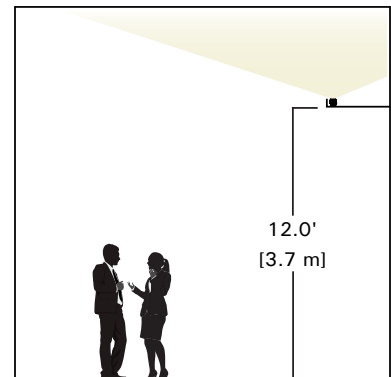
Top Product Features

- Cove lighting fixture with integral dimming driver
- Rated for interior / damp installations
- Field Selectable CCT (2700K, 3000K, 3500K, 4000K)
- Field Selectable output (350 lm/ft and 700 lm/ft)
- Up to 200ft run from a single power drop
- 1 ft and 4 ft length options
- Adjustable mount (+/- 30 deg)
- Integral dimming to 10% (0-10V, 100% - 10%)
- 80 CRI option available (90+ CRI Coming Soon)

Dimensions



Scale



[additional product diagrams](#)



Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 CS0SL-8SCT-120-ID-UNV-W-SA-STD1F CS-10V-STD
 Notes:

Type:
L9
 LDI24-110942

io LED **CovSelect**

Completing an Order

Color Key: Orange shading denotes options coming soon!

Orders must include:

- 1 Fixture(s) + 2 Power Harness / Control Module + 3 Optional Accessories as needed

1 Fixtures
 (REQUIRED)

Catalog Number	Length	CCT Setting	Low Output Setting			High Output Setting		
			Power (W)	Delivered Lumens (lm)	Efficacy (LPW)	Power (W)	Delivered Lumens (lm)	Efficacy (LPW)
CS-SL-8SCT-120-ID-UNV-W-SA-STD-1F	1 ft (12" / 305 mm)	2700K	3.5	357	102	6.2	677	108
		3000K	3.5	369	105	6.2	700	112
		3500K	3.5	378	109	6.2	717	115
		4000K	3.5	385	112	6.2	730	118
CS-SL-8SCT-120-ID-UNV-W-SA-STD-4F	4 ft (48" / 1220 mm)	2700K	11.5	1424	123	21.4	2630	122
		3000K	11.5	1472	128	21.4	2720	127
		3500K	11.5	1508	132	21.4	2786	131
		4000K	11.5	1535	135	21.4	2837	134

2 Power Harness/Control Modules
 (REQUIRED)

Note: Please utilize run length limits at right to determine the number of power harnesses / control modules required to support planned runs.

io CovSelect Run Length Limits

Catalog Number	Details
CS-10V-STD	Standard Power Harness (for beginning of run power connection)
Notes A Power harness or Control module is required for line voltage connection of each run.	

		Run Length Limits (ft)		
		1F = 12"	4F = 48"	
Fixture Length				
Fixture Input Wattage		7W	24W	
Source Current		0.2mA	0.2mA	
Input Current (120-277V)		64.8mA	222mA	
Dimming Protocol	0-10V (STD)	Maximum Run Length (ft) @ 120V	100	116*
		Maximum Run Length (ft) @ 277V	150***	288**

3 Accessories
 (OPTIONAL)

Note: Jumpers are required for all curves and corners in planned runs.

Catalog Number	Details
CS-JHARN02-006	6" Jumper accessory
CS-JHARN02-012	12" Jumper accessory
CS-JHARN02-036	36" Jumper accessory
CS-JHARN02-144	144" Jumper accessory

Notes
 *Run must be limited to 100 ft when using both 1F and 4F fixtures in a single run at 120V.
 **Run must be limited to 200 ft when using both 1F and 4F fixtures in a single run at 277V.
 *** Run length is limited based on common 30 mA dimmer limit. Run length could be extended to 200 ft for dimmers with 50 mA current rating.

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

CS0SL-8SCT-120-ID-UNV-W-SA-STD1F CS-10V-STD

Notes:

Type:**L9**

LDI24-110942

iO LED**CovSelect****Catalog Number Details**

Color Key: Orange shading denotes options coming soon!

No QS prefix needed for Stock or Quick Spec orders.SAMPLE CATALOG NUMBER: **CS-SL-8SCT-120-ID-UNV-W-SA-STD-4F**

Series	Lumen Package (Power)	LED CRI & CCT	Optical Distribution	Environment	Voltage
CS=CovSelect Linear LED	SL=Selectable Output (350lm/ft or 700lm/ft)	8SCT=80 CRI, Selectable CCT	120=Standard lambertian	ID=Indoor	UNV=120-277V
Notes Architectural LED cove luminaire with integral driver from iO LED.	Notes Nominal for 12" section. See lumen output table below for specific lumen and wattage output by output and CCT setting.	Notes 4 selectable CCT settings: 2700K - 3000K - 3500K - 4000K 90 CRI coming soon	Notes Nominal optical distribution. See photometry details on pg 5 for more details.	Notes CovSelect is indoor rated for damp locations only	Notes See pg 4 for Voltage impact on run length limits.

Housing Color	Mounting	Control	Length
W=Standard White	SA=Surface Mount - Adjustable	STD=0-10V dimming (100%-10%)	1F=1 ft (12") Individual fixture 4F=4 ft (48") Individual fixture
Notes	Notes Mounting bracket has built in +/- 30 deg adjustability and can be mounted in any direction facing up, facing down or vertically. Mounting brackets are shipped pre-attached to fixtures for easy installation.	Notes All fixtures have integral 0-10V dimming drivers.	Notes

**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

CS0SL-8SCT-120-ID-UNV-W-SA-
STD1F CS-10V-STD

Notes:

Type:**L9**

LDI24-110942

iO LED**CovSelect****Product Specifications****Construction**

- Housing is powder coated, extruded aluminum.
- Diffuse polycarbonate extruded lens.
- Proprietary quick connect plugs for quick installation.
- Available in 1 ft (12") or 4 ft (48") lengths.

Electrical

- Integral high performance constant current driver.
- Field Selectable output with nominal 350 and 700 lm/ft setting options.
- Flicker free performance with Pst < 1.0 and SVM < 1.0
- Standard 0-10V dimming (10% - 100%).
- Each cove module is configured for a line voltage feed while providing through wiring and quick connects for continuous mounting applications.
- Universal driver accepts 120V to 277V supply voltage. Higher supply voltage increases run lengths possible from a power drop.
- Utilize jumpers and separate power feed(s) to create Emergency circuits. Consult customer service for additional guidance.
- See pg 2 for Run Length Limits.
- See pg 7 for Dimmer compatibility chart.

LED Optics

- 80 CRI option available [\(90 CRI Coming Soon\)](#)
- Field Selectable CCT with 2700, 3000, 3500 or 4000K setting options within 3-step MacAdam ellipse.
- Discrete mid-powered LED array with diffuse, extruded lens delivers a cove light distribution free from striations.
- Fixtures designed to connect directly end to end to deliver the most consistent cove illumination possible.
- Luminaires tested per IESNA LM-79.
- LM-80 data utilized in TM-21 lumen maintenance projections:
 - L70 at 25°C > 60,000 hours
 - L70 at 50°C > 60,000 hours
 - L90 at 25°C = 54,000 hours
 - L90 at 50°C = 49,000 hours

Mounting

- Each individual fixture comes with molded polycarbonate mounting bracket(s) with integrated +/- 30 deg adjustability.
- Mounts are designed to be mounted in any orientation: facing up, facing down or vertically mounted.
- Mount feet can be snapped off at scoring on one side for tightly spaced installations. Please note that 2 mounts/ fixture and at least 1 screw per mount is required for secure installation.
- Power harness is required for connection to line voltage at the beginning of each run and must be ordered separately as an accessory.
- STD power harness includes beginning of run power harness + junction box for line voltage connection.
- Fixture end caps include quick connects for easy and secure end-to-end installation in straight runs. Release tab must be pressed to disconnect fixtures.
- Jumper cables are available in a variety of lengths (6", 12", 36" and 144") to enable a wide variety of curved installations. Jumpers must be ordered separately as accessories when needed.

Finish

- Fixture housing is powder coated aluminum.
- Standard color is white with white end caps and white power harness and white jumpers.

Compliance

- Luminaires are ULus listed for 40° C ambient environments.
- Energy Star qualified.
- Damp Location Listed.
- RoHS compliant.
- Tested according to IESNA LM-79 (See pg pg 5). Full set of IES files are available at CooperLighting.com

Environment

- Suited for indoor / damp installations

Control

- Integral driver with 0-10V dimming to 10% is standard.

Weight

- 1F = 0.46 lbs.
- 4F = 1.33 lbs

Warranty

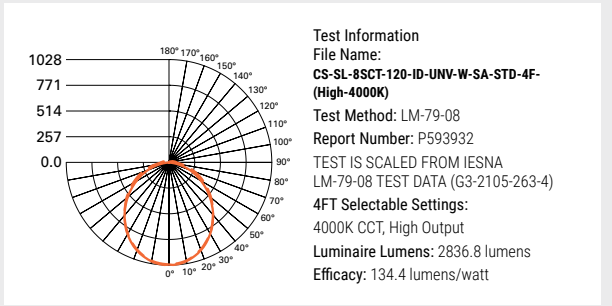
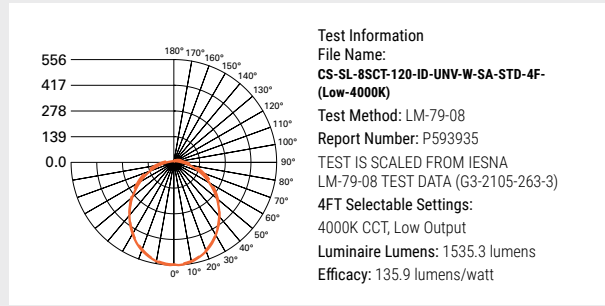
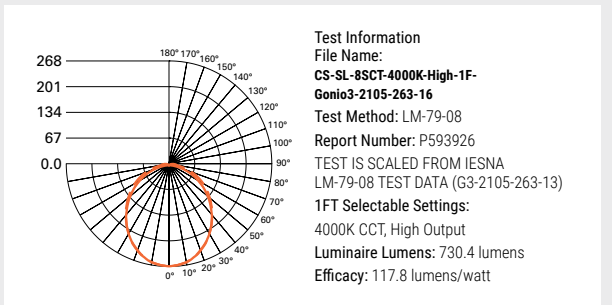
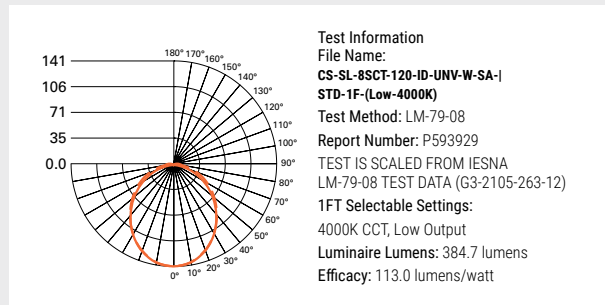
- 5 year standard limited warranty.



iO LED **CovSelect**

Photometric Data

[View IES files](#)



Note: Refer to IES files for complete product data for all CCT and output settings. Full set of IES files are available at CooperLighting.com.

Light Output Conversion Table

CRI	CCT	Low	High
80	2700K	0.488	0.927
	3000K	0.505	0.959
	3500K	0.517	0.982
	4000K	0.527	1.000

Energy Data
>0.9 Power Factor
<20% Total Harmonic Distortion
Efficacy > 102 lm / W
-30°C Min Temperature
50°C Max Temperature

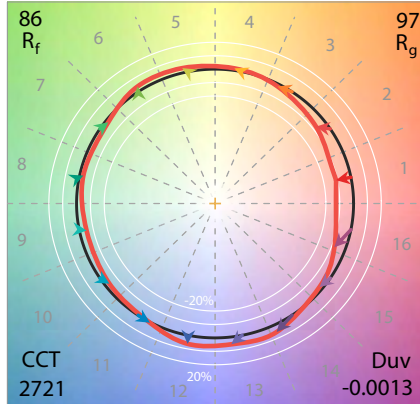


iO LED **CovSelect**

**TM-30 DATA FOR 80 CRI, SELECTABLE CCT
 (2700K SETTING)**

CS-SL-8SCT-2700K-High-Sphere1-2105-263-1 (color)

ANSI/IES TM-30-18 Color Rendition Report

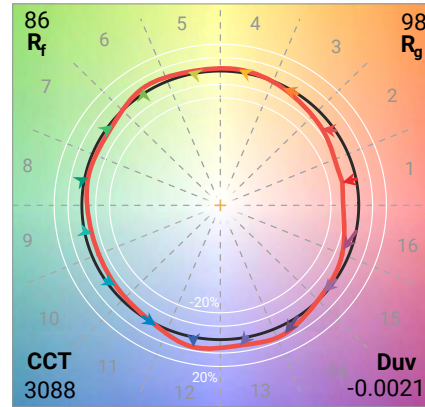


Reference Illuminant Test Source

**TM-30 DATA FOR 80 CRI, SELECTABLE CCT
 (3000K SETTING)**

CS-SL-8SCT-3000K-High-Sphere1-2105-263-2 (color)

ANSI/IES TM-30-18 Color Rendition Report

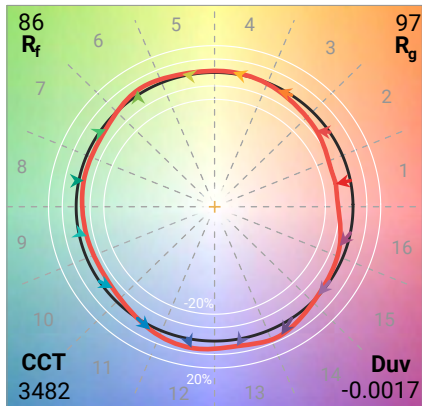


Reference Illuminant Test Source

**TM-30 DATA FOR 80 CRI, SELECTABLE CCT
 (3500K SETTING)**

CS-SL-8SCT-3500K-High-Sphere1-2105-263-3 (color)

ANSI/IES TM-30-18 Color Rendition Report

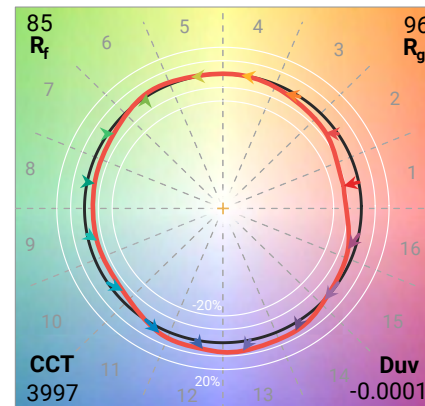


Reference Illuminant Test Source

**TM-30 DATA FOR 80 CRI, SELECTABLE CCT
 (4000K SETTING)**

CS-SL-8SCT-120-ID-UNV-W-SA-STD-1F (High-4000K)

ANSI/IES TM-30-18 Color Rendition Report



Reference Illuminant Test Source

Light Tm-30 and Photometric Sphere test results are summarized in the table below. Contact Cooper Lighting for specific TM-30 reports.

CRI	CCT	CRI	R _f	R _g	R ₉
80	2700K	83.6	85.9	96.8	11
	3000K	84.9	86.1	97.7	15.8
	3500K	85.1	86	97	16.7
	4000K	84.3	85.2	96	13.3



io LED **CovSelect**

Dimmer Compatability

List of Tested Dimmers			Notes
Manufacturer	Technology	Part Number	
EWD (Eaton)	0-10Vdc	SF10P-W	
EWD (Eaton)	0-10Vdc	SF10P-W	
Lutron	0-10Vdc	DVSTV-WH	
Lutron	0-10Vdc	IP710-LFZ	
EWD (Eaton)	0-10Vdc	WBSD-010M-C1	

Mounting and Installation

CovSelect fixtures are designed to directly connect end-to-end to deliver the most consistent cove illumination possible. The diagram below shows how each fixture joins to the next fixture in the run. The connector includes a snap feature to ensure a secure connection will be maintained over time. The release button on the bottom of the connector must be pressed to disconnect the fixtures.

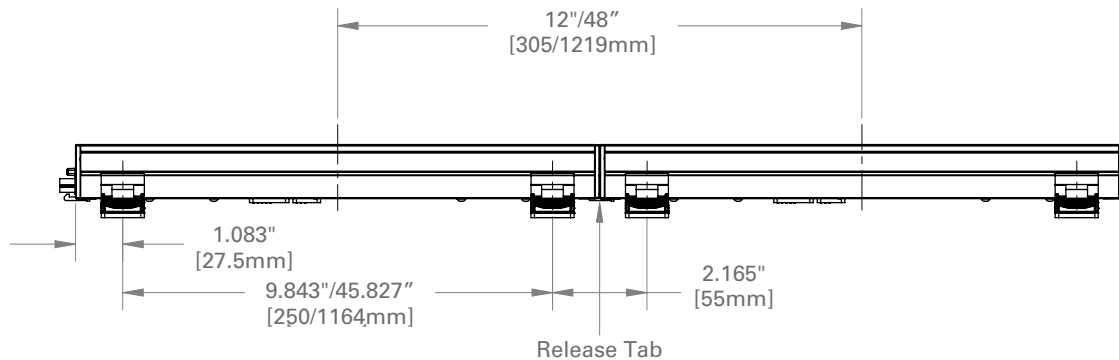
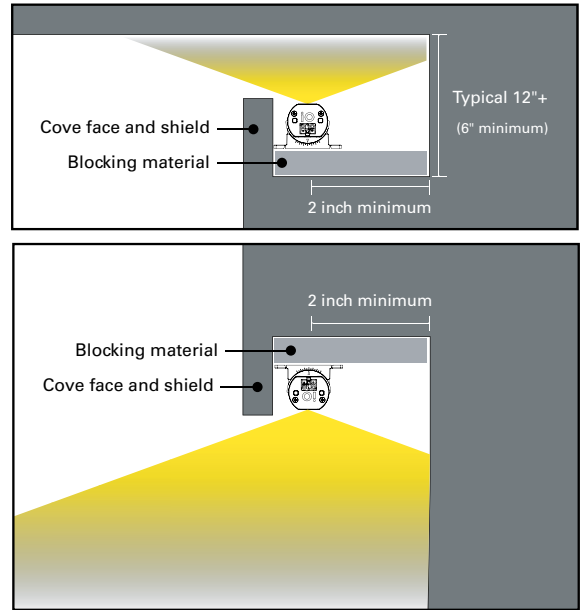
Other mounting considerations:

- Mounting location must have solid base / blocking material for securing mount.
- The adjustable mount is designed to secure fixtures in any orientation: facing up, facing down or vertically mounted.
- The adjustable mount can be aimed +/- 30 deg in either direction to optimize light distribution for each installation.
- Matte surface finishes in, above and adjacent to cove will deliver optimal cove light distribution.
- Fixtures should be mounted at least 2" from wall for optimal cove light distribution. See cove design guidelines at right.
- Cove height should be optimized to allow for effective light distribution from the cove. See design guidelines at right.
- Jumper cable accessory or corner fixture is require for curves and corners.
- CovSelect is approved for dry or damp installations only.
- The height of the cove face and should be designed the fixture from direct view but not interfere with the optical distribution of the light.

Cove Design Guidelines

Optimize cove design details utilizing the considerations at left and the diagram below.

Note: Design the cove big enough so the light will wash the intended surface effectively. More space typically results in a more pleasing cove effect. A smaller cove does not produce better illumination and may limit light output distribution. The cove face height should be optimized to hide visibility of the cove fixture while not interfering with the light distribution. See diagram below for reference.

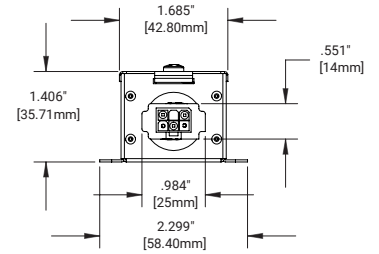
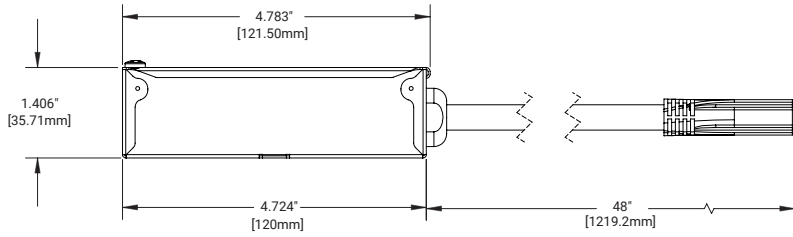




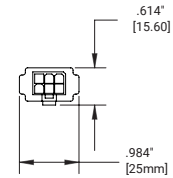
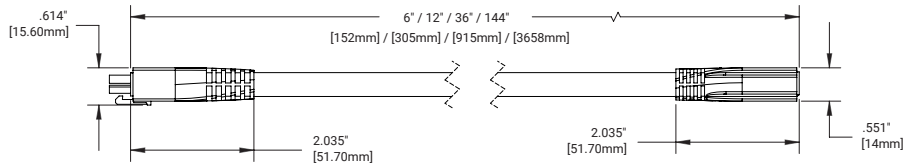
iO LED **CovSelect**

STD - Beginning of Run Power Harness

Color Key: Orange shading denotes options coming soon!



Jumper Harness Accessory



Job Name:

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

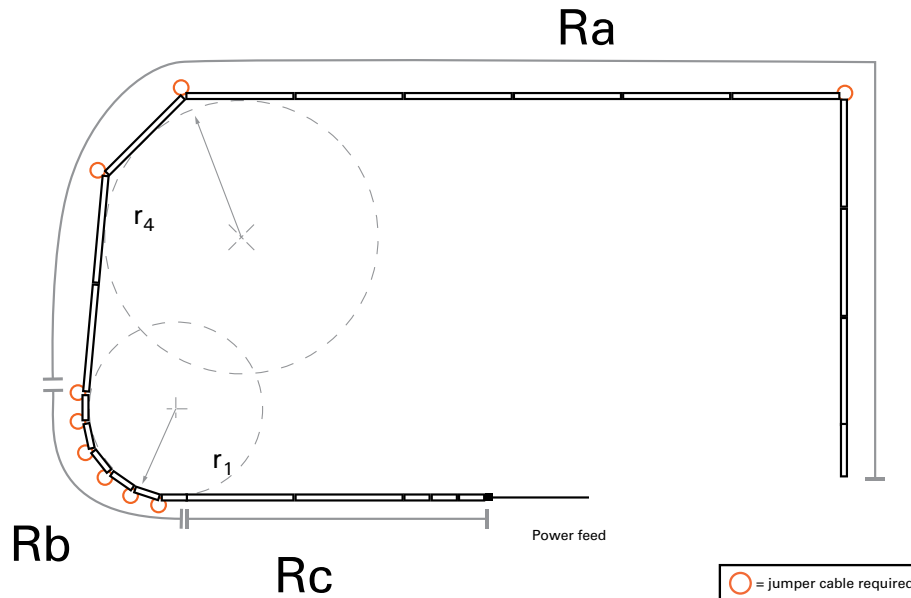
Catalog Number:

CS0SL-8SCT-120-ID-UNV-W-SA-
STD1F CS-10V-STD

Notes:

Type:**L9**

LDI24-110942

iO LED**CovSelect****Run Layout Guidelines****Linear Run Layout / Design**

CovSelect fixtures and accessories must be ordered separately. ([see details on pg.2](#)) It is helpful to plan run layout details in advance to make sure all accessories are included so the installation meets the design intent. Orders must include:

1. 1F and 4F fixtures (mounts are included) to cover desired run length.
2. Power harness or control module for line voltage connection (see page 2 for run length limits).
3. Jumper accessories or corner fixtures are required for any curves or corners.

- Ra is a 49 ft run and would be ordered as 12x 4F fixtures + 1x 1F fixture + 3x jumpers (for corner and curves)
- Rb is a 6 ft curved run and would be ordered as 6x 1F fixtures + 6x jumpers (for curve)
- Rc is an 11 ft run and would be ordered as 2x 4F fixtures + 3x 1F fixtures + 1x power cord
- **Summary:** The entire run shown in the diagram above would be ordered as 14x 4F fixtures + 10x 1F fixtures + 9x jumpers + 1x power cord.
Since this run is only 66 ft long, only 1x power cord is required (see pg 2 for run length limits).

**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

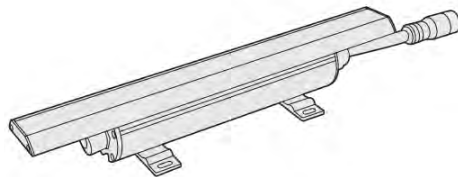
Catalog Number:

ACA-242-1AAHN

Notes:

Type:**L9-1**

LDI24-110942

AL COVE DMX™**ACCLAIM**
LIGHTING

Client:

Project:

Type:

Order Code:


Quantity:

Spectrum™
TECHNOLOGY

AL Cove DMX is a high power, interior linear cove fixture, with standard and eco output modes.

Available in 1' and 4' sections, it offers RGB, QW and dynamic white configurations. Featuring RDM addressing, a multi-voltage switching power supply, and linkable cable system, it is the perfect option for any interior cove applications.

SPECIFICATIONS

Color	RGB, QW w/ Spectrum Technology (RGBW, W=3000K), Dynamic White (2700K-5500K)
Available Lengths	1' & 4'
Beam Angle	110°
Max Fixtures In Series	100' (30m) @ 120V, 200' (60m) @ 240V+
Total Lumens	SO: QW 280 per foot / DW 482 per foot EO: QW 140 per foot / DW 220 per foot
Control	DMX / RDM
Mounting	30° Swivel Mount Included
Power Consumption	SO: 12W (1'), 48W (4'), EO: 5W (1'), 20W (4')
Operating Voltage	100-277VAC, 50/60Hz
Lumen Maintenance	L70 @ 150,000 Hours (25° C)
Finish	Gray standard, black, white or custom optional
Housing Material	Aluminum with polycarbonate lens
Operating Temperature	-4° F to 113° F (-20° C to 45° C)
IP Rating	IP20, Dry Location
Fixture Connectors	Attached Multipin 6 Conductor AC + DMX Lead, end to end link included
Warranty	5 Years, Limited
Weight	1 lb. / 0.45 kg (1'), 4' lbs. / 1.81 kg (4')
Dimensions	L: 12" / 48" W: 2.55" H: 2" (L: 305mm / 1220mm W: 65mm H: 51mm)
Certifications	 

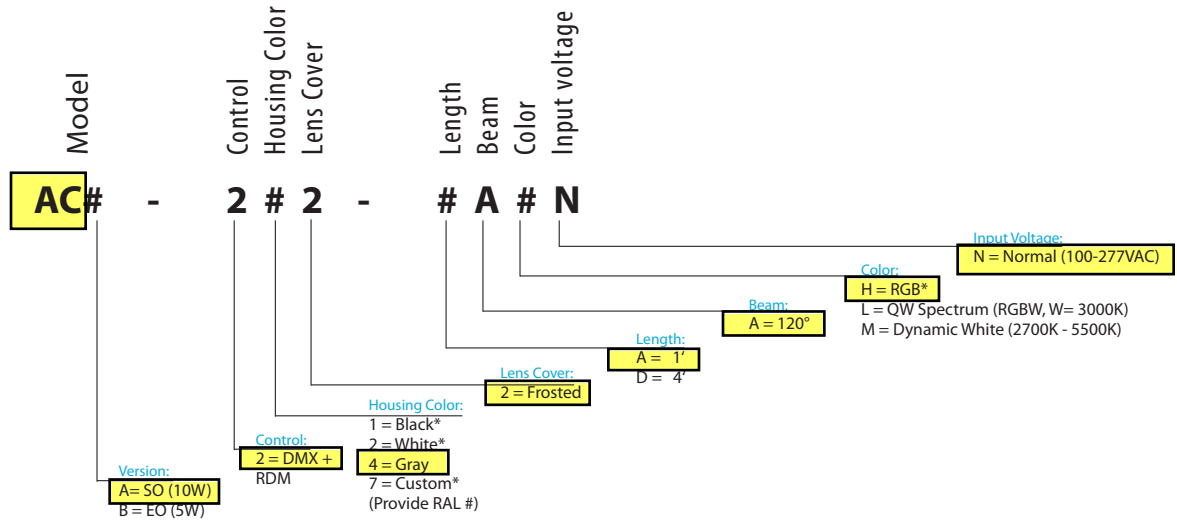


AL COVE DMX™

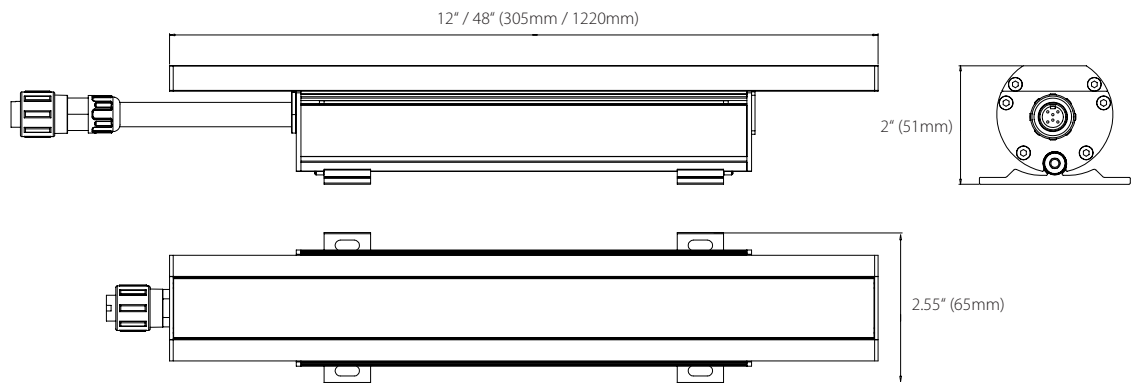


ORDER CODES

* Indicates Special Order



DIMENSIONS





Job Name:

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

ACA-242-1AAHN

Type:

L9-1

Notes:

LDI24-110942

AL COVE DMX™



RELATED COMPONENTS

Cables



H6FC10

10' Feed Cable For AL Cove DMX + End Cap
Powers up to 100' at 120VAC / 200' at 240V+



H6LC1

1' Link Cable for AL Cove DMX



H6LC5

5' Link Cable for AL Cove DMX



H6LC10

10' Link Cable for AL Cove DMX



H6EC

End Cap for AL Cove DMX

Fixture Setup Accessories



XMT350

DMX + RDM Addressing and Testing Tool



Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
P1044-48-LD-35K-CLV-MV-WM-
PWM-ACC
Notes:

Type:
L10
LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Slim Profile (4" High x 4" Wide)
- Extruded Aluminum Inside & Outside Walls
- Flat Matte White Acrylic Bottom Lens (plus Top Lens on Direct/Indirect Lamping)
- Multiple Cables & Power Cord; Multiple Hanging Options Available
- Up to 60" Ships Assembled

Dimensions and Lamping:

P1044-24	24" A x 192" B x 4" C x 4" DWeight: 21 lbs.
LN	LED: Direct / Indirect, Nominal 115W, 9050 Delivered Lumens
LD	LED: Direct, Nominal 70W, 6100 Delivered Lumens
P1044-36	36" A x 192" B x 4" C x 4" DWeight: 32 lbs.
LN	LED: Direct / Indirect, Nominal 170W, 13700 Delivered Lumens
LD	LED: Direct, Nominal 115W, 9800 Delivered Lumens
P1044-48	48" A x 192" B x 4" C x 4" DWeight: 42 lbs.
LN	LED: Direct / Indirect, Nominal 235W, 18800 Delivered Lumens
LD	LED: Direct, Nominal 150W, 12850 Delivered Lumens
P1044-60	60" A x 192" B x 4" C x 4" DWeight 52 lbs.*
LN	LED: Direct / Indirect, Nominal 295W, 23900 Delivered Lumens
LD	LED: Direct, Nominal 190W, 16450 Delivered Lumens
P1044-72	72" A x 192" B x 4" C x 4" DWeight 63 lbs.*
LN	LED: Direct / Indirect, Nominal 335W, 27650 Delivered Lumens
LD	LED: Direct, Nominal 235W, 20200 Delivered Lumens
P1044-96	96" A x 192" B x 4" C x 4" DWeight: 83 lbs.*
LN	LED: Direct / Indirect, Nominal 440W, 36400 Delivered Lumens
LD	LED: Direct, Nominal 315W, 27500 Delivered Lumens
P1044-108	108" A x 192" B x 4" C x 4" DWeight: 94 lbs.*
LN	LED: Direct / Indirect, Nominal 545W, 44850 Delivered Lumens
LD	LED: Direct, Nominal 380W, 32950 Delivered Lumens
P1044-144	144" A x 192" B x 4" C x 4" DWeight: 125 lbs.*
LN	LED: Direct / Indirect, Nominal 755W, 61750 Delivered Lumens
LD	LED: Direct, Nominal 505W, 44050 Delivered Lumens
P1044-192	192" A x 192" B x 4" C x 4" DWeight 166 lbs.*
LN	LED: Direct / Indirect, Nominal 1005W, 82400 Delivered Lumens
LD	LED: Direct, Nominal 670W, 58650 Delivered Lumens
P1044-216	216" A x 192" B x 4" C x 4" DWeight 187 lbs.*
LN	LED: Direct / Indirect, Nominal 1090W, 89650 Delivered Lumens
LD	LED: Direct, Nominal 755W, 65700 Delivered Lumens

* If ACC option is selected, structural support independent of the junction box is required.

LED Color Temperature:

30K	3000K	35K	3500K	40K	4000K
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Control:

CLV	Integral Power Supply, 0-10V Dimming to 1%
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Voltage:

1	120V	2	277V	MV	Multi-Volt
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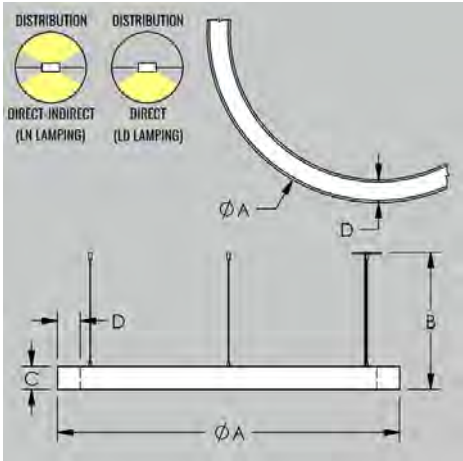
Diffusers:

WM:	Matte White Acrylic
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Notes:

- LN / LH (Direct/Indirect) Lamping: Uplight is not uniform. If uniform uplight is required, contact the factory.
- LN / LH (Direct/Indirect) Lamping: Minimum recommended mounting distance to ceiling is 36".
- Maximum tilt angle: 5 degrees.

P1044 | Avalon 4



Notes:

- Custom sizes and finishes available upon request.
- Camman reserves the right to make design changes without prior notice.
- Mounting is to a 4 inch octagonal junction box.
- 60" and Larger Sizes: If the ACC or ACH Hanging Option is selected, structural support independent of the junction box is required.
- Photometric information is available at cammanlighting.com.





Job Name:
 South Dade Regional Library Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1044-48-LD-35K-CLV-MV-WM-PWM-ACC
 Notes:

Type:
L10
 LDI24-110942

Standard Finishes:

PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Hanging Options:

ACM Multiple Vertical Cables



ACC Cables to Canopy



ACH Cables to Hub



(24", 36", 48" Sizes Only)

Other Options:

OAH Overall Height (Specify in Comments)	2C 2-Circuit Wiring
REM Remote Emergency Power Supply	

Number of Cables	
P1044-24	3
P1044-36	3
P1044-48	3
P1044-60	3
P1044-72	3
P1044-96	6
P1044-108	4
P1044-144	6
P1044-192	6
P1044-216	8

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard (90CRI Available)
L70 (Projected):	>72,000 hours

Warranty	5 years (electrical components retain the component manufacturer warranty).
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Camman Plus Customizations



Camman **Standard Plus** products provide an extra degree of freedom to customize most standard products, including dimensions, finish, performance, and adding or removing details.

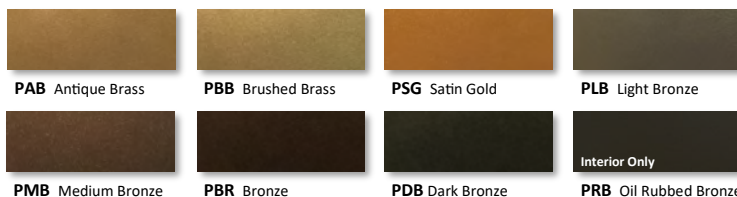
Visit www.cammanlighting.com/plus to learn more about the Plus program, and visit this fixture to see what specific options might be available.

Standard Finishes

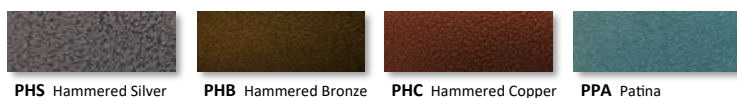
MODERN



NEUTRAL



TEXTURES



COLORS



- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.





Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1044-72-LN-35K-CLV-MV-WM-
 PWM-ACC
 Notes:

Type:
L11-3
 LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Slim Profile (4" High x 4" Wide)
- Extruded Aluminum Inside & Outside Walls
- Flat Matte White Acrylic Bottom Lens (plus Top Lens on Direct/Indirect Lamping)
- Multiple Cables & Power Cord; Multiple Hanging Options Available
- Up to 60" Ships Assembled

Dimensions and Lamping:

P1044-24	24" A x 192" B x 4" C x 4" DWeight: 21 lbs.
LN	LED: Direct / Indirect, Nominal 115W, 9050 Delivered Lumens
LD	LED: Direct, Nominal 70W, 6100 Delivered Lumens
P1044-36	36" A x 192" B x 4" C x 4" DWeight: 32 lbs.
LN	LED: Direct / Indirect, Nominal 170W, 13700 Delivered Lumens
LD	LED: Direct, Nominal 115W, 9800 Delivered Lumens
P1044-48	48" A x 192" B x 4" C x 4" DWeight: 42 lbs.
LN	LED: Direct / Indirect, Nominal 235W, 18800 Delivered Lumens
LD	LED: Direct, Nominal 150W, 12850 Delivered Lumens
P1044-60	60" A x 192" B x 4" C x 4" DWeight 52 lbs.*
LN	LED: Direct / Indirect, Nominal 295W, 23900 Delivered Lumens
LD	LED: Direct, Nominal 190W, 16450 Delivered Lumens
P1044-72	72" A x 192" B x 4" C x 4" DWeight 63 lbs.*
LN	LED: Direct / Indirect, Nominal 335W, 27650 Delivered Lumens
LD	LED: Direct, Nominal 235W, 20200 Delivered Lumens
P1044-96	96" A x 192" B x 4" C x 4" DWeight: 83 lbs.*
LN	LED: Direct / Indirect, Nominal 440W, 36400 Delivered Lumens
LD	LED: Direct, Nominal 315W, 27500 Delivered Lumens
P1044-108	108" A x 192" B x 4" C x 4" DWeight: 94 lbs.*
LN	LED: Direct / Indirect, Nominal 545W, 44850 Delivered Lumens
LD	LED: Direct, Nominal 380W, 32950 Delivered Lumens
P1044-144	144" A x 192" B x 4" C x 4" DWeight: 125 lbs.*
LN	LED: Direct / Indirect, Nominal 755W, 61750 Delivered Lumens
LD	LED: Direct, Nominal 505W, 44050 Delivered Lumens
P1044-192	192" A x 192" B x 4" C x 4" DWeight 166 lbs.*
LN	LED: Direct / Indirect, Nominal 1005W, 82400 Delivered Lumens
LD	LED: Direct, Nominal 670W, 58650 Delivered Lumens
P1044-216	216" A x 192" B x 4" C x 4" DWeight 187 lbs.*
LN	LED: Direct / Indirect, Nominal 1090W, 89650 Delivered Lumens
LD	LED: Direct, Nominal 755W, 65700 Delivered Lumens

* If ACC option is selected, structural support independent of the junction box is required.

LED Color Temperature:

30K	3000K	35K	3500K	40K	4000K
-----	-------	------------	-------	-----	-------

Control:

CLV	Integral Power Supply, 0-10V Dimming to 1%
-----	--

Voltage:

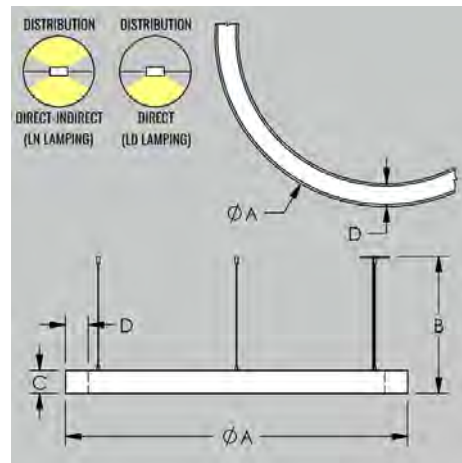
1	120V	2	277V	MV	Multi-Volt
---	------	---	------	-----------	------------

Diffusers:

WM:	Matte White Acrylic
-----	---------------------

Notes:

- LN / LH (Direct/Indirect) Lamping: Uplight is not uniform. If uniform uplight is required, contact the factory.
- LN / LH (Direct/Indirect) Lamping: Minimum recommended mounting distance to ceiling is 36".
- Maximum tilt angle: 5 degrees.



Notes:

- Custom sizes and finishes available upon request.
- Camman reserves the right to make design changes without prior notice.
- Mounting is to a 4 inch octagonal junction box.
- 60" and Larger Sizes: If the ACC or ACH Hanging Option is selected, structural support independent of the junction box is required.
- Photometric information is available at cammanlighting.com.





Job Name:
 South Dade Regional Library Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1044-72-LN-35K-CLV-MV-WM-PWM-ACC
 Notes:

Type:
L11-3
 LDI24-110942

Standard Finishes:

PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Hanging Options:

ACM Multiple Vertical Cables



ACC Cables to Canopy



ACH Cables to Hub



(24", 36", 48" Sizes Only)

Other Options:

OAH Overall Height (Specify in Comments)	2C 2-Circuit Wiring
REM Remote Emergency Power Supply	

Number of Cables	
P1044-24	3
P1044-36	3
P1044-48	3
P1044-60	3
P1044-72	3
P1044-96	6
P1044-108	4
P1044-144	6
P1044-192	6
P1044-216	8

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard (90CRI Available)
L70 (Projected):	>72,000 hours

Warranty	5 years (electrical components retain the component manufacturer warranty).
-----------------	---

Camman Plus Customizations



Camman **Standard Plus** products provide an extra degree of freedom to customize most standard products, including dimensions, finish, performance, and adding or removing details.

Visit www.cammanlighting.com/plus to learn more about the Plus program, and visit this fixture to see what specific options might be available.

Standard Finishes

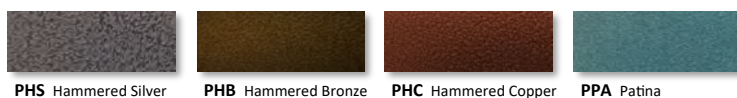
MODERN



NEUTRAL



TEXTURES



COLORS



- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.





Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1044-96-LN-35K-CLV-MV-WM-
 PWM-ACC
 Notes:

Type:
L11-4
 LDI24-110942

Fixture Number				
Project Title		Type	Qty	
Comments				



- Slim Profile (4" High x 4" Wide)
- Extruded Aluminum Inside & Outside Walls
- Flat Matte White Acrylic Bottom Lens (plus Top Lens on Direct/Indirect Lamping)
- Multiple Cables & Power Cord; Multiple Hanging Options Available
- Up to 60" Ships Assembled

Dimensions and Lamping:

P1044-24	24" A x 192" B x 4" C x 4" DWeight: 21 lbs.
LN	LED: Direct / Indirect, Nominal 115W, 9050 Delivered Lumens
LD	LED: Direct, Nominal 70W, 6100 Delivered Lumens
P1044-36	36" A x 192" B x 4" C x 4" DWeight: 32 lbs.
LN	LED: Direct / Indirect, Nominal 170W, 13700 Delivered Lumens
LD	LED: Direct, Nominal 115W, 9800 Delivered Lumens
P1044-48	48" A x 192" B x 4" C x 4" DWeight: 42 lbs.
LN	LED: Direct / Indirect, Nominal 235W, 18800 Delivered Lumens
LD	LED: Direct, Nominal 150W, 12850 Delivered Lumens
P1044-60	60" A x 192" B x 4" C x 4" DWeight 52 lbs.*
LN	LED: Direct / Indirect, Nominal 295W, 23900 Delivered Lumens
LD	LED: Direct, Nominal 190W, 16450 Delivered Lumens
P1044-72	72" A x 192" B x 4" C x 4" DWeight 63 lbs.*
LN	LED: Direct / Indirect, Nominal 335W, 27650 Delivered Lumens
LD	LED: Direct, Nominal 235W, 20200 Delivered Lumens
P1044-96	96" A x 192" B x 4" C x 4" DWeight: 83 lbs.*
LN	LED: Direct / Indirect, Nominal 440W, 36400 Delivered Lumens
LD	LED: Direct, Nominal 315W, 27500 Delivered Lumens
P1044-108	108" A x 192" B x 4" C x 4" DWeight: 94 lbs.*
LN	LED: Direct / Indirect, Nominal 545W, 44850 Delivered Lumens
LD	LED: Direct, Nominal 380W, 32950 Delivered Lumens
P1044-144	144" A x 192" B x 4" C x 4" DWeight: 125 lbs.*
LN	LED: Direct / Indirect, Nominal 755W, 61750 Delivered Lumens
LD	LED: Direct, Nominal 505W, 44050 Delivered Lumens
P1044-192	192" A x 192" B x 4" C x 4" DWeight 166 lbs.*
LN	LED: Direct / Indirect, Nominal 1005W, 82400 Delivered Lumens
LD	LED: Direct, Nominal 670W, 58650 Delivered Lumens
P1044-216	216" A x 192" B x 4" C x 4" DWeight 187 lbs.*
LN	LED: Direct / Indirect, Nominal 1090W, 89650 Delivered Lumens
LD	LED: Direct, Nominal 755W, 65700 Delivered Lumens

* If ACC option is selected, structural support independent of the junction box is required.

LED Color Temperature:

30K	3000K	35K	3500K	40K	4000K
-----	-------	-----	-------	-----	-------

Control:

CLV	Integral Power Supply, 0-10V Dimming to 1%
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Voltage:

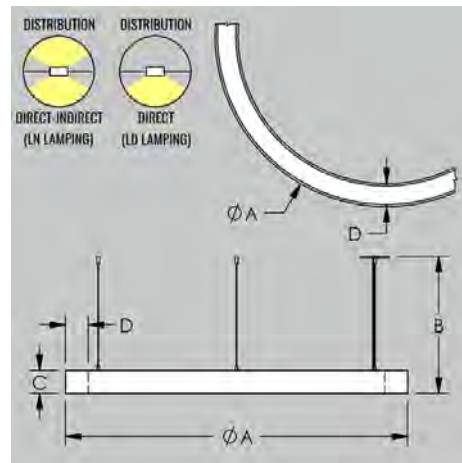
1	120V	2	277V	MV	Multi-Volt
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Diffusers:

WM:	Matte White Acrylic
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Notes:

- LN / LH (Direct/Indirect) Lamping: Uplight is not uniform. If uniform uplight is required, contact the factory.
- LN / LH (Direct/Indirect) Lamping: Minimum recommended mounting distance to ceiling is 36".
- Maximum tilt angle: 5 degrees.



Notes:

- Custom sizes and finishes available upon request.
- Camman reserves the right to make design changes without prior notice.
- Mounting is to a 4 inch octagonal junction box.
- 60" and Larger Sizes: If the ACC or ACH Hanging Option is selected, structural support independent of the junction box is required.
- Photometric information is available at cammanlighting.com.





Job Name:
 South Dade Regional Library Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1044-96-LN-35K-CLV-MV-WM-PWM-ACC
 Notes:

Type:
L11-4
 LDI24-110942

Standard Finishes:

PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Number of Cables	
P1044-24	3
P1044-36	3
P1044-48	3
P1044-60	3
P1044-72	3
P1044-96	6
P1044-108	4
P1044-144	6
P1044-192	6
P1044-216	8

Hanging Options:

ACM Multiple Vertical Cables 	ACC Cables to Canopy 	ACH Cables to Hub (24", 36", 48" Sizes Only)
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Other Options:

OAH Overall Height (Specify in Comments)	2C 2-Circuit Wiring
REM Remote Emergency Power Supply	

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard (90CRI Available)
L70 (Projected):	>72,000 hours

Warranty	5 years (electrical components retain the component manufacturer warranty).
-----------------	---

Camman Plus Customizations

Camman **Standard Plus** products provide an extra degree of freedom to customize most standard products, including dimensions, finish, performance, and adding or removing details.

Visit www.cammanlighting.com/plus to learn more about the Plus program, and visit this fixture to see what specific options might be available.

Standard Finishes

MODERN

PAL Aluminum	PNL Nickel	PSB Satin Black	PMW Matte White

NEUTRAL

PAB Antique Brass	PBB Brushed Brass	PSG Satin Gold	PLB Light Bronze
PMB Medium Bronze	PBR Bronze	PDB Dark Bronze	PRB Oil Rubbed Bronze

TEXTURES

PHS Hammered Silver	PHB Hammered Bronze	PHC Hammered Copper	PPA Patina

COLORS

PRD Traffic Red (RAL 3020)	POR Pure Orange (RAL 2004)
PYL Traffic Yellow (RAL 1023)	PGR Emerald Green (RAL 6001)
PBL Signal Blue (RAL 5005)	

- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.





Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1044-144-LN-35K-CLV-MV-WM-
 PWM-ACC
 Notes:

Type:
L11-6
 LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Slim Profile (4" High x 4" Wide)
- Extruded Aluminum Inside & Outside Walls
- Flat Matte White Acrylic Bottom Lens (plus Top Lens on Direct/Indirect Lamping)
- Multiple Cables & Power Cord; Multiple Hanging Options Available
- Up to 60" Ships Assembled

Dimensions and Lamping:

P1044-24	24" A x 192" B x 4" C x 4" DWeight: 21 lbs.
LN	LED: Direct / Indirect, Nominal 115W, 9050 Delivered Lumens
LD	LED: Direct, Nominal 70W, 6100 Delivered Lumens
P1044-36	36" A x 192" B x 4" C x 4" DWeight: 32 lbs.
LN	LED: Direct / Indirect, Nominal 170W, 13700 Delivered Lumens
LD	LED: Direct, Nominal 115W, 9800 Delivered Lumens
P1044-48	48" A x 192" B x 4" C x 4" DWeight: 42 lbs.
LN	LED: Direct / Indirect, Nominal 235W, 18800 Delivered Lumens
LD	LED: Direct, Nominal 150W, 12850 Delivered Lumens
P1044-60	60" A x 192" B x 4" C x 4" DWeight 52 lbs.*
LN	LED: Direct / Indirect, Nominal 295W, 23900 Delivered Lumens
LD	LED: Direct, Nominal 190W, 16450 Delivered Lumens
P1044-72	72" A x 192" B x 4" C x 4" DWeight 63 lbs.*
LN	LED: Direct / Indirect, Nominal 335W, 27650 Delivered Lumens
LD	LED: Direct, Nominal 235W, 20200 Delivered Lumens
P1044-96	96" A x 192" B x 4" C x 4" DWeight: 83 lbs.*
LN	LED: Direct / Indirect, Nominal 440W, 36400 Delivered Lumens
LD	LED: Direct, Nominal 315W, 27500 Delivered Lumens
P1044-108	108" A x 192" B x 4" C x 4" DWeight: 94 lbs.*
LN	LED: Direct / Indirect, Nominal 545W, 44850 Delivered Lumens
LD	LED: Direct, Nominal 380W, 32950 Delivered Lumens
P1044-144	144" A x 192" B x 4" C x 4" DWeight: 125 lbs.*
LN	LED: Direct / Indirect, Nominal 755W, 61750 Delivered Lumens
LD	LED: Direct, Nominal 505W, 44050 Delivered Lumens
P1044-192	192" A x 192" B x 4" C x 4" DWeight 166 lbs.*
LN	LED: Direct / Indirect, Nominal 1005W, 82400 Delivered Lumens
LD	LED: Direct, Nominal 670W, 58650 Delivered Lumens
P1044-216	216" A x 192" B x 4" C x 4" DWeight 187 lbs.*
LN	LED: Direct / Indirect, Nominal 1090W, 89650 Delivered Lumens
LD	LED: Direct, Nominal 755W, 65700 Delivered Lumens

* If ACC option is selected, structural support independent of the junction box is required.

LED Color Temperature:

30K	3000K	35K	3500K	40K	4000K
-----	-------	------------	-------	-----	-------

Control:

CLV	Integral Power Supply, 0-10V Dimming to 1%
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Voltage:

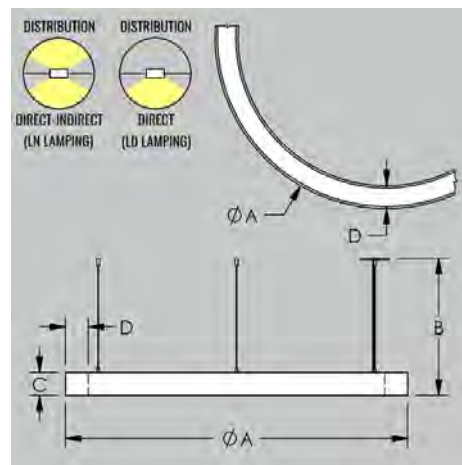
1	120V	2	277V	MV	Multi-Volt
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Diffusers:

WM:	Matte White Acrylic
-----	---------------------

Notes:

- LN / LH (Direct/Indirect) Lamping: Uplight is not uniform. If uniform uplight is required, contact the factory.
- LN / LH (Direct/Indirect) Lamping: Minimum recommended mounting distance to ceiling is 36".
- Maximum tilt angle: 5 degrees.



Notes:

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- Mounting is to a 4 inch octagonal junction box.
- 60" and Larger Sizes: If the ACC or ACH Hanging Option is selected, structural support independent of the junction box is required.
- Photometric information is available at cammanlighting.com.





Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1044-144-LN-35K-CLV-MV-WM-
 PWM-ACC
 Notes:

Type:
L11-6

LDI24-110942

Standard Finishes:

PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Hanging Options:

ACM Multiple Vertical Cables



ACC Cables to Canopy



ACH Cables to Hub



(24", 36", 48" Sizes Only)

Other Options:

OAH Overall Height (Specify in Comments)	2C 2-Circuit Wiring
REM Remote Emergency Power Supply	

Number of Cables	
P1044-24	3
P1044-36	3
P1044-48	3
P1044-60	3
P1044-72	3
P1044-96	6
P1044-108	4
P1044-144	6
P1044-192	6
P1044-216	8

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard (90CRI Available)
L70 (Projected):	>72,000 hours

Warranty	5 years (electrical components retain the component manufacturer warranty).
-----------------	---

Camman Plus Customizations



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Standard Finishes

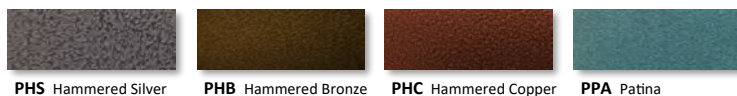
MODERN



NEUTRAL



TEXTURES



COLORS



- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.



**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

PD9117-WH/GD

Type:**L12-1**

Notes:

LDI24-110942

HELENA

PROJECT

PD9117 -WH/GD

PENDANTS



PD9117-BK/BK
Black/Black



PD9117-WH/SV
White/Silver



PD9117-BK/GD
Black/Gold



PD9117-WH/GD
White/Gold

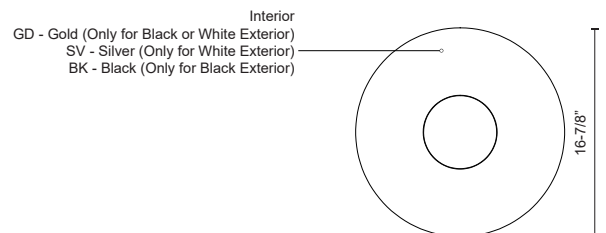
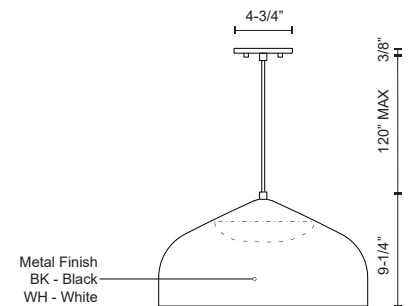
SPECIFICATION DETAILS

Fixture Dimensions	D16-7/8" x H9-1/4"
Light Source	AC LED Module
Wattage	38W
Total Lumens	2990lm
Delivered Lumens	BK/BK - 1169lm
Voltage	120V
Color Temperature	3000K
CRI (Ra)	90CRI
Optional Color Temps	2700K - 5000K Available, Minimum Order Quantities Apply
LED Rated Life	50,000 hours
Dimming	100% - 10%, ELV Dimmer (Not Included)
Diffuser Details	White Acrylic Diffuser
Shade Details	Spun Aluminum Shade
Adjustable	Yes
Wire Length	120" Max
Wire Type	BK - Black Braided Cord; WH - White Braided Cord;
Minimum Hang Height	12"
Sloped Ceiling Adaptable	Yes
Location	Dry
Illumination Direction	Downlight
CEC Title 24 JA8	Yes, JA8-2022
Paint Finish	BK01; GD01; SV01; WH01;
Canopy Dimensions	D4-3/4" x H3/8"

* For custom options, consult factory for details.

* For warranty information, please visit www.kuzcolighting.com/warranty**DESCRIPTION**

The smooth spun metal shade is available in black or white for this modern pendant but add your choice of multiple interior lamp shade colors and the possibilities are endless. Suspended by a matching braided fabric cord the Helena exudes effortless elegance. The acorn-shaped lamp shade measures 17 inches in diameter. Hang this pendant solo or in multiples for a more dramatic look.

**KUZCO**

CANADA: 19054 28TH AVENUE - SURREY, BC V3Z 6M3
USA: 3035 E. LONE MOUNTAIN ROAD - LAS VEGAS, NV 89081

WWW.KUZCOLIGHTING.COM

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COMMENT



**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

PD9117-WH/SV

Notes:

Type:**L12-2**

LDI24-110942

HELENA

PROJECT

PD9117 -WH/SV

PENDANTS



PD9117-BK/BK
Black/Black



PD9117-WH/SV
White/Silver



PD9117-BK/GD
Black/Gold



PD9117-WH/GD
White/Gold

SPECIFICATION DETAILS

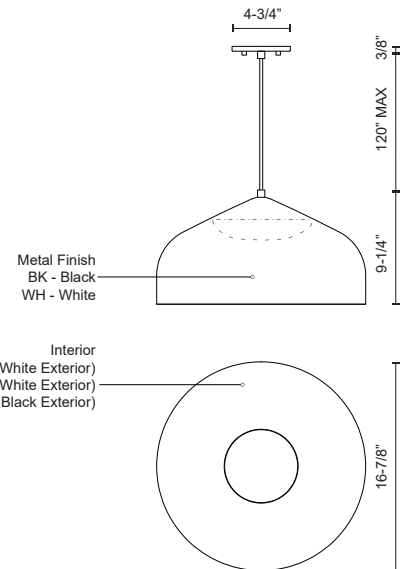
Fixture Dimensions	D16-7/8" x H9-1/4"
Light Source	AC LED Module
Wattage	38W
Total Lumens	2990lm
Delivered Lumens	BK/BK - 1169lm
Voltage	120V
Color Temperature	3000K
CRI (Ra)	90CRI
Optional Color Temps	2700K - 5000K Available, Minimum Order Quantities Apply
LED Rated Life	50,000 hours
Dimming	100% - 10%, ELV Dimmer (Not Included)
Diffuser Details	White Acrylic Diffuser
Shade Details	Spun Aluminum Shade
Adjustable	Yes
Wire Length	120" Max
Wire Type	BK - Black Braided Cord; WH - White Braided Cord;
Minimum Hang Height	12"
Sloped Ceiling Adaptable	Yes
Location	Dry
Illumination Direction	Downlight
CEC Title 24 JA8	Yes, JA8-2022
Paint Finish	BK01; GD01; SV01; WH01;
Canopy Dimensions	D4-3/4" x H3/8"

* For custom options, consult factory for details.

* For warranty information, please visit www.kuzcolighting.com/warranty

DESCRIPTION

The smooth spun metal shade is available in black or white for this modern pendant but add your choice of multiple interior lamp shade colors and the possibilities are endless. Suspended by a matching braided fabric cord the Helena exudes effortless elegance. The acorn-shaped lamp shade measures 17 inches in diameter. Hang this pendant solo or in multiples for a more dramatic look.

**KUZCO**

CANADA: 19054 28TH AVENUE - SURREY, BC V3Z 6M3
USA: 3035 E. LONE MOUNTAIN ROAD - LAS VEGAS, NV 89081

WWW.KUZCOLIGHTING.COM

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COMMENT



**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

PD9117-WH/BU

Type:**L12-3**

LDI24-110942

HELENA DOWN PENDANTS WHITE/BLUE - PD9117-WH/BU

DESCRIPTION

"The smooth spun metal shade is available in graphite or white for this modern pendant but add your choice of one of the four interior lamp shade colors and the possibilities are endless Suspended by a matching braided fabric cord the Helena exudes effortless elegance The acorn shaped lamp shade measures inches in diameter Hang this pendant solo or in multiples for a more dramatic look "

INFORMATION

SKU	PD9117-WH/BU
Brand	Kuzco
Finish	White/Blue
Kelvins	N/A
CRI	N/A
Lumens	N/A
Collection	Helena
Length	1.00
Width	1.00
Height	9.00
Weight	0.00 LBS
Warranty	N/A
Availability	N/A
Origin	N/A





Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S24-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

Type:

L13-2

LDI24-110942



LIGHTPLANE+ 2R

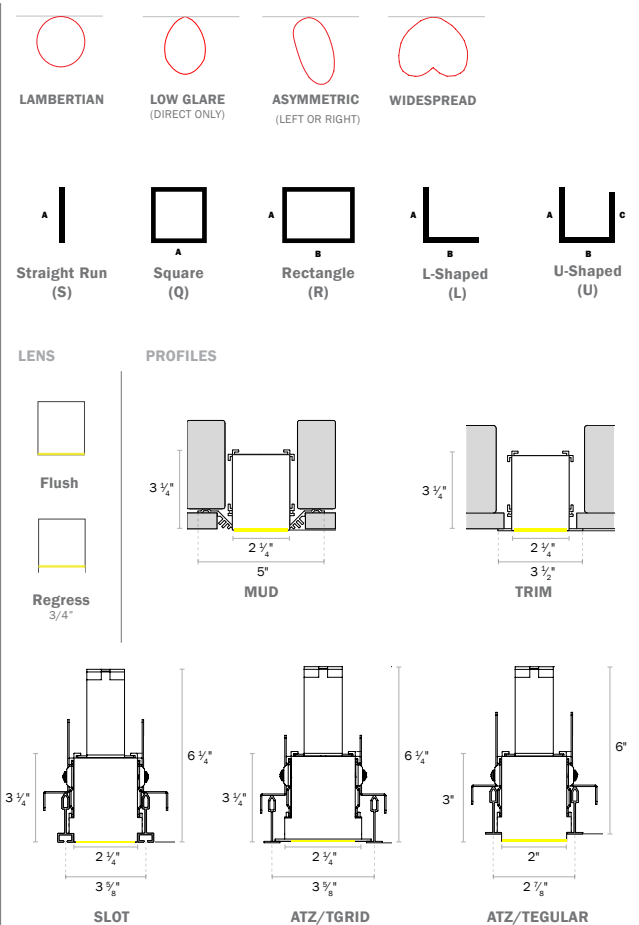
LPX2R | RECESSED



SPECIFICATIONS

PROFILE	2" Aperture, 3 1/4" height
SIZES	Individual/Straight Run sections starting at 2ft. Continuous runs & shapes
LED OUTPUT	350lm/ft - 1,200lm/ft, up to 169 lm/ft
CCT/CRI	2700K/3000K/3500K/4000K/5000K • 80 or 90+ CRI Tunable White (2700K - 6500K) • RGB and RGB+W
DIMMING/DRIVER	Integral and Remote Driver: 0-10V, Phase, DALI, DMX, eldoLED, Lutron®, PoE (Molex, NuLEDS, WTEC Smartengine). Dimming to 0% for select models.
EMBEDDED CONTROLS	Acuity nLight, Avi-on, Casambi, Cooper Wavelinx, Encelium, Enlighted, Lutron Athena, Lutron Vive, NX Controls, Wattstopper, and more
POWER	3W - 11W per ft
INPUT	120VAC, 277VAC, or 347VAC
OPTICS	Lambertian, Low Glare (UGR < 19), Asymmetric, Widespread
LENS	Standard Snap-in Flush, Regressed
FINISHES	16 standard finishes at no extra charge Custom finishes available
MATERIAL	6063-T6 Extruded Aluminum
ENVIRONMENT	Dry or damp locations
WARRANTY	11 years
WELL/UGR	See ALW WELL and BIOS pages for recommended options that contribute to meeting the WELL Building Standard™

DISTRIBUTIONS & PROFILES



Not to scale. Dimensions are nominal. Consult factory for CAD drawing



LPX2R - SPECIFICATIONS
RECESSED

ALW-INC.COM



Job Name:
South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
LPX2RMD-FN-S24-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

Type:

L13-2

LDI24-110942



PRODUCT SPECIFICATION SHEET

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
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EXAMPLE: LPX2RMDFN – S8 – 053090SLV00 – SW – UNV – EMC/2 – N – N – DC – QS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

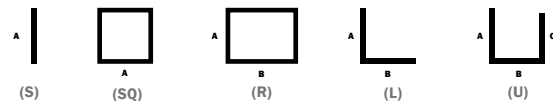
1. FAMILY	2. SIZE	3. MODEL (CHOOSE 1)	4. MOUNTING (CHOOSE 1)	5. LENS TYPE (CHOOSE 1)
QS LPX Lightplane ¹	QS 2 2'	QS R Recessed Direct	QS MD Mud	QS FN Flush Lens

- QS TM² Trim
- QS T9 TGrid 9/16
- QS T5 TGrid 15/16
- HF Hidden Flange
- ST Slot
- G9 Tegular 9/16
- G5 Tegular 15/16
- AS^{3,4} Armstrong Techzone[®] Slot
- AS^{3,4} Armstrong Techzone[®] T-grid 9/16
- AS^{3,4} Armstrong Techzone[®] T-grid 15/16
- AG^{3,4} Armstrong Techzone[®] Tegular 9/16
- AW⁵ Armstrong Woodworks[®]
- AM⁶ Armstrong Metalworks[®]

¹For install in wood, drywall, metal, etc.
²Fits Armstrong 4" TechZone[®]
³All product and company names are trademarks or registered trademarks of their respective holders. Use of them does not imply any affiliation with or endorsement by them.

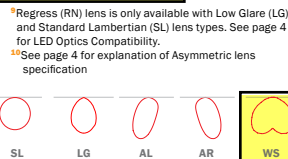
6. SHAPE/LENGTH* (CHOOSE 1 & ENTER LENGTH IN FEET) - FOR CUSTOM ANGLES, CONTACT ALW	7. LUMENS* (CHOOSE 1)	8. CCT (CHOOSE 1)
QS S24 Individual/Straight Run Section (enter length in product code above, ex. S18)	QS 03 350lm/ft	QS N Choose for RB, RW, or BO
QS Q___ Square Configuration (enter side length A, ex: Q18)	QS 05 500lm/ft	27 ⁷ 2700K
QS R___ Rectangular Configuration (enter side lengths A and B, ex. R12/24)	QS 07 750lm/ft	QS 30 3000K
QS L___ L-Shaped Configuration (enter side lengths A and B, ex. L12/24)	QS 10 1000lm/ft	QS 35 3500K
QS U___ U-Shaped Configuration (enter side lengths A, B, and C, ex. U12/12/24)	QS 12 1200lm/ft	QS 40 4000K
	RB RGB	50 ⁸ 5000K
	RB RGB + 3500K White, 80CRI	TW ⁹ Tunable White, 90CRI, 2700K - 6500K
	BO/___ ⁴ BIOS, 80CRI. Choose your lm/ft	⁷ 2700K only available in 90CRI
	CM/___ ⁵ Custom Lumens. Write in your lumens/ft (ex: 0100 = 100lm/ft).	⁸ 5000K only available in 80CRI
		⁹ Tunable White (TW) not available with BIOS. BIOS has its own tunable white option to be specified by request.

*To qualify for QS, all corners of shape must be 90°, same plane
*Lengths greater than 8' consist of multiple individual housing sections joined together. Lengths are nominal and may vary based on lamping and other specification selections. Contact ALW when exact lengths are required.



Shape orientation (Looking from the Ceiling down to the floor).

9. CRI (CHOOSE 1)	10. OPTICS (CHOOSE 1)	11. DRIVER* (CHOOSE 1)	12. FINISH* (CHOOSE 1)
QS N Choose for RB, RW, or TW	QS SL ¹⁰ Standard Lambertian	QS V00 0-10V, dim to 0%	STANDARD FINISHES
QS 80 80	QS LG ¹⁰ Low Glare	QS V01 0-10V, dim to 1%	QS SW <input checked="" type="checkbox"/> Satin White
QS 90 90	QS AL ¹⁰ Asymmetric Left (outside of shape)	QS LDE Lutron LDE1 Ecosystem, dim to 1%	QS SB <input type="checkbox"/> Satin Black
	QS AR ¹⁰ Asymmetric Right (inside of shape)	P01 ¹¹ ELV/TRIAC phase dim to 1%	QS AS <input type="checkbox"/> Aluminum Silver Anodized Effect
	QS WS Widespread	TSE ¹² Lutron T-Series Driver	QS TB <input type="checkbox"/> Textured Black
		ELO eldoLED, 0-10V dim to 0%	PREMIUM FINISHES
		DAL DALI, dim to 0%	___ See chart on page 10 for premium finishes. Manually type in the finish code (Ex: OB = Oil-Rubbed Bronze)
		DMX DMX, dim to 0%	SPECIAL ORDER FINISHES ¹³
		POE ¹³ POE Ready	RAL___ Specify RAL Classic Color (Ex: RAL 3003)
		CM ¹⁴ Custom driver	CCM___ Custom Color Match



*See "Driver" and lamping charts for driver details
¹⁰Phase dim drivers are 120 VAC only
¹¹For Tunable White (TW) CCT only
¹²Contact ALW with the POE spec details
¹³Contact ALW for custom driver specifications

QS = QuickShip-qualifying option. For the entire luminaire configuration to be QuickShip-eligible, ALL options specified in the configuration must be ones notated with "QS".
NOTE: Maximum 800 ft. of QuickShip-eligible product per order.

Rev 112823

LPX2R – SPECIFICATIONS
RECESSED

ALW-INC.COM
2 of 14



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S24-RW-N-N-WS-
 DMX-SW-UNV-N-N

Notes:

Type:

L13-2

LDI24-110942



PRODUCT SPECIFICATION SHEET CONT'D

13. VOLTAGE (CHOOSE 1)	14. EMERGENCY CIRCUITS (OPTIONAL)	15. CONTROL OPTIONS* (OPTIONAL)	16. ADDITIONAL OPTIONS - A (OPTIONAL)
QS UNV Universal Voltage (120VAC-277VAC) 347 347 Volt (Driver options may be limited. Not available with EMB)	QS N None QS EMC/___ ¹⁵ Emergency power feed whip for connection to remote Generator Transfer Devices (Specify 1x for every 4ft or contact ALW for longer runs) QS EMB/___ 10W Integral Emergency Battery (Specify 1x for every 4ft of emergency lighting) GTD/___ Integral Generator Transfer Device/Switch Bypass - 3A (Specify 1x for every 4ft) ALC/___ Integral Automated Load Control Relay - 10A (Specify 1x for every 4ft or contact ALW for longer runs)	QS N None FACTORY CONTROLS QS OS/PH/INT/___ Integral Occupancy/Daylight sensor QS OS/PH/HV/___ Remote Occupancy/Daylight sensor NETWORK CONTROLS Embedded controls below are placeholder specs. See the ALW Controls Guide to finalize your final control spec. AY/xx Acuity AN/xx Avi-on CA/xx Casambi CW/xx/___ Cooper Wavelinx EN/xx/___ Encelium EL/xx/___ Enlighted LU/xx/___ Lutron NX/xx/___ NX Controls WA/xx/___ Wattstopper	QS N None QS CP Chicago Plenum

¹⁵ No EM components provided. Choose None when designating entire fixture for EMC. When 4ft EMC sections are chosen, the power whip will be labeled as an EMC whip.

* Quickship availability on occupancy and photocell daylight sensors may vary. Contact ALW for more information.
 * Contact ALW for Additional Zone specifications

17. ADDITIONAL OPTIONS - B (OPTIONAL)	18. QUICKSHIP OPTIONS
DC Living Building Challenge Declared and Red List Approved	QS Select if you want your fixture to be QS Note: To be eligible for the Quickship (QS) program, all previous selected options must also be marked QS

QS = QuickShip-qualifying option. For the entire luminaire configuration to be QuickShip-eligible, ALL options specified in the configuration must be ones notated with "QS".
 NOTE: Maximum 800 ft. of QuickShip-eligible product per order.

Rev 112823

**LPX2R – SPECIFICATIONS
 RECESSED**

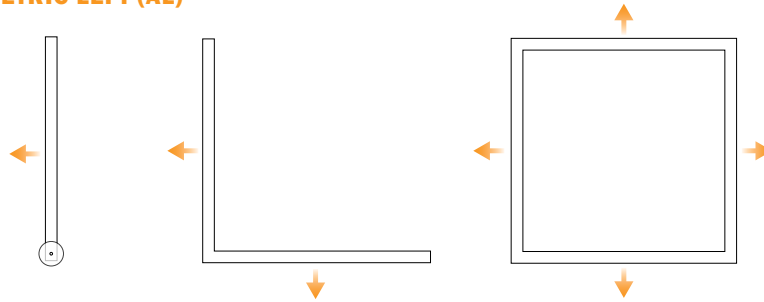
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 3 of 14



LENS & OPTICS COMPATIBILITY

		OPTICS			
		STANDARD LAMBERTIAN (SL)	LOW GLARE (LG)	ASYMMETRIC (AL, AR)	WIDESPREAD (WS)
LENS TYPES	FLUSH (FN)	●	●	●	●
	CONTROLROLL FLUSH (CN)	●	●	●	●
	REGRESSED (RN)	●	●		

ASYMMETRIC LEFT (AL)



Straight Sections
 Light is thrown to left of the powerfeed
 (Can be reconfigured in field)

Shapes
 Light is thrown outside the shape
 (Cannot be reconfigured in the field because of mitered cuts)

Note: For unique applications, mark up the submittal drawings for desired asymmetric light throw.

ASYMMETRIC RIGHT (AR)



Straight Sections
 Light is thrown to right of the powerfeed
 (Can be reconfigured in field)

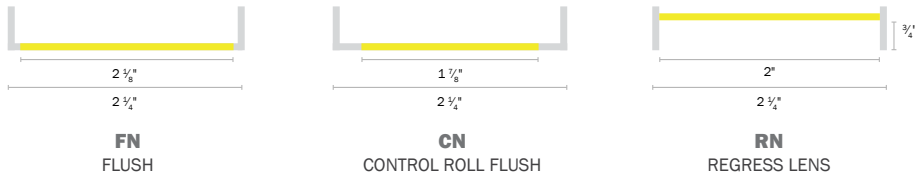
Shapes
 Light is thrown inside the shape
 (Cannot be reconfigured in the field because of mitered cuts)



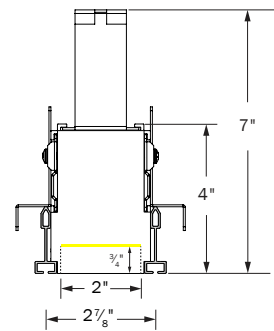
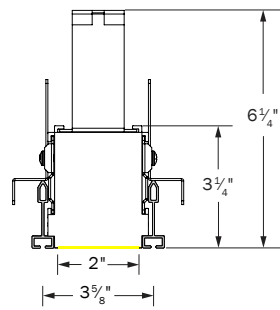
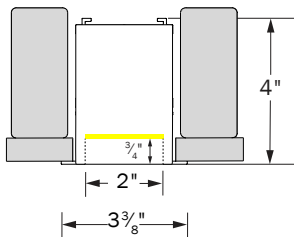
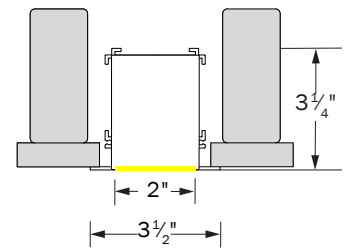
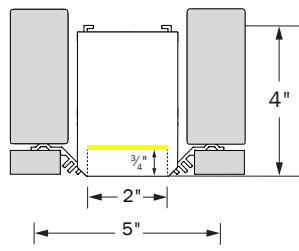
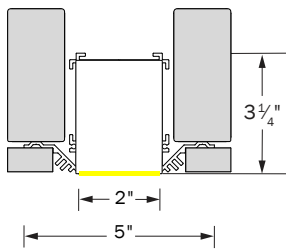
LENS DETAILS

Applicable to all models

— FIXTURE BODY — LENS

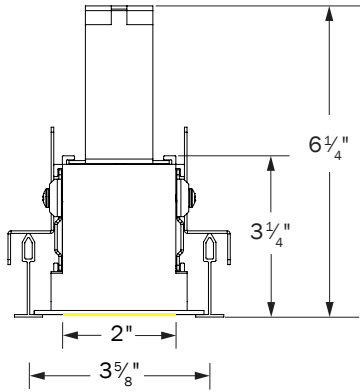


MECHANICAL DIAGRAMS

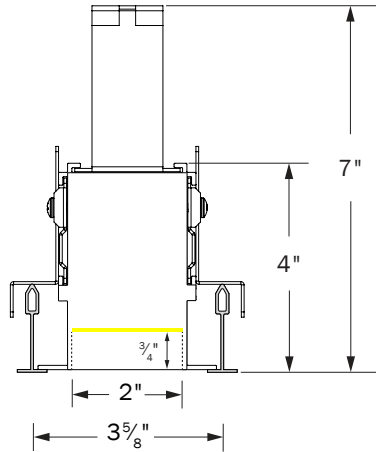




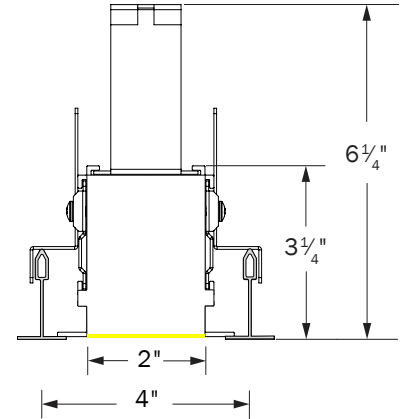
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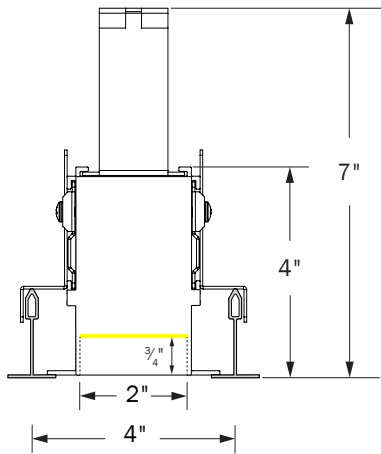
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RECESSED TGRID 9/16
FLUSH LENS



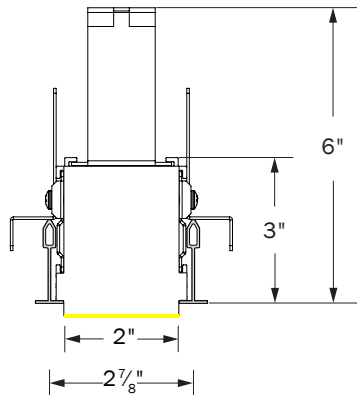
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RECESSED TGRID 9/16
REGRESSED LENS



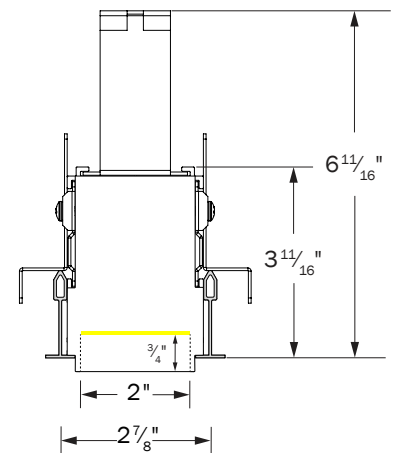
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FLUSH LENS



LPX2RT5RN
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REGRESSED LENS



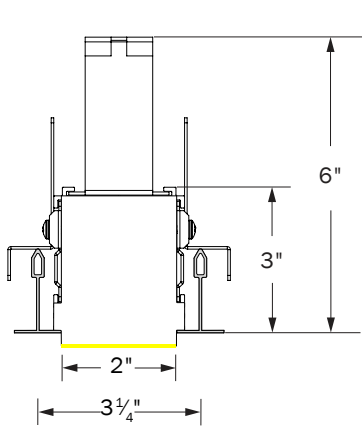
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FLUSH LENS



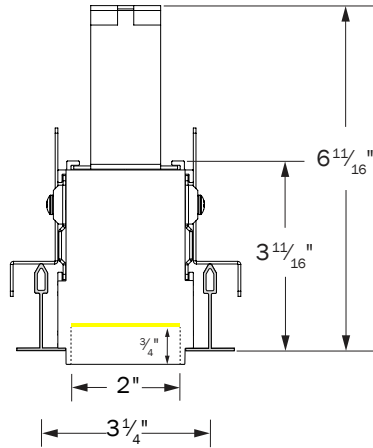
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REGRESSED LENS



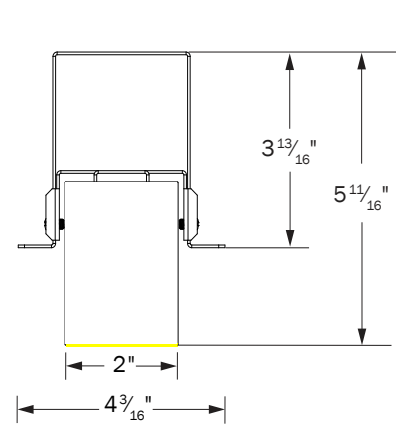
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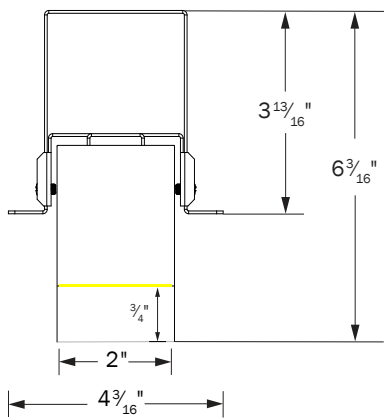
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FLUSH LENS



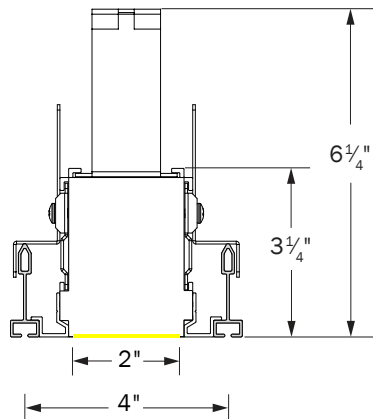
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REGRESSED LENS



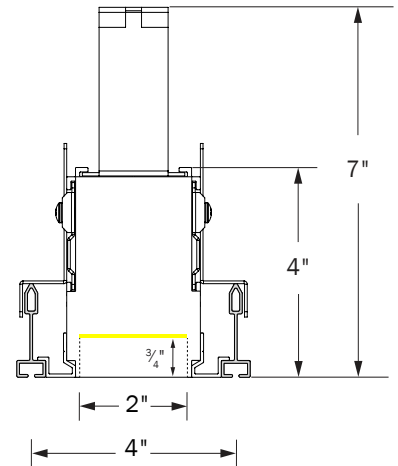
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RECESSED HIDDEN FLANGE
FLUSH LENS



LPX2RHFRN
RECESSED HIDDEN FLANGE
REGRESSED LENS



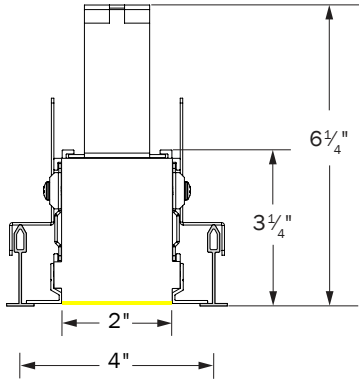
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RECESSED SLOT ARMSTRONG
TECHZONE® FLUSH LENS



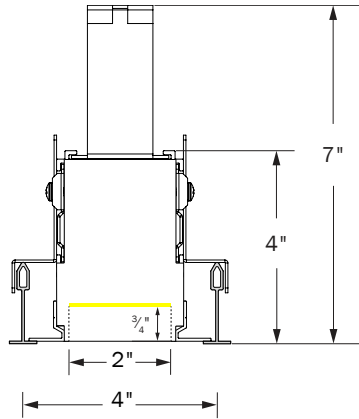
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TECHZONE® REGRESSED LENS



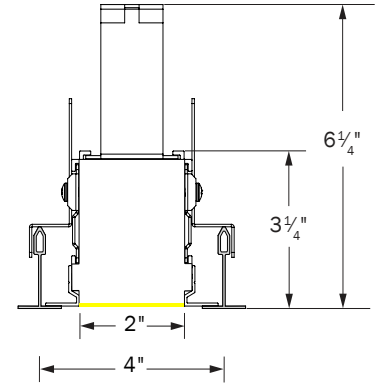
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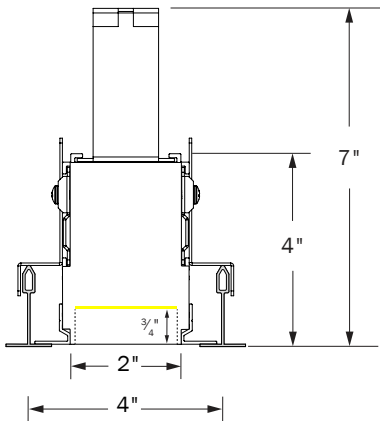
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ARMSTRONG TECHZONE®
FLUSH LENS



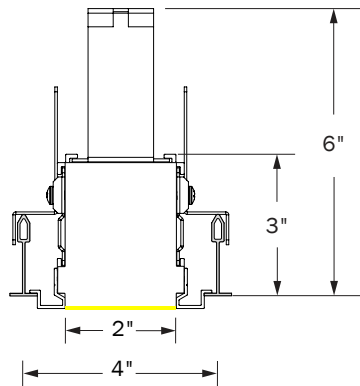
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REGRESSED LENS



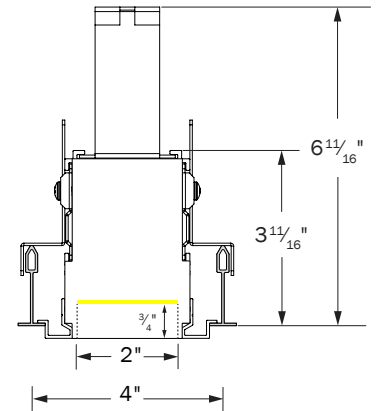
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ARMSTRONG TECHZONE®
FLUSH LENS



LPX2RA5RN
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ARMSTRONG TECHZONE®
REGRESSED LENS



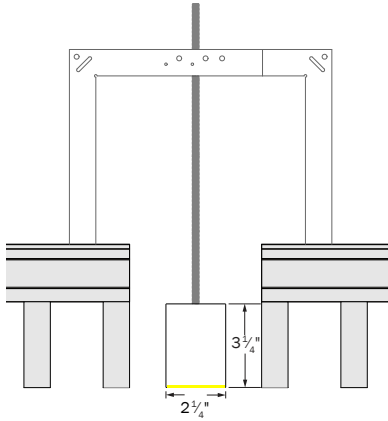
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ARMSTRONG TECHZONE®
FLUSH LENS



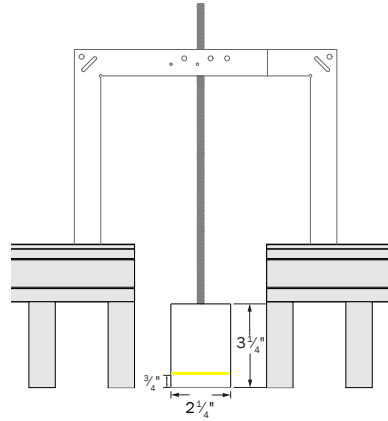
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ARMSTRONG TECHZONE®
REGRESSED LENS



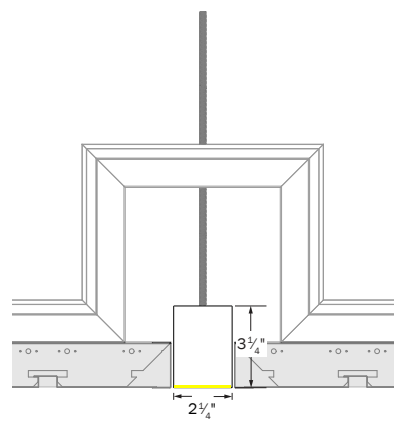
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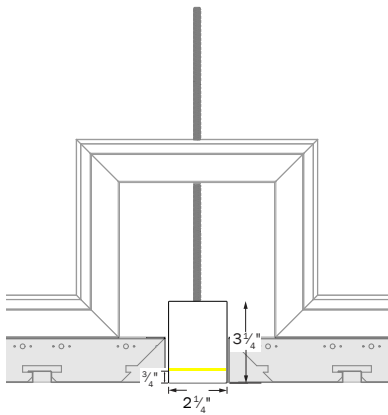
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WOODWORKS® FLUSH LENS



LPX2RAWRN
RECESSED ARMSTRONG
WOODWORKS® REGRESSED LENS



LPX2RAMFN
RECESSED ARMSTRONG
METALWORKS® FLUSH LENS



LPX2RAMRN
RECESSED ARMSTRONG
METALWORKS® REGRESSED LENS



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S24-RW-N-N-WS-
 DMX-SW-UNV-N-N

Notes:

Type:

L13-2





LDI24-110942



FINISHES

Standard finishes are available at no additional charge.

STANDARD FINISHES - QS ELIGIBLE

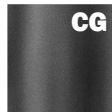


 SW	 AS	 SB	 TB
Satin White QS	Aluminum Silver Anodized Effect QS	Satin Black QS	Textured Black QS

PREMIUM FINISHES

BASIC POWDER COAT

 GW	 AW	 TW
Gloss White	Antimicrobial Gloss White White	Textured Matte White





METALLIC POWDER COAT

 CG	 CU	 BR
Charcoal Gray	Copper	Brass

SATIN ANODIZED EFFECT POWDER COAT

 OB	 DB
Oil-Rubbed Bronze	Dark Bronze

GLOSS POWDER COAT (80-95% GLOSS)

 GO	 GR	 GM	 GB
Orange RAL 2003	Red RAL 3020	Magenta RAL 4010	Blue RAL 5015

Contact ALW Quotes for sample paint finish swatches.

SPECIAL ORDER FINISHES*



RAL CLASSIC COLORS (80-95% GLOSS): RAL_ _ _ _

Most RAL Classic Colors are available for a minimum setup fee. On your specification submittal choose your RAL color by entering the 4-digit RAL code (Ex: RAL 3003). See www.alw-inc.com/resources/finishes



CUSTOM COLOR MATCH: CCM_ _ _ _

Custom powder coat color matching is available for a premium setup fee. Consult ALW for additional information.

*An individual setup fee will apply to each unique Special Order Finish per purchase order.
 (ex: RAL 5023 and RAL 2008 are specified for multiple line items on a purchase order. 2x setup fees will apply)

*Printed or on-screen colors are only approximations - consult actual Color Chip Set before specifying

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S24-RW-N-N-WS-
DMX-SW-UNV-N-N

Notes:

Type:**L13-2**

LDI24-110942

**PERFORMANCE DETAILS**

OUTPUT OPTION	OPTIC TYPE	DELIVERED LUMENS/FT	EFFICACY (LM/W)	WATTS/FT ¹⁵	CRI OPTIONS	CCT OPTIONS
03¹⁶	SL	359	119	3	80+ 90+	2700K 3000K 3500K 4000K 5000K
	WS	428	142			
	LG	416	138			
	AL	416	138			
05¹⁶	SL	511	117	4.4		
	WS	609	140			
	LG	593	136			
	AL	593	136			
07¹⁶	SL	764	122	6.3		
	WS	912	145			
	LG	887	141			
	AL	887	141			
10¹⁶	SL	1008	112	9		
	WS	1203	134			
	LG	1170	130			
	AL	1170	130			
12¹⁶	SL	1204	110	11		
	WS	1437	131			
	LG	1398	127			
	AL	1398	127			
TUNE	SL, WW	921	65	14.2	90	2700K - 6500K
	SL, CW	977	69			
RGB¹⁷	SL	184	17	11	N/A	
RGBW¹⁷	SL	W: 177 RGB: 184	20	17.7	W: 80 CRI	W: 3500K

¹⁵ Lumens/Watt and Watts/ft have been calculated assuming a driver efficiency of 85%. Depending on field conditions, actual measured values may fluctuate by 5-8%.

¹⁶ Performance calculations are based on LM-79 test of 1200lm output at 80 CRI and 3500K. All other output calculations are extrapolated values.

¹⁷ Performance calculations are derived from LM-79 test with all RGB LEDs illuminated (Red, Green, Blue) and White LED only illuminated

TM-30-18 DETAILS (90 CRI LAMPING)

CCT	CRI (Ra)	CRI (R9)	TM-30 Rf	TM-30 Rg	Duv
2700K	94	56	92	100	-0.0009
3000K	94	59	92	100	-0.0013
3500K	94	64	92	100	-0.0005
4000K	94	66	92	100	-0.0004

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S24-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

Type:**L13-2**

LDI24-110942

**DRIVERS**

PRODUCT CODE	DESCRIPTION
V00	0-10V dimming down to 1% with electronic dim-to-off (0%).
V01	0-10V dimming down to 1%.
LDE	Lutron Hi-lume (LDE1) 1% EcoSystem LED driver with Soft-on, Fade-to-Black dimming technology.
P01	TRIAC Forward Phase 2-Wire and ELV Reverse Phase 3-Wire hybrid LED driver. Dimming down to 1%. 120VAC only.
ELO	EldoLED 0-10V SOLODrive 0.1% dimming with electronic dim-to-off (0%).
TSE	Lutron T-Series (PSQ0) 1% 2-channel tunable white driver (For use with Lutron Quantum Control Systems).
DAL	DALI flicker-free dimming down to 1% with electronic dim-to-off (0%).
DMX	DMX flicker-free dimming down to 0%.
POE/READY	Specify a PoE driver of your choice. Fixture supplied with low voltage leads and no LED driver. Contact ALW to register your project.

*Most drivers can be programmed to specific dimming levels if desired. Contact ALW for specific dimming level requests.

ALW lighting fixtures are intended for use with a wide range of sensors, lighting controls, LED drivers, and building management systems. If there are specific components required for your application that aren't listed on this spec sheet, please contact ALW customer support to specify a compatible solution of your choice.

DRIVER/LED LAMPING COMPATIBILITY						
	STD	STD/BIOS	TUNE*	RGB OR RGBW	CA TITLE 24 JA8/JA10 ¹⁸	IEEE P1789 & HD TV STUDIO ¹⁹
V00	●	●	●		●	
V01	●	●	●		●	
LDE	●	●			●	●
P01	●	●			●	
ELO	●	●	●		●	●
TSE			●		●	●
DALI	●	●	●		●	
DMX	●	●	●	●	PER REQUEST	PER REQUEST
POE/READY	PER REQUEST					

● - Indicates compatibility

* Standard lamping (STD) - 350 - 1200 lm/ft

¹⁸ Fixtures specified with 90CRI 2700K, 3000K, 3500K, 4000K, and 5000K lamping with applicable LED drivers have the ability to conform to California Title 24 JA8 and JA10 Appendices

¹⁹ The following drivers conform to IEEE P1789 Flicker Standard: 'IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers'. These drivers may also be installed in HD TV Studio applications utilizing high frequency camera equipment.

*ELO with TUNE Lamping will include an EldoLED DUALDrive 0-10V Tunable White LED Driver.



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S24-RW-N-N-WS-
 DMX-SW-UNV-N-N

Notes:

Type:

L13-2

LDI24-110942



PHOTOMETRICS

OPTIC	POLAR PLOT (CD)	MTG HEIGHT	LIGHT LEVEL (FC)	SPACING CRITERION (SC) ²⁰ (0°- 180°) (90°- 270°)	MAX INTENSITY (CD)	OUTPUT (LM/FT)
AL		6 ft	16.4	1.20 1.28	673	1398
		8 ft	9.2			
		10 ft	5.9			
		12 ft	4.1			
		14 ft	3.0			
		16 ft	2.3			
WS		6 ft	10.7	1.24 1.32	549.5	1437
		8 ft	6.0			
		10 ft	3.9			
		12 ft	2.7			
		14 ft	2.0			
		16 ft	1.5			
LG		6 ft	18.4	1.20 1.14	619.4	1398
		8 ft	10.3			
		10 ft	6.6			
		12 ft	4.6			
		14 ft	3.4			
		16 ft	2.6			
SL		6 ft	11.9	1.24 1.24	428.8	1204
		8 ft	6.7			
		10 ft	4.3			
		12 ft	3.0			
		14 ft	2.2			
		16 ft	1.7			

*Photometric calculations based on 1200lm 3500K 80 CRI fixture combination. Actual results may vary in the field.

For footcandle and output multipliers refer to the [ALW Lightplane+ IES File Multipliers Chart](#)

²⁰Spacing criterion refers to maximum distance luminaires can be spaced to provide uniform illumination on the working plane or surface.
 Luminaire spacing = Spacing Criterion (SC) x Mounting Height (MH) (ex. 1.14 (SC) x 10' (MH) = 11.4' Luminaire Spacing).

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S24-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

Type:**L13-2**

LDI24-110942

**ADDITIONAL OPTIONS & SPECIFICATIONS****LED PERFORMANCE**

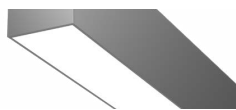
> 60,000 hours at 70% lumen maintenance, LM80 / TM-21

HOUSING

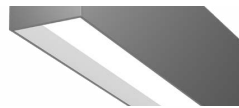
100% recyclable, extruded architectural grade 6063 aluminum with a 0.09" minimum wall thickness.

LENS & OPTICS

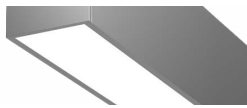
ALW offers three different lens types: Flush, ControlRoll Flush, and Regressed. A wide range of optics are available including, Lamberian, Asymmetric, Low Glare, and Widespread. See page 4 for the Lens & Optics Compatibility chart.



FN
STANDARD FLUSH



RN
REGRESSED



CN
CONTROL ROLL FLUSH



The optically engineered ControlRoll lens provides smooth, uniform, and seamless illumination for linear lengths of 250' to eliminated lens gaps. ControlRoll lens rolls out and presses into the housing channel for easy installation.

SAFETY & REGULATORY

ETL Listed (U.S. & Canada). Suitable for dry or damp locations.
For integral driver, Conforms to UL std. 1598 luminaires.
For remote driver, Conforms to UL std. 2018 luminaires.
Certified to CSA std. C22.2#250.0:2008 Ed. 3+G1;G2.

Fixtures specified with 90CRI, 2700K, 3000K, 3500K, and 4000K lamping with applicable LED drivers have the ability to conform to **California Title 24 JA8 and JA10** Appendices. EldoLED and Lutron conform to IEEE P1789 Flicker Standard: 'IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers.

OPERATING TEMPERATURE

Luminaire should be installed and operated **ONLY** in dry environments where the ambient temperature ranges from -4 °F to 122 °F (-20 °C to 50 °C). Luminaire operation in environments outside the listed temperature range voids the warranty AND may damage the product or adversely impact lamp life, lumen output and color consistency.

WEIGHT

Approximately 2lbs. per linear foot. Weight may vary depending on additional options selected.

EMERGENCY OPTIONS

Emergency options are available for various applications including 10W Emergency Batteries (EMB), EMC circuits (EMC), Generator Transfer Devices (GTD), and Automated Load Control Relays (ALC). Contact ALW for emergency component spec sheets.

EMBEDDED CONTROLS, SENSORS, & OEM COMPONENTS

ALW lighting fixtures are intended for use with a wide range of embedded OEM components (control devices, occupancy and photocell sensors, LED drivers) for use with specified building management systems. Our component portfolio is continually expanding to adopt to the latest technologies and specification needs.

ALW is your embedded controls partner, supporting integration with Acuity, Avi-on, Casambi, Cooper Wavelinx, Encelium, Enlighted, Lutron, NX Controls, Wattstopper, eldoLED, Philips, Molex PoE, NuLEDs PoE, WTEC Smartengine PoE, and more. If there's a component or system required that you don't see on the spec sheet please contact [ALW customer support](#) today so we can review your requirements.

Rev 112823

LPX2R – SPECIFICATIONS
RECESSED

ALW-INC.COM
14 of 14



Job Name:

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S36-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

Type:

L13-3

LDI24-110942



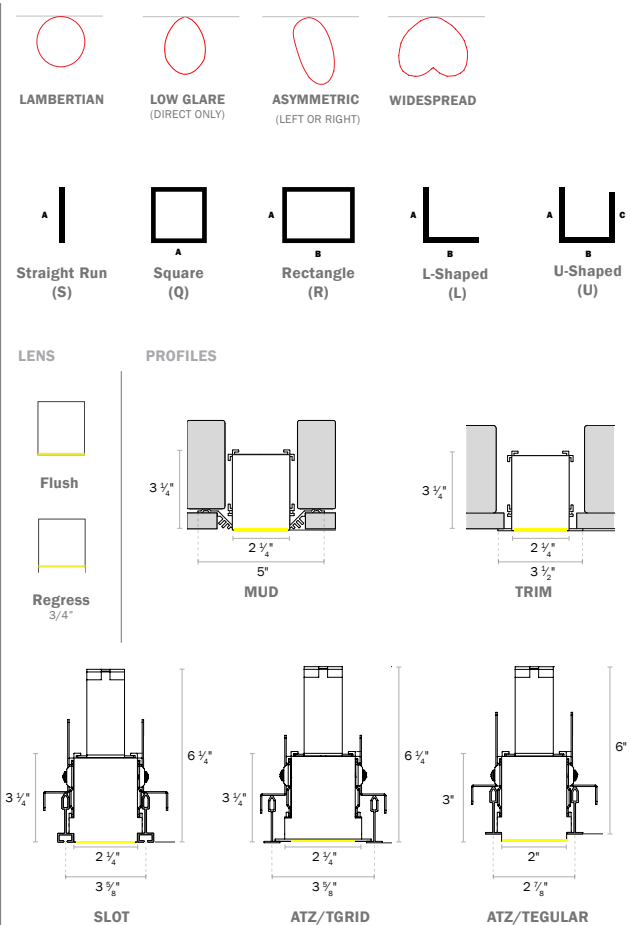
LIGHTPLANE+ 2R
LPX2R | RECESSED



SPECIFICATIONS

PROFILE	2" Aperture, 3 1/4" height
SIZES	Individual/Straight Run sections starting at 2ft. Continuous runs & shapes
LED OUTPUT	350lm/ft - 1,200lm/ft, up to 169 lm/ft
CCT/CRI	2700K/3000K/3500K/4000K/5000K • 80 or 90+ CRI Tunable White (2700K - 6500K) • RGB and RGB+W
DIMMING/DRIVER	Integral and Remote Driver: 0-10V, Phase, DALI, DMX, eldoLED, Lutron®, PoE (Molex, NuLEDS, WTEC Smartengine). Dimming to 0% for select models.
EMBEDDED CONTROLS	Acuity nLight, Avi-on, Casambi, Cooper Wavelinx, Encelium, Enlighted, Lutron Athena, Lutron Vive, NX Controls, Wattstopper, and more
POWER	3W - 11W per ft
INPUT	120VAC, 277VAC, or 347VAC
OPTICS	Lambertian, Low Glare (UGR < 19), Asymmetric, Widespread
LENS	Standard Snap-in Flush, Regressed
FINISHES	16 standard finishes at no extra charge Custom finishes available
MATERIAL	6063-T6 Extruded Aluminum
ENVIRONMENT	Dry or damp locations
WARRANTY	11 years
WELL/UGR	See ALW WELL and BIOS pages for recommended options that contribute to meeting the WELL Building Standard™

DISTRIBUTIONS & PROFILES



Not to scale. Dimensions are nominal. Consult factory for CAD drawing





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Catalog Number:
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Notes:

Type:

L13-3

LDI24-110942



PRODUCT SPECIFICATION SHEET

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----

EXAMPLE: LPX2RMDFN - S8 - 053090SLV00 - SW - UNV - EMC/2 - N - N - DC - QS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

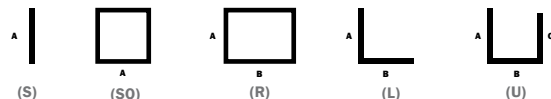
1. FAMILY	2. SIZE	3. MODEL (CHOOSE 1)	4. MOUNTING (CHOOSE 1)	5. LENS TYPE (CHOOSE 1)
QS LPX Lightplane ¹	QS 2 2'	QS R Recessed Direct	QS MD Mud	QS FN Flush Lens

- QS TM² Trim
- QS T9 TGrid 9/16
- QS T5 TGrid 15/16
- HF Hidden Flange
- ST Slot
- G9 Tegular 9/16
- G5 Tegular 15/16
- AS^{3,4} Armstrong Techzone[®] Slot
- AS^{3,4} Armstrong Techzone[®] T-grid 9/16
- AS^{3,4} Armstrong Techzone[®] T-grid 15/16
- AG^{3,4} Armstrong Techzone[®] Tegular 9/16
- AW⁵ Armstrong Woodworks[®]
- AM⁶ Armstrong Metalworks[®]

¹For install in wood, drywall, metal, etc.
²Fits Armstrong 4" TechZone[®]
³All product and company names are trademarks or registered trademarks of their respective holders. Use of them does not imply any affiliation with or endorsement by them.

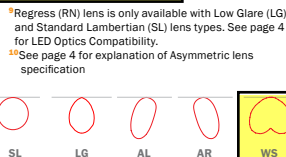
6. SHAPE/LENGTH* (CHOOSE 1 & ENTER LENGTH IN FEET) - FOR CUSTOM ANGLES, CONTACT ALW	7. LUMENS* (CHOOSE 1)	8. CCT (CHOOSE 1)
QS S36 Individual/Straight Run Section (enter length in product code above, ex. S18)	QS 03 350lm/ft	QS N Choose for RB, RW, or BO
QS Q___ Square Configuration (enter side length A, ex: Q18)	QS 05 500lm/ft	27 ⁷ 2700K
QS R___ Rectangular Configuration (enter side lengths A and B, ex. R12/24)	QS 07 750lm/ft	QS 30 3000K
QS L___ L-Shaped Configuration (enter side lengths A and B, ex. L12/24)	QS 10 1000lm/ft	QS 35 3500K
QS U___ U-Shaped Configuration (enter side lengths A, B, and C, ex. U12/12/24)	QS 12 1200lm/ft	QS 40 4000K
	RB RGB	50 ⁸ 5000K
	RB RGB + 3500K White, 80CRI	TW ⁹ Tunable White, 90CRI, 2700K - 6500K
	BO/___ ⁴ BIOS, 80CRI. Choose your lm/ft	⁷ 2700K only available in 90CRI
	CM/___ ⁵ Custom Lumens. Write in your lumens/ft (ex: 0100 = 100lm/ft).	⁸ 5000K only available in 80CRI
		⁹ Tunable White (TW) not available with BIOS. BIOS has its own tunable white option to be specified by request.

*To qualify for QS, all corners of shape must be 90°, same plane
*Lengths greater than 8' consist of multiple individual housing sections joined together. Lengths are nominal and may vary based on lamping and other specification selections. Contact ALW when exact lengths are required.



Shape orientation (Looking from the Ceiling down to the floor).

9. CRI (CHOOSE 1)	10. OPTICS (CHOOSE 1)	11. DRIVER* (CHOOSE 1)	12. FINISH* (CHOOSE 1)
QS N Choose for RB, RW, or TW	QS SL ¹⁰ Standard Lambertian	QS V00 0-10V, dim to 0%	STANDARD FINISHES
QS 80 80	QS LG ¹⁰ Low Glare	QS V01 0-10V, dim to 1%	QS SW <input checked="" type="checkbox"/> Satin White
QS 90 90	QS AL ¹⁰ Asymmetric Left (outside of shape)	QS LDE Lutron LDE1 Ecosystem, dim to 1%	QS SB <input type="checkbox"/> Satin Black
	QS AR ¹⁰ Asymmetric Right (inside of shape)	P01 ¹¹ ELV/TRIAC phase dim to 1%	QS AS <input type="checkbox"/> Aluminum Silver Anodized Effect
	QS WS Widespread	TSE ¹² Lutron T-Series Driver	QS TB <input type="checkbox"/> Textured Black
		ELO eldoLED, 0-10V dim to 0%	PREMIUM FINISHES
		DAL DALI, dim to 0%	___ See chart on page 10 for premium finishes. Manually type in the finish code (Ex: OB = Oil-Rubbed Bronze)
		DMX DMX, dim to 0%	SPECIAL ORDER FINISHES ¹³
		POE ¹³ POE Ready	RAL___ Specify RAL Classic Color (Ex: RAL 3003)
		CM ¹⁴ Custom driver	CCM___ Custom Color Match



¹⁰Regress (RN) lens is only available with Low Glare (LG) and Standard Lambertian (SL) lens types. See page 4 for LED Optics Compatibility.
¹⁰See page 4 for explanation of Asymmetric lens specification
¹¹See "Driver" and lamping charts for driver details
¹²Phase dim drivers are 120 VAC only
¹³For Tunable White (TW) CCT only
¹⁴Contact ALW with the POE spec details
¹⁴Contact ALW for custom driver specifications

QS = QuickShip-qualifying option. For the entire luminaire configuration to be QuickShip-eligible, ALL options specified in the configuration must be ones notated with "QS".
NOTE: Maximum 800 ft. of QuickShip-eligible product per order.

Rev 112823

LPX2R - SPECIFICATIONS
RECESSED

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2 of 14



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S36-RW-N-N-WS-
 DMX-SW-UNV-N-N
 Notes:

Type:
L13-3
 LDI24-110942



PRODUCT SPECIFICATION SHEET CONT'D

13. VOLTAGE (CHOOSE 1)	14. EMERGENCY CIRCUITS (OPTIONAL)	15. CONTROL OPTIONS* (OPTIONAL)	16. ADDITIONAL OPTIONS - A (OPTIONAL)
QS UNV Universal Voltage (120VAC-277VAC) 347 347 Volt (Driver options may be limited. Not available with EMB)	QS N None QS EMC/___ ¹⁵ Emergency power feed whip for connection to remote Generator Transfer Devices (Specify 1x for every 4ft or contact ALW for longer runs) QS EMB/___ 10W Integral Emergency Battery (Specify 1x for every 4ft of emergency lighting) GTD/___ Integral Generator Transfer Device/Switch Bypass - 3A (Specify 1x for every 4ft) ALC/___ Integral Automated Load Control Relay - 10A (Specify 1x for every 4ft or contact ALW for longer runs)	QS N None FACTORY CONTROLS QS OS/PH/INT/___ Integral Occupancy/Daylight sensor QS OS/PH/HV/___ Remote Occupancy/Daylight sensor NETWORK CONTROLS Embedded controls below are placeholder specs. See the ALW Controls Guide to finalize your final control spec. AY/xx Acuity AN/xx Avi-on CA/xx Casambi CW/xx/___ Cooper Wavelinx EN/xx/___ Encelium EL/xx/___ Enlighted LU/xx/___ Lutron NX/xx/___ NX Controls WA/xx/___ Wattstopper	QS N None QS CP Chicago Plenum
<p>¹⁵ No EM components provided. Choose None when designating entire fixture for EMC. When 4ft EMC sections are chosen, the power whip will be labeled as an EMC whip.</p> <p>* Quickship availability on occupancy and photocell daylight sensors may vary. Contact ALW for more information. * Contact ALW for Additional Zone specifications</p>			

17. ADDITIONAL OPTIONS - B (OPTIONAL)	18. QUICKSHIP OPTIONS
DC Living Building Challenge Declared and Red List Approved	QS Select if you want your fixture to be QS Note: To be eligible for the Quickship (QS) program, all previous selected options must also be marked QS

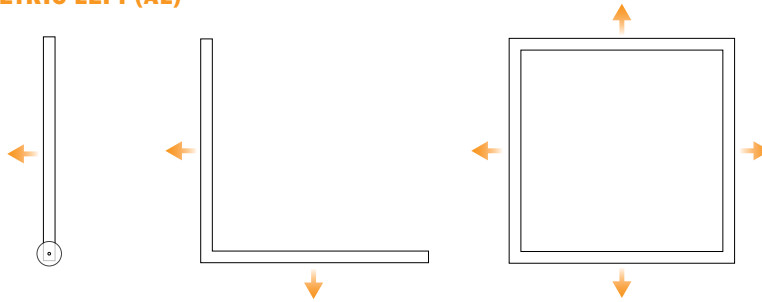
QS = QuickShip-qualifying option. For the entire luminaire configuration to be QuickShip-eligible, ALL options specified in the configuration must be ones notated with "QS".
 NOTE: Maximum 800 ft. of QuickShip-eligible product per order.



LENS & OPTICS COMPATIBILITY

		OPTICS			
		STANDARD LAMBERTIAN (SL)	LOW GLARE (LG)	ASYMMETRIC (AL, AR)	WIDESPREAD (WS)
LENS TYPES	FLUSH (FN)	●	●	●	●
	CONTROLROLL FLUSH (CN)	●	●	●	●
	REGRESSED (RN)	●	●		

ASYMMETRIC LEFT (AL)



Straight Sections
 Light is thrown to left of the powerfeed
 (Can be reconfigured in field)

Shapes
 Light is thrown outside the shape
 (Cannot be reconfigured in the field because of mitered cuts)

Note: For unique applications, mark up the submittal drawings for desired asymmetric light throw.

ASYMMETRIC RIGHT (AR)



Straight Sections
 Light is thrown to right of the powerfeed
 (Can be reconfigured in field)

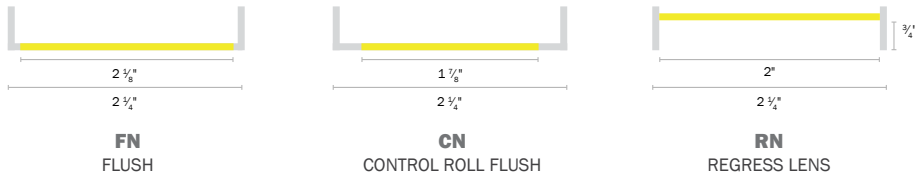
Shapes
 Light is thrown inside the shape
 (Cannot be reconfigured in the field because of mitered cuts)



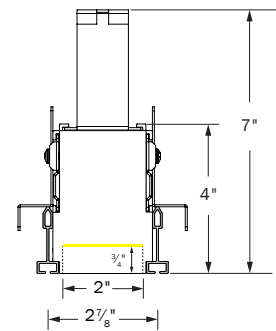
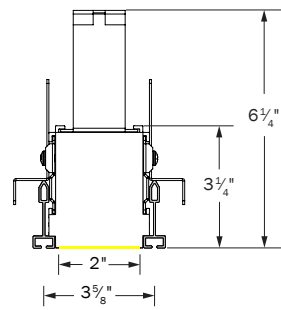
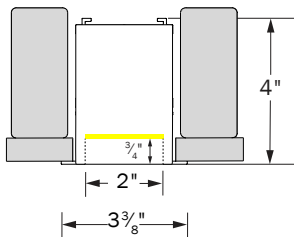
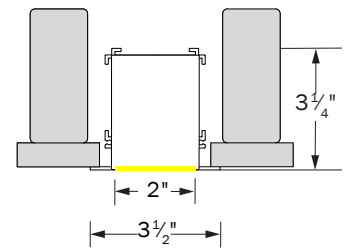
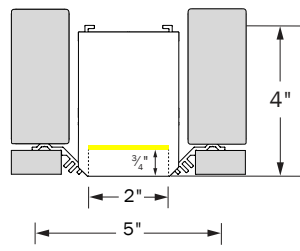
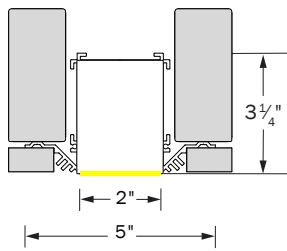
LENS DETAILS

Applicable to all models

— FIXTURE BODY — LENS

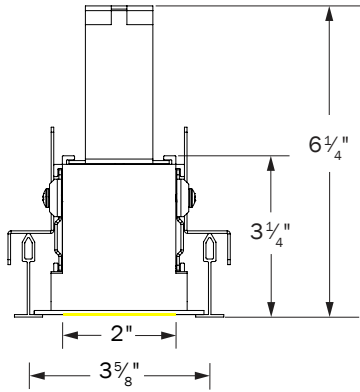


MECHANICAL DIAGRAMS

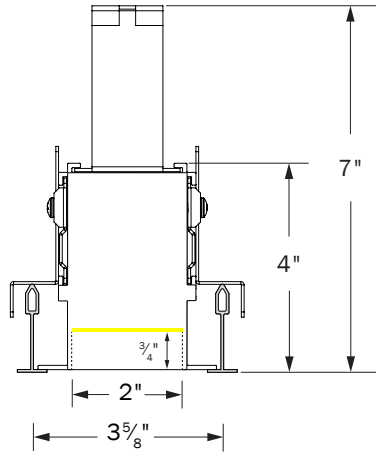




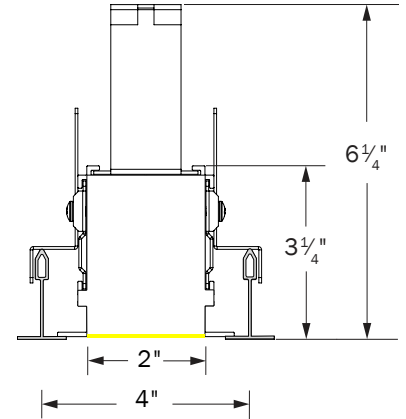
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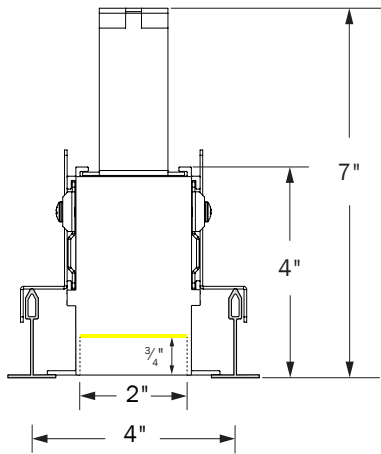
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FLUSH LENS



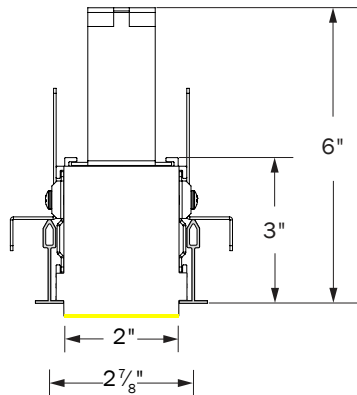
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REGRESSED LENS



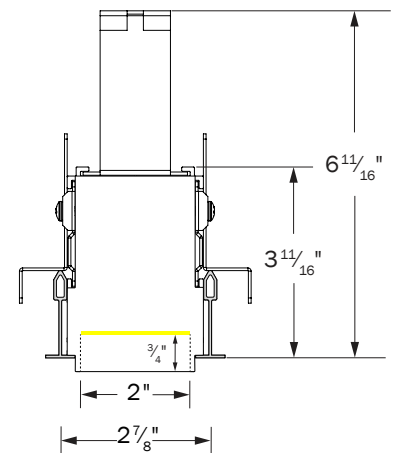
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FLUSH LENS



LPX2RT5RN
RECESSED TGRID 15/16
REGRESSED LENS



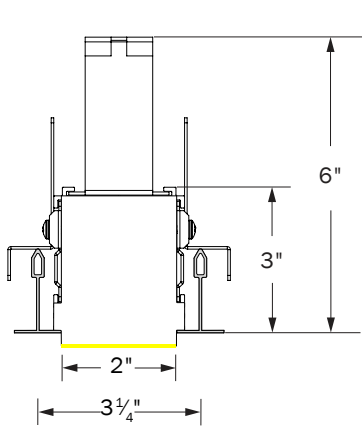
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FLUSH LENS



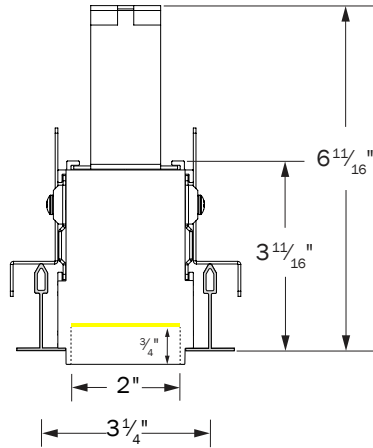
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REGRESSED LENS



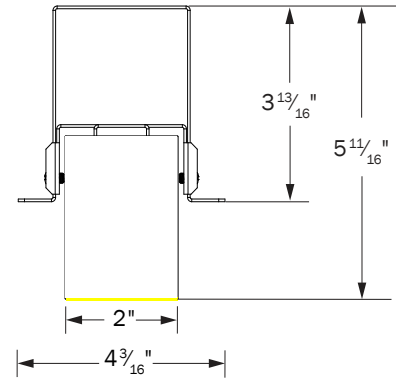
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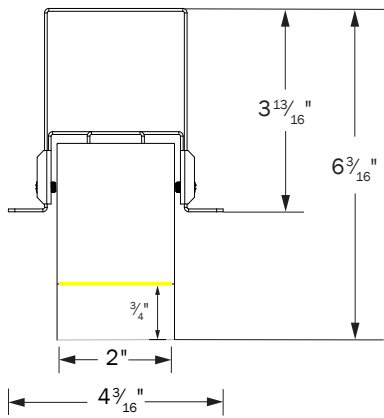
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RECESSED TEGULAR 15/16
FLUSH LENS



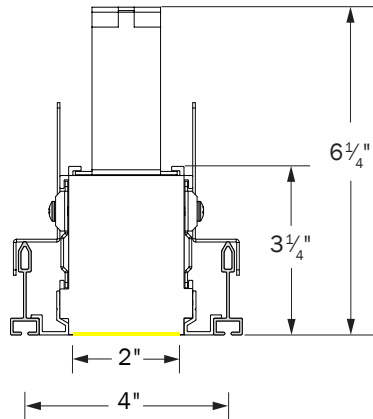
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REGRESSED LENS



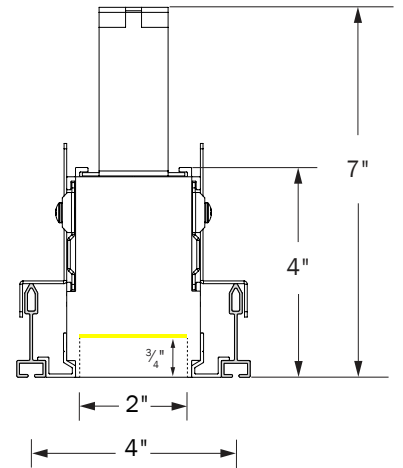
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FLUSH LENS



LPX2RHFRN
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REGRESSED LENS



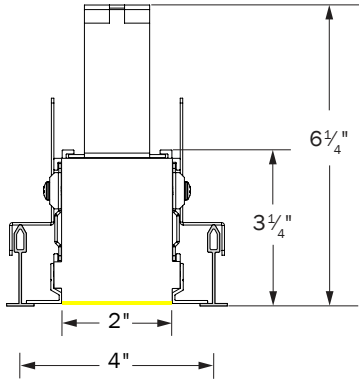
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RECESSED SLOT ARMSTRONG
TECHZONE® FLUSH LENS



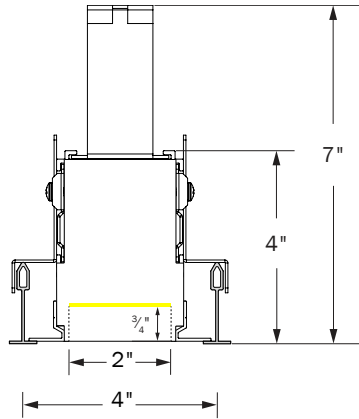
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RECESSED SLOT ARMSTRONG
TECHZONE® REGRESSED LENS



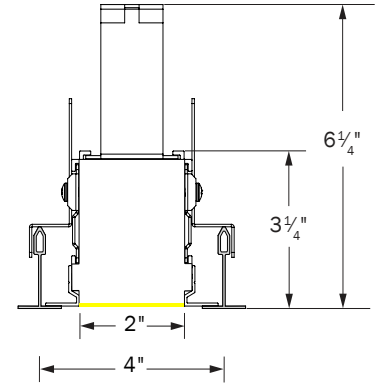
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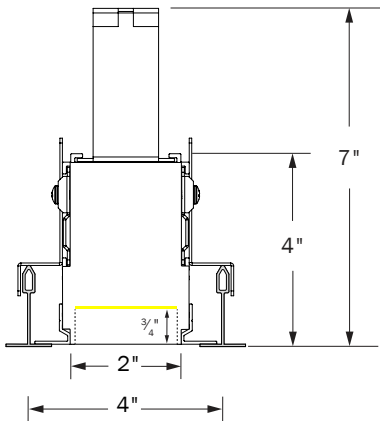
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ARMSTRONG TECHZONE®
FLUSH LENS



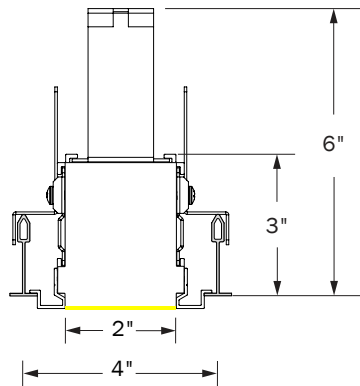
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REGRESSED LENS



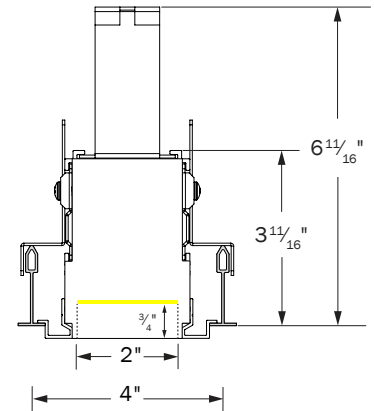
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FLUSH LENS



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REGRESSED LENS



LPX2RAGFN
RECESSED TEGULAR 9/16
ARMSTRONG TECHZONE®
FLUSH LENS



LPX2RAGRN
RECESSED TEGULAR 9/16
ARMSTRONG TECHZONE®
REGRESSED LENS



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Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S36-RW-N-N-WS-DMX-SW-UNV-N-N

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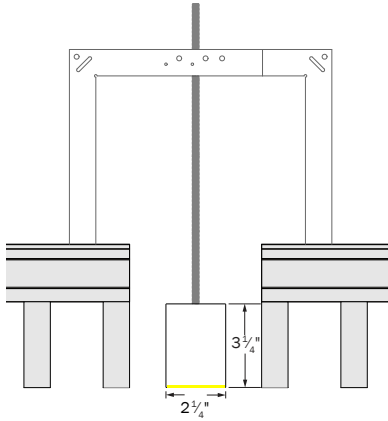
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L13-3

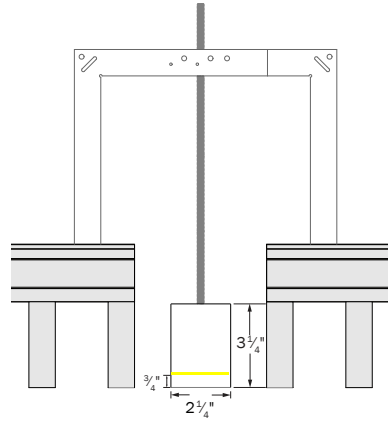
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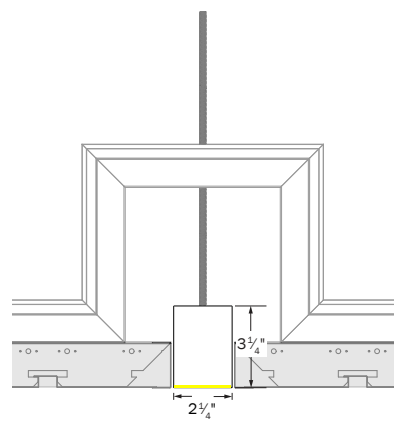
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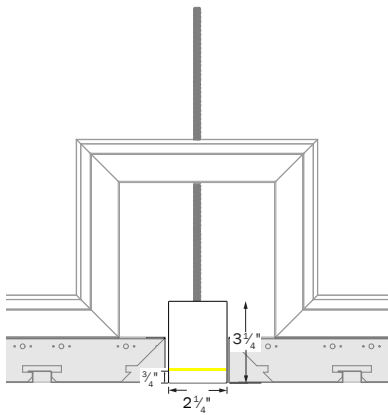
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WOODWORKS® FLUSH LENS



LPX2RAWRN
RECESSED ARMSTRONG
WOODWORKS® REGRESSED LENS



LPX2RAMFN
RECESSED ARMSTRONG
METALWORKS® FLUSH LENS



LPX2RAMRN
RECESSED ARMSTRONG
METALWORKS® REGRESSED LENS

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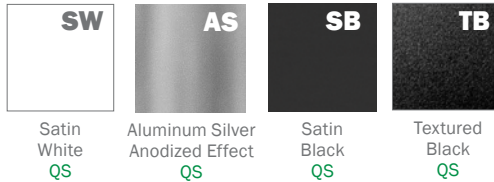
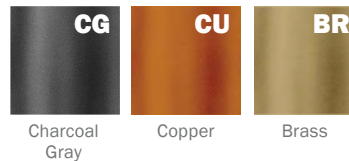
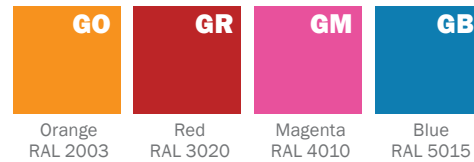
Notes:

Type:**L13-3**

LDI24-110942

**FINISHES**

Standard finishes are available at no additional charge.

STANDARD FINISHES - QS ELIGIBLE**PREMIUM FINISHES****BASIC POWDER COAT****METALLIC POWDER COAT****SATIN ANODIZED EFFECT POWDER COAT****GLOSS POWDER COAT (80-95% GLOSS)**

Contact ALW Quotes for sample paint finish swatches.

SPECIAL ORDER FINISHES***RAL CLASSIC COLORS (80-95% GLOSS): RAL_ _ _ _**

Most RAL Classic Colors are available for a minimum setup fee. On your specification submittal choose your RAL color by entering the 4-digit RAL code (Ex: RAL 3003). See www.alw-inc.com/resources/finishes

**CUSTOM COLOR MATCH: CCM_ _ _ _**

Custom powder coat color matching is available for a premium setup fee. Consult ALW for additional information.

*An individual setup fee will apply to each unique Special Order Finish per purchase order.
(ex: RAL 5023 and RAL 2008 are specified for multiple line items on a purchase order. 2x setup fees will apply)

*Printed or on-screen colors are only approximations - consult actual Color Chip Set before specifying

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Type:**L13-3**

LDI24-110942

**PERFORMANCE DETAILS**

OUTPUT OPTION	OPTIC TYPE	DELIVERED LUMENS/FT	EFFICACY (LM/W)	WATTS/FT ¹⁵	CRI OPTIONS	CCT OPTIONS
03¹⁶	SL	359	119	3	80+ 90+	2700K 3000K 3500K 4000K 5000K
	WS	428	142			
	LG	416	138			
	AL	416	138			
05¹⁶	SL	511	117	4.4		
	WS	609	140			
	LG	593	136			
	AL	593	136			
07¹⁶	SL	764	122	6.3		
	WS	912	145			
	LG	887	141			
	AL	887	141			
10¹⁶	SL	1008	112	9		
	WS	1203	134			
	LG	1170	130			
	AL	1170	130			
12¹⁶	SL	1204	110	11		
	WS	1437	131			
	LG	1398	127			
	AL	1398	127			
TUNE	SL, WW	921	65	14.2	90	2700K - 6500K
	SL, CW	977	69			
RGB¹⁷	SL	184	17	11	N/A	
RGBW¹⁷	SL	W: 177 RGB: 184	20	17.7	W: 80 CRI	W: 3500K

¹⁵ Lumens/Watt and Watts/ft have been calculated assuming a driver efficiency of 85%. Depending on field conditions, actual measured values may fluctuate by 5-8%.

¹⁶ Performance calculations are based on LM-79 test of 1200lm output at 80 CRI and 3500K. All other output calculations are extrapolated values.

¹⁷ Performance calculations are derived from LM-79 test with all RGB LEDs illuminated (Red, Green, Blue) and White LED only illuminated

TM-30-18 DETAILS (90 CRI LAMPING)

CCT	CRI (Ra)	CRI (R9)	TM-30 Rf	TM-30 Rg	Duv
2700K	94	56	92	100	-0.0009
3000K	94	59	92	100	-0.0013
3500K	94	64	92	100	-0.0005
4000K	94	66	92	100	-0.0004

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S36-RW-N-N-WS-
DMX-SW-UNV-N-N

Notes:

Type:**L13-3**

LDI24-110942

**ALW****DRIVERS**

PRODUCT CODE	DESCRIPTION
V00	0-10V dimming down to 1% with electronic dim-to-off (0%).
V01	0-10V dimming down to 1%.
LDE	Lutron Hi-lume (LDE1) 1% EcoSystem LED driver with Soft-on, Fade-to-Black dimming technology.
P01	TRIAC Forward Phase 2-Wire and ELV Reverse Phase 3-Wire hybrid LED driver. Dimming down to 1%. 120VAC only.
ELO	EldoLED 0-10V SOLODrive 0.1% dimming with electronic dim-to-off (0%).
TSE	Lutron T-Series (PSQ0) 1% 2-channel tunable white driver (For use with Lutron Quantum Control Systems).
DAL	DALI flicker-free dimming down to 1% with electronic dim-to-off (0%).
DMX	DMX flicker-free dimming down to 0%.
POE/READY	Specify a PoE driver of your choice. Fixture supplied with low voltage leads and no LED driver. Contact ALW to register your project.

*Most drivers can be programmed to specific dimming levels if desired. Contact ALW for specific dimming level requests.

ALW lighting fixtures are intended for use with a wide range of sensors, lighting controls, LED drivers, and building management systems. If there are specific components required for your application that aren't listed on this spec sheet, please contact ALW customer support to specify a compatible solution of your choice.

DRIVER/LED LAMPING COMPATIBILITY						
	STD	STD/BIOS	TUNE*	RGB OR RGBW	CA TITLE 24 JA8/JA10 ¹⁸	IEEE P1789 & HD TV STUDIO ¹⁹
V00	●	●	●		●	
V01	●	●	●		●	
LDE	●	●			●	●
P01	●	●			●	
ELO	●	●	●		●	●
TSE			●		●	●
DALI	●	●	●		●	
DMX	●	●	●	●	PER REQUEST	PER REQUEST
POE/READY	PER REQUEST					

● - Indicates compatibility

* Standard lamping (STD) - 350 - 1200 lm/ft

¹⁸ Fixtures specified with 90CRI 2700K, 3000K, 3500K, 4000K, and 5000K lamping with applicable LED drivers have the ability to conform to California Title 24 JA8 and JA10 Appendices

¹⁹ The following drivers conform to IEEE P1789 Flicker Standard: 'IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers'. These drivers may also be installed in HD TV Studio applications utilizing high frequency camera equipment.

*ELO with TUNE Lamping will include an EldoLED DUALDrive 0-10V Tunable White LED Driver.



Job Name:
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 110942_1st_Out_2024.06.28_PG
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 DMX-SW-UNV-N-N

Notes:

Type:

L13-3

LDI24-110942



PHOTOMETRICS

OPTIC	POLAR PLOT (CD)	MTG HEIGHT	LIGHT LEVEL (FC)	SPACING CRITERION (SC) ²⁰ (0° - 180°) (90° - 270°)	MAX INTENSITY (CD)	OUTPUT (LM/FT)
AL		6 ft	16.4	1.20 1.28	673	1398
		8 ft	9.2			
		10 ft	5.9			
		12 ft	4.1			
		14 ft	3.0			
		16 ft	2.3			
WS		6 ft	10.7	1.24 1.32	549.5	1437
		8 ft	6.0			
		10 ft	3.9			
		12 ft	2.7			
		14 ft	2.0			
		16 ft	1.5			
LG		6 ft	18.4	1.20 1.14	619.4	1398
		8 ft	10.3			
		10 ft	6.6			
		12 ft	4.6			
		14 ft	3.4			
		16 ft	2.6			
SL		6 ft	11.9	1.24 1.24	428.8	1204
		8 ft	6.7			
		10 ft	4.3			
		12 ft	3.0			
		14 ft	2.2			
		16 ft	1.7			

*Photometric calculations based on 1200lm 3500K 80 CRI fixture combination. Actual results may vary in the field.

For footcandle and output multipliers refer to the [ALW Lightplane+ IES File Multipliers Chart](#)

²⁰Spacing criterion refers to maximum distance luminaires can be spaced to provide uniform illumination on the working plane or surface.
 Luminaire spacing = Spacing Criterion (SC) x Mounting Height (MH) (ex. 1.14 (SC) x 10' (MH) = 11.4' Luminaire Spacing).

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
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LPX2RMD-FN-S36-RW-N-N-WS-
DMX-SW-UNV-N-N

Notes:

Type:**L13-3**

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**ADDITIONAL OPTIONS & SPECIFICATIONS****LED PERFORMANCE**

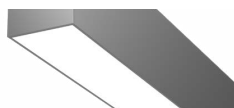
> 60,000 hours at 70% lumen maintenance, LM80 / TM-21

HOUSING

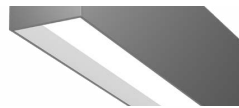
100% recyclable, extruded architectural grade 6063 aluminum with a 0.09" minimum wall thickness.

LENS & OPTICS

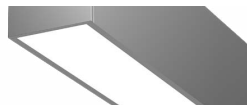
ALW offers three different lens types: Flush, ControlRoll Flush, and Regressed. A wide range of optics are available including, Lamberian, Asymmetric, Low Glare, and Widespread. See page 4 for the Lens & Optics Compatibility chart.



FN
STANDARD FLUSH



RN
REGRESSED



CN
CONTROL ROLL FLUSH



The optically engineered ControlRoll lens provides smooth, uniform, and seamless illumination for linear lengths of 250' to eliminated lens gaps. ControlRoll lens rolls out and presses into the housing channel for easy installation.

SAFETY & REGULATORY

ETL Listed (U.S. & Canada). Suitable for dry or damp locations.
For integral driver, Conforms to UL std. 1598 luminaires.
For remote driver, Conforms to UL std. 2018 luminaires.
Certified to CSA std. C22.2#250.0:2008 Ed. 3+G1;G2.

Fixtures specified with 90CRI, 2700K, 3000K, 3500K, and 4000K lamping with applicable LED drivers have the ability to conform to **California Title 24 JA8 and JA10** Appendices. EldoLED and Lutron conform to IEEE P1789 Flicker Standard: 'IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers.

OPERATING TEMPERATURE

Luminaire should be installed and operated **ONLY** in dry environments where the ambient temperature ranges from -4 °F to 122 °F (-20 °C to 50 °C). Luminaire operation in environments outside the listed temperature range voids the warranty AND may damage the product or adversely impact lamp life, lumen output and color consistency.

WEIGHT

Approximately 2lbs. per linear foot. Weight may vary depending on additional options selected.

EMERGENCY OPTIONS

Emergency options are available for various applications including 10W Emergency Batteries (EMB), EMC circuits (EMC), Generator Transfer Devices (GTD), and Automated Load Control Relays (ALC). Contact ALW for emergency component spec sheets.

EMBEDDED CONTROLS, SENSORS, & OEM COMPONENTS

ALW lighting fixtures are intended for use with a wide range of embedded OEM components (control devices, occupancy and photocell sensors, LED drivers) for use with specified building management systems. Our component portfolio is continually expanding to adopt to the latest technologies and specification needs.

ALW is your embedded controls partner, supporting integration with Acuity, Avi-on, Casambi, Cooper Wavelinx, Encelium, Enlighted, Lutron, NX Controls, Wattstopper, eldoLED, Philips, Molex PoE, NuLEDs PoE, WTEC Smartengine PoE, and more. If there's a component or system required that you don't see on the spec sheet please contact [ALW customer support](#) today so we can review your requirements.

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LPX2R – SPECIFICATIONS
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Job Name:
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 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S48-RW-N-N-WS-
 DMX-SW-UNV-N-N

Notes:

Type:

L13-4

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LIGHTPLANE+ 2R

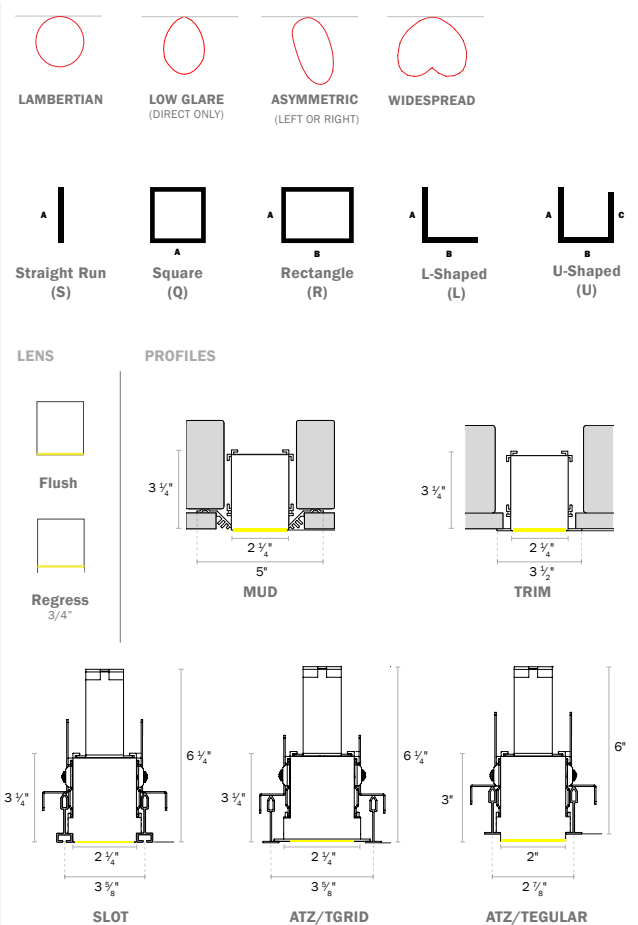
LPX2R | RECESSED



SPECIFICATIONS

PROFILE	2" Aperture, 3 1/4" height
SIZES	Individual/Straight Run sections starting at 2ft. Continuous runs & shapes
LED OUTPUT	350lm/ft - 1,200lm/ft, up to 169 lm/ft
CCT/CRI	2700K/3000K/3500K/4000K/5000K • 80 or 90+ CRI Tunable White (2700K - 6500K) • RGB and RGB+W
DIMMING/DRIVER	Integral and Remote Driver: 0-10V, Phase, DALI, DMX, eldoLED, Lutron®, PoE (Molex, NuLEDS, WTEC Smartengine). Dimming to 0% for select models.
EMBEDDED CONTROLS	Acuity nLight, Avi-on, Casambi, Cooper Wavelinx, Encelium, Enlighted, Lutron Athena, Lutron Vive, NX Controls, Wattstopper, and more
POWER	3W - 11W per ft
INPUT	120VAC, 277VAC, or 347VAC
OPTICS	Lambertian, Low Glare (UGR < 19), Asymmetric, Widespread
LENS	Standard Snap-in Flush, Regressed
FINISHES	16 standard finishes at no extra charge Custom finishes available
MATERIAL	6063-T6 Extruded Aluminum
ENVIRONMENT	Dry or damp locations
WARRANTY	11 years
WELL/UGR	See ALW WELL and BIOS pages for recommended options that contribute to meeting the WELL Building Standard™

DISTRIBUTIONS & PROFILES



Not to scale. Dimensions are nominal. Consult factory for CAD drawing



LPX2R - SPECIFICATIONS
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Job Name:
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Architect: Forbes Architects (Coral Gables)

Catalog Number:
LPX2RMD-FN-S48-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

Type:

L13-4

LDI24-110942



PRODUCT SPECIFICATION SHEET

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----

EXAMPLE: LPX2RMDFN – S8 – 053090SLV00 – SW – UNV – EMC/2 – N – N – DC – QS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

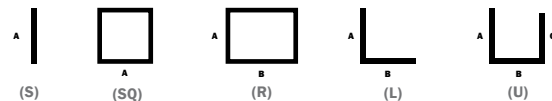
1. FAMILY	2. SIZE	3. MODEL (CHOOSE 1)	4. MOUNTING (CHOOSE 1)	5. LENS TYPE (CHOOSE 1)
QS LPX Lightplane ¹	QS 2 2'	QS R Recessed Direct	QS MD Mud	QS FN Flush Lens

- QS TM² Trim
- QS T9 TGrid 9/16
- QS T5 TGrid 15/16
- HF Hidden Flange
- ST Slot
- G9 Tegular 9/16
- G5 Tegular 15/16
- AS^{3,4} Armstrong Techzone[®] Slot
- AS^{3,4} Armstrong Techzone[®] T-grid 9/16
- AS^{3,4} Armstrong Techzone[®] T-grid 15/16
- AG^{3,4} Armstrong Techzone[®] Tegular 9/16
- AW⁵ Armstrong Woodworks[®]
- AM⁶ Armstrong Metalworks[®]

¹For install in wood, drywall, metal, etc.
²Fits Armstrong 4" TechZone[®]
³All product and company names are trademarks or registered trademarks of their respective holders. Use of them does not imply any affiliation with or endorsement by them.

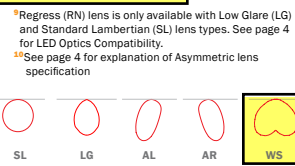
6. SHAPE/LENGTH* (CHOOSE 1 & ENTER LENGTH IN FEET) - FOR CUSTOM ANGLES, CONTACT ALW	7. LUMENS* (CHOOSE 1)	8. CCT (CHOOSE 1)
QS S48 Individual/Straight Run Section (enter length in product code above, ex. S18)	QS 03 350lm/ft	QS N Choose for RB, RW, or BO
QS Q___ Square Configuration (enter side length A, ex: Q18)	QS 05 500lm/ft	27 ⁷ 2700K
QS R___ Rectangular Configuration (enter side lengths A and B, ex. R12/24)	QS 07 750lm/ft	QS 30 3000K
QS L___ L-Shaped Configuration (enter side lengths A and B, ex. L12/24)	QS 10 1000lm/ft	QS 35 3500K
QS U___ U-Shaped Configuration (enter side lengths A, B, and C, ex. U12/12/24)	QS 12 1200lm/ft	QS 40 4000K
	RB RGB	50 ⁸ 5000K
	RB RGB + 3500K White, 80CRI	TW ⁹ Tunable White, 90CRI, 2700K - 6500K
	BO/___ ⁴ BIOS, 80CRI. Choose your lm/ft	⁷ 2700K only available in 90CRI
	CM/___ ⁵ Custom Lumens. Write in your lumens/ft (ex: 0100 = 100lm/ft).	⁸ 5000K only available in 80CRI
		⁹ Tunable White (TW) not available with BIOS. BIOS has its own tunable white option to be specified by request.

*To qualify for QS, all corners of shape must be 90°, same plane
*Lengths greater than 8' consist of multiple individual housing sections joined together. Lengths are nominal and may vary based on lamping and other specification selections. Contact ALW when exact lengths are required.



Shape orientation (Looking from the Ceiling down to the floor).

9. CRI (CHOOSE 1)	10. OPTICS (CHOOSE 1)	11. DRIVER* (CHOOSE 1)	12. FINISH* (CHOOSE 1)
QS N Choose for RB, RW, or TW	QS SL ¹⁰ Standard Lambertian	QS V00 0-10V, dim to 0%	STANDARD FINISHES
QS 80 80	QS LG ¹⁰ Low Glare	QS V01 0-10V, dim to 1%	QS SW <input checked="" type="checkbox"/> Satin White
QS 90 90	QS AL ¹⁰ Asymmetric Left (outside of shape)	QS LDE Lutron LDE1 Ecosystem, dim to 1%	QS SB <input type="checkbox"/> Satin Black
	QS AR ¹⁰ Asymmetric Right (inside of shape)	P01 ¹¹ ELV/TRIAC phase dim to 1%	QS AS <input type="checkbox"/> Aluminum Silver Anodized Effect
	QS WS Widespread	TSE ¹² Lutron T-Series Driver	QS TB <input type="checkbox"/> Textured Black
		ELO eldoLED, 0-10V dim to 0%	PREMIUM FINISHES
		DAL DALI, dim to 0%	___ See chart on page 10 for premium finishes. Manually type in the finish code (Ex: OB = Oil-Rubbed Bronze)
		DMX DMX, dim to 0%	SPECIAL ORDER FINISHES*
		POE ¹³ POE Ready	RAL___ Specify RAL Classic Color (Ex: RAL 3003)
		CM ¹⁴ Custom driver	CCM___ Custom Color Match



¹⁰Regress (RN) lens is only available with Low Glare (LG) and Standard Lambertian (SL) lens types. See page 4 for LED Optics Compatibility.
¹⁰See page 4 for explanation of Asymmetric lens specification
¹¹See "Driver" and lamping charts for driver details
¹²Phase dim drivers are 120 VAC only
¹³For Tunable White (TW) CCT only
¹⁴Contact ALW with the POE spec details
¹⁴Contact ALW for custom driver specifications

QS = QuickShip-qualifying option. For the entire luminaire configuration to be QuickShip-eligible, ALL options specified in the configuration must be ones notated with "QS".
NOTE: Maximum 800 ft. of QuickShip-eligible product per order.

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Job Name:
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 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S48-RW-N-N-WS-
 DMX-SW-UNV-N-N
 Notes:

Type:
L13-4
 LDI24-110942



PRODUCT SPECIFICATION SHEET CONT'D

13. VOLTAGE (CHOOSE 1)	14. EMERGENCY CIRCUITS (OPTIONAL)	15. CONTROL OPTIONS* (OPTIONAL)	16. ADDITIONAL OPTIONS - A (OPTIONAL)
QS UNV Universal Voltage (120VAC-277VAC) 347 347 Volt (Driver options may be limited. Not available with EMB)	QS N None EMC/___ ¹⁵ Emergency power feed whip for connection to remote Generator Transfer Devices (Specify 1x for every 4ft or contact ALW for longer runs) EMB/___ 10W Integral Emergency Battery (Specify 1x for every 4ft of emergency lighting) GTD/___ Integral Generator Transfer Device/Switch Bypass - 3A (Specify 1x for every 4ft) ALC/___ Integral Automated Load Control Relay - 10A (Specify 1x for every 4ft or contact ALW for longer runs)	QS N None FACTORY CONTROLS QS OS/PH/INT/___ Integral Occupancy/Daylight sensor QS OS/PH/HV/___ Remote Occupancy/Daylight sensor NETWORK CONTROLS Embedded controls below are placeholder specs. See the ALW Controls Guide to finalize your final control spec. AY/xx Acuity AN/xx Avi-on CA/xx Casambi CW/xx/___ Cooper Wavelinx EN/xx/___ Encelium EL/xx/___ Enlighted LU/xx/___ Lutron NX/xx/___ NX Controls WA/xx/___ Wattstopper	QS N None QS CP Chicago Plenum
<p>¹⁵ No EM components provided. Choose None when designating entire fixture for EMC. When 4ft EMC sections are chosen, the power whip will be labeled as an EMC whip.</p> <p>* Quickship availability on occupancy and photocell daylight sensors may vary. Contact ALW for more information. * Contact ALW for Additional Zone specifications</p>			

17. ADDITIONAL OPTIONS - B (OPTIONAL)	18. QUICKSHIP OPTIONS
DC Living Building Challenge Declared and Red List Approved	QS Select if you want your fixture to be QS Note: To be eligible for the Quickship (QS) program, all previous selected options must also be marked QS

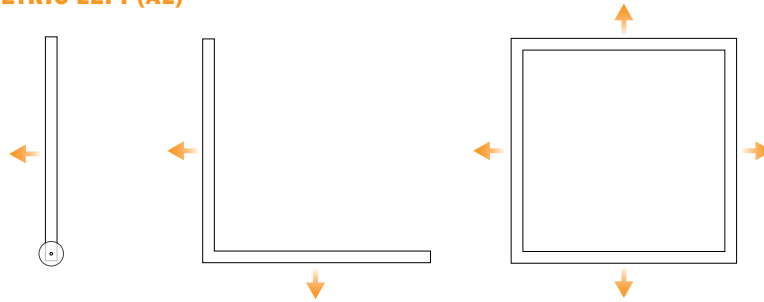
QS = QuickShip-qualifying option. For the entire luminaire configuration to be QuickShip-eligible, ALL options specified in the configuration must be ones notated with "QS".
 NOTE: Maximum 800 ft. of QuickShip-eligible product per order.



LENS & OPTICS COMPATIBILITY

		OPTICS			
		STANDARD LAMBERTIAN (SL)	LOW GLARE (LG)	ASYMMETRIC (AL, AR)	WIDESPREAD (WS)
LENS TYPES	FLUSH (FN)	●	●	●	●
	CONTROLROLL FLUSH (CN)	●	●	●	●
	REGRESSED (RN)	●	●		

ASYMMETRIC LEFT (AL)



Straight Sections
 Light is thrown to left of the powerfeed
 (Can be reconfigured in field)

Shapes
 Light is thrown outside the shape
 (Cannot be reconfigured in the field because of mitered cuts)

Note: For unique applications, mark up the submittal drawings for desired asymmetric light throw.

ASYMMETRIC RIGHT (AR)



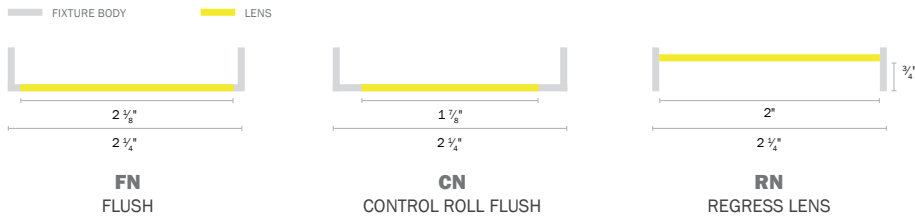
Straight Sections
 Light is thrown to right of the powerfeed
 (Can be reconfigured in field)

Shapes
 Light is thrown inside the shape
 (Cannot be reconfigured in the field because of mitered cuts)

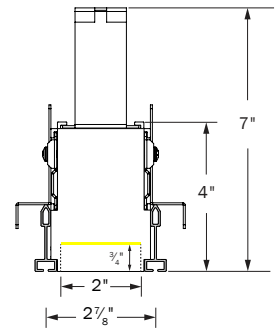
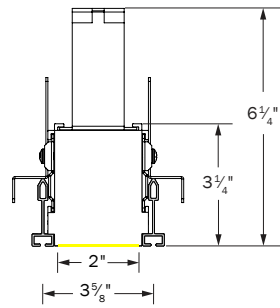
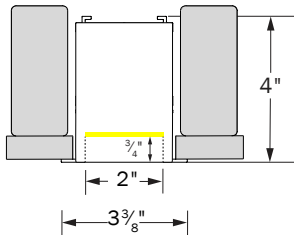
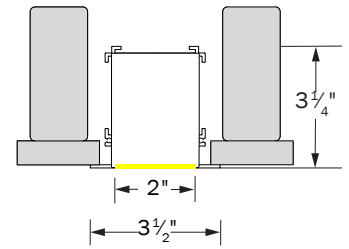
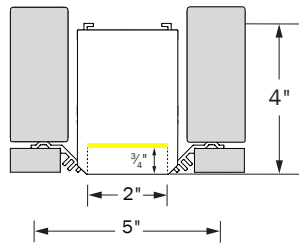
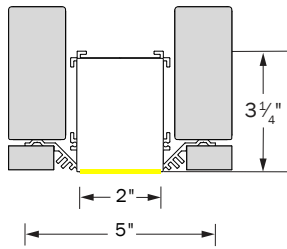


LENS DETAILS

Applicable to all models

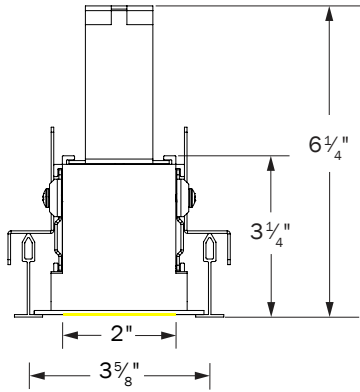


MECHANICAL DIAGRAMS

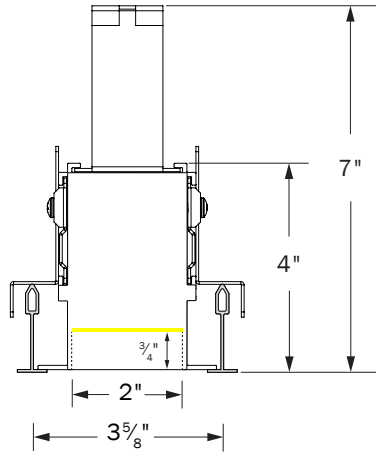




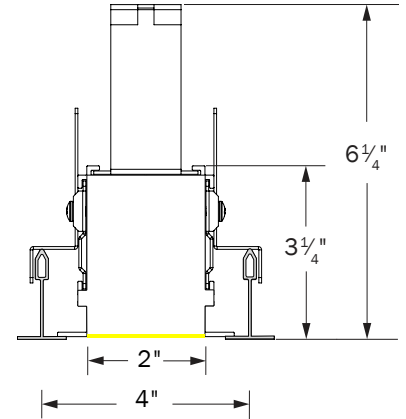
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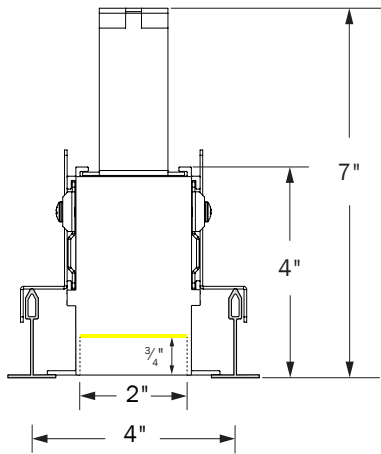
LPX2RT9FN
RECESSED TGRID 9/16
FLUSH LENS



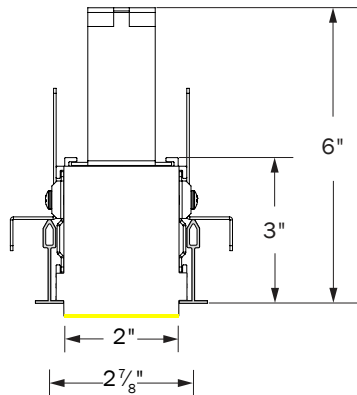
LPX2RT9RN
RECESSED TGRID 9/16
REGRESSED LENS



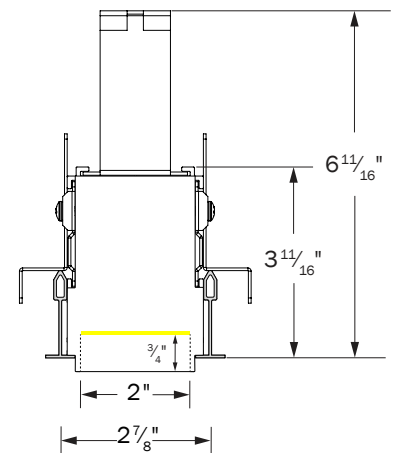
LPX2RT5FN
RECESSED TGRID 15/16
FLUSH LENS



LPX2RT5RN
RECESSED TGRID 15/16
REGRESSED LENS



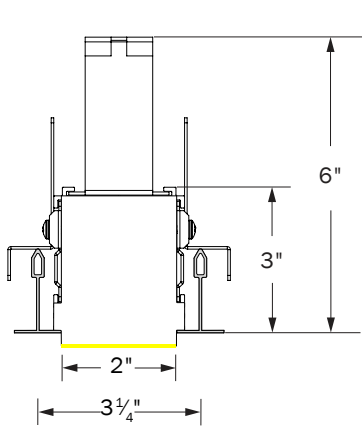
LPX2RG9FN
RECESSED TEGULAR 9/16
FLUSH LENS



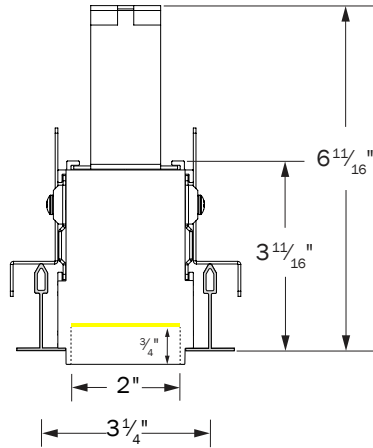
LPX2RG9RN
RECESSED TEGULAR 9/16
REGRESSED LENS



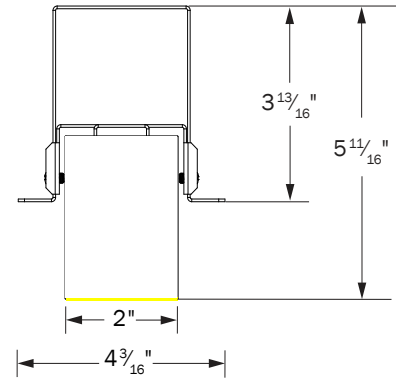
MECHANICAL DIAGRAMS CONT'D



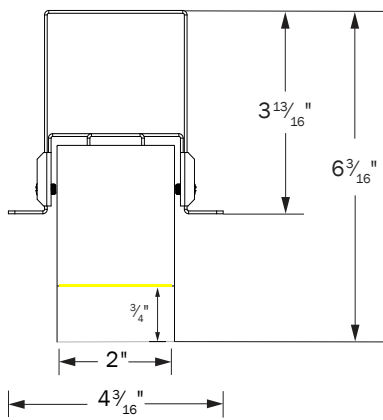
LPX2RG5FN
RECESSED TEGULAR 15/16
FLUSH LENS



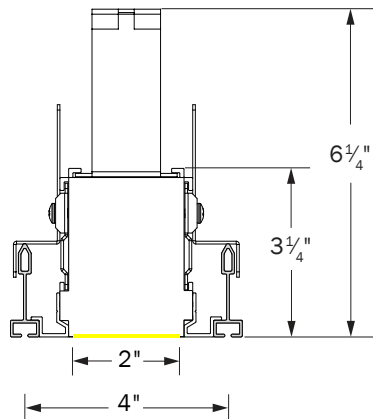
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RECESSED TEGULAR 15/16
REGRESSED LENS



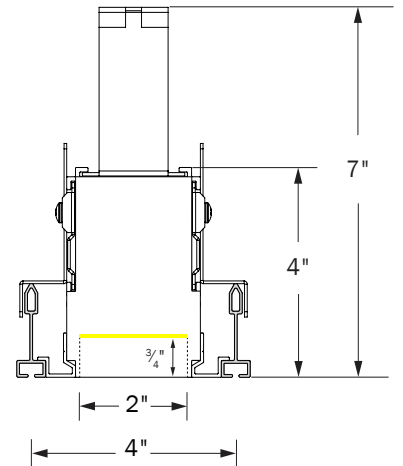
LPX2RHFFN
RECESSED HIDDEN FLANGE
FLUSH LENS



LPX2RHFRN
RECESSED HIDDEN FLANGE
REGRESSED LENS



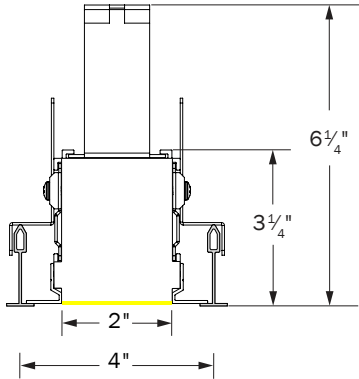
LPX2RASFN
RECESSED SLOT ARMSTRONG
TECHZONE® FLUSH LENS



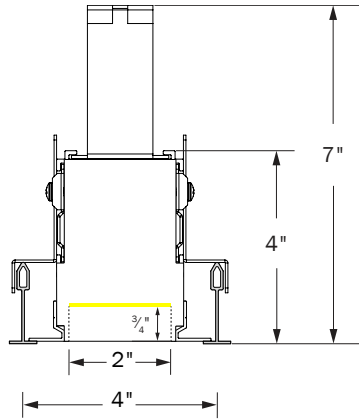
LPX2RASRN
RECESSED SLOT ARMSTRONG
TECHZONE® REGRESSED LENS



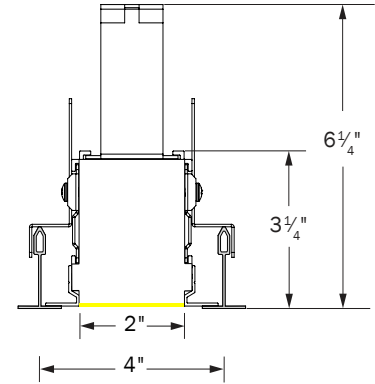
MECHANICAL DIAGRAMS CONT'D



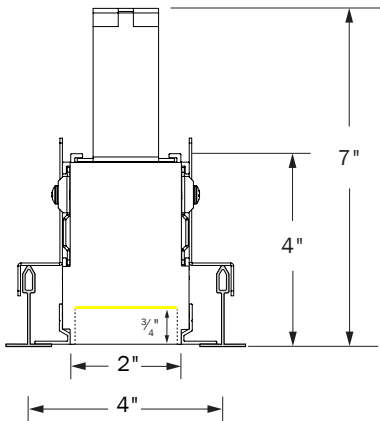
LPX2RAGFN
RECESSED TGRID 9/16
ARMSTRONG TECHZONE®
FLUSH LENS



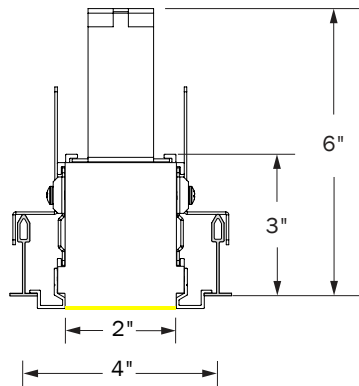
LPX2RA9RN
RECESSED TGRID 9/16
ARMSTRONG TECHZONE®
REGRESSED LENS



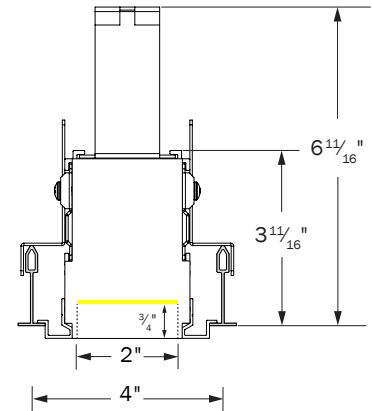
LPX2RA5FN
RECESSED TGRID 15/16
ARMSTRONG TECHZONE®
FLUSH LENS



LPX2RA5RN
RECESSED TGRID 15/16
ARMSTRONG TECHZONE®
REGRESSED LENS



LPX2RAGFN
RECESSED TEGULAR 9/16
ARMSTRONG TECHZONE®
FLUSH LENS



LPX2RAGRN
RECESSED TEGULAR 9/16
ARMSTRONG TECHZONE®
REGRESSED LENS



Job Name:

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S48-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

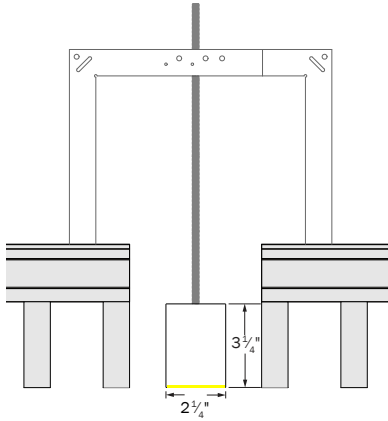
Type:

L13-4

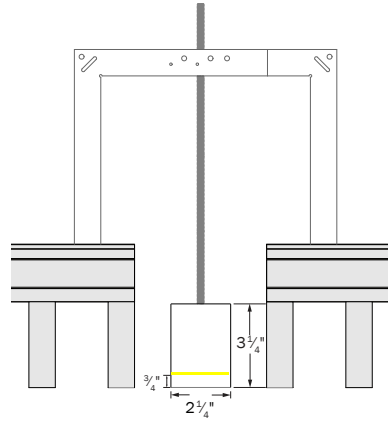
LDI24-110942



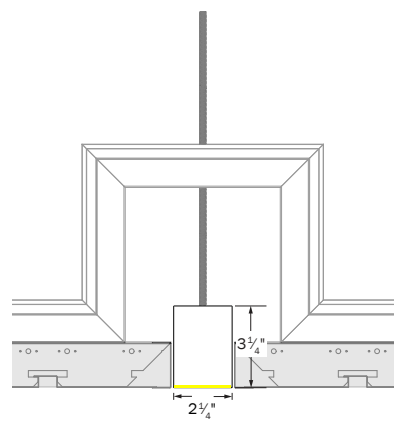
MECHANICAL DIAGRAMS CONT'D



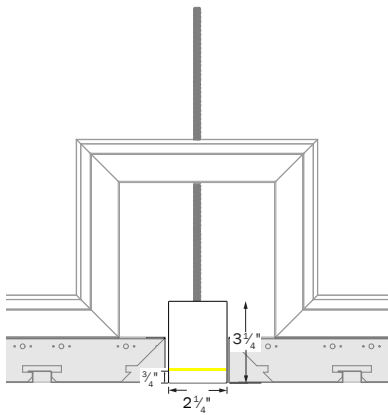
LPX2RAWFN
RECESSED ARMSTRONG
WOODWORKS® FLUSH LENS



LPX2RAWRN
RECESSED ARMSTRONG
WOODWORKS® REGRESSED LENS



LPX2RAMFN
RECESSED ARMSTRONG
METALWORKS® FLUSH LENS



LPX2RAMRN
RECESSED ARMSTRONG
METALWORKS® REGRESSED LENS

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S48-RW-N-N-WS-DMX-SW-UNV-N-N

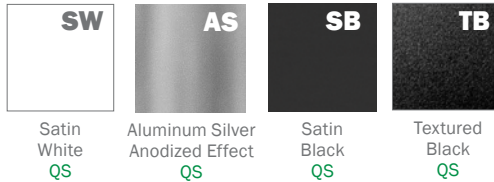
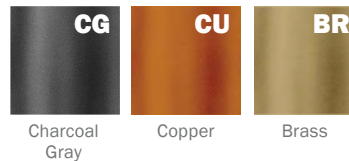
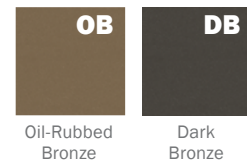
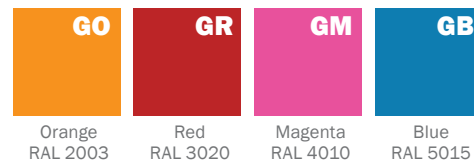
Notes:

Type:**L13-4**

LDI24-110942

**FINISHES**

Standard finishes are available at no additional charge.

STANDARD FINISHES - QS ELIGIBLE**PREMIUM FINISHES****BASIC POWDER COAT****METALLIC POWDER COAT****SATIN ANODIZED EFFECT POWDER COAT****GLOSS POWDER COAT (80-95% GLOSS)**

Contact ALW Quotes for sample paint finish swatches.

SPECIAL ORDER FINISHES***RAL CLASSIC COLORS (80-95% GLOSS): RAL_ _ _ _**

Most RAL Classic Colors are available for a minimum setup fee. On your specification submittal choose your RAL color by entering the 4-digit RAL code (Ex: RAL 3003). See www.alw-inc.com/resources/finishes

**CUSTOM COLOR MATCH: CCM_ _ _ _**

Custom powder coat color matching is available for a premium setup fee. Consult ALW for additional information.

*An individual setup fee will apply to each unique Special Order Finish per purchase order.
(ex: RAL 5023 and RAL 2008 are specified for multiple line items on a purchase order. 2x setup fees will apply)

*Printed or on-screen colors are only approximations - consult actual Color Chip Set before specifying

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**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S48-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

Type:**L13-4**

LDI24-110942

**PERFORMANCE DETAILS**

OUTPUT OPTION	OPTIC TYPE	DELIVERED LUMENS/FT	EFFICACY (LM/W)	WATTS/FT ¹⁵	CRI OPTIONS	CCT OPTIONS
03¹⁶	SL	359	119	3	80+ 90+	2700K 3000K 3500K 4000K 5000K
	WS	428	142			
	LG	416	138			
	AL	416	138			
05¹⁶	SL	511	117	4.4		
	WS	609	140			
	LG	593	136			
	AL	593	136			
07¹⁶	SL	764	122	6.3		
	WS	912	145			
	LG	887	141			
	AL	887	141			
10¹⁶	SL	1008	112	9		
	WS	1203	134			
	LG	1170	130			
	AL	1170	130			
12¹⁶	SL	1204	110	11		
	WS	1437	131			
	LG	1398	127			
	AL	1398	127			
TUNE	SL, WW	921	65	14.2	90	2700K - 6500K
	SL, CW	977	69			
RGB¹⁷	SL	184	17	11	N/A	
RGBW¹⁷	SL	W: 177 RGB: 184	20	17.7	W: 80 CRI	W: 3500K

¹⁵ Lumens/Watt and Watts/ft have been calculated assuming a driver efficiency of 85%. Depending on field conditions, actual measured values may fluctuate by 5-8%.

¹⁶ Performance calculations are based on LM-79 test of 1200lm output at 80 CRI and 3500K. All other output calculations are extrapolated values.

¹⁷ Performance calculations are derived from LM-79 test with all RGB LEDs illuminated (Red, Green, Blue) and White LED only illuminated

TM-30-18 DETAILS (90 CRI LAMPING)

CCT	CRI (Ra)	CRI (R9)	TM-30 Rf	TM-30 Rg	Duv
2700K	94	56	92	100	-0.0009
3000K	94	59	92	100	-0.0013
3500K	94	64	92	100	-0.0005
4000K	94	66	92	100	-0.0004

**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S48-RW-N-N-WS-
DMX-SW-UNV-N-N

Notes:

Type:**L13-4**

LDI24-110942

**DRIVERS**

PRODUCT CODE	DESCRIPTION
V00	0-10V dimming down to 1% with electronic dim-to-off (0%).
V01	0-10V dimming down to 1%.
LDE	Lutron Hi-lume (LDE1) 1% EcoSystem LED driver with Soft-on, Fade-to-Black dimming technology.
P01	TRIAC Forward Phase 2-Wire and ELV Reverse Phase 3-Wire hybrid LED driver. Dimming down to 1%. 120VAC only.
ELO	EldoLED 0-10V SOLODrive 0.1% dimming with electronic dim-to-off (0%).
TSE	Lutron T-Series (PSQ0) 1% 2-channel tunable white driver (For use with Lutron Quantum Control Systems).
DAL	DALI flicker-free dimming down to 1% with electronic dim-to-off (0%).
DMX	DMX flicker-free dimming down to 0%.
POE/READY	Specify a PoE driver of your choice. Fixture supplied with low voltage leads and no LED driver. Contact ALW to register your project.

*Most drivers can be programmed to specific dimming levels if desired. Contact ALW for specific dimming level requests.

ALW lighting fixtures are intended for use with a wide range of sensors, lighting controls, LED drivers, and building management systems. If there are specific components required for your application that aren't listed on this spec sheet, please contact ALW customer support to specify a compatible solution of your choice.

DRIVER/LED LAMPING COMPATIBILITY						
	STD	STD/BIOS	TUNE*	RGB OR RGBW	CA TITLE 24 JA8/JA10 ¹⁸	IEEE P1789 & HD TV STUDIO ¹⁹
V00	●	●	●		●	
V01	●	●	●		●	
LDE	●	●			●	●
P01	●	●			●	
ELO	●	●	●		●	●
TSE			●		●	●
DALI	●	●	●		●	
DMX	●	●	●	●	PER REQUEST	PER REQUEST
POE/READY	PER REQUEST					

● - Indicates compatibility

* Standard lamping (STD) - 350 - 1200 lm/ft

¹⁸ Fixtures specified with 90CRI 2700K, 3000K, 3500K, 4000K, and 5000K lamping with applicable LED drivers have the ability to conform to California Title 24 JA8 and JA10 Appendices

¹⁹ The following drivers conform to IEEE P1789 Flicker Standard: 'IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers'. These drivers may also be installed in HD TV Studio applications utilizing high frequency camera equipment.

*ELO with TUNE Lamping will include an EldoLED DUALDrive 0-10V Tunable White LED Driver.



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S48-RW-N-N-WS-
 DMX-SW-UNV-N-N

Notes:

Type:

L13-4

LDI24-110942



PHOTOMETRICS

OPTIC	POLAR PLOT (CD)	MTG HEIGHT	LIGHT LEVEL (FC)	SPACING CRITERION (SC) ²⁰ (0°- 180°) (90°- 270°)	MAX INTENSITY (CD)	OUTPUT (LM/FT)
AL		6 ft	16.4	1.20 1.28	673	1398
		8 ft	9.2			
		10 ft	5.9			
		12 ft	4.1			
		14 ft	3.0			
		16 ft	2.3			
WS		6 ft	10.7	1.24 1.32	549.5	1437
		8 ft	6.0			
		10 ft	3.9			
		12 ft	2.7			
		14 ft	2.0			
		16 ft	1.5			
LG		6 ft	18.4	1.20 1.14	619.4	1398
		8 ft	10.3			
		10 ft	6.6			
		12 ft	4.6			
		14 ft	3.4			
		16 ft	2.6			
SL		6 ft	11.9	1.24 1.24	428.8	1204
		8 ft	6.7			
		10 ft	4.3			
		12 ft	3.0			
		14 ft	2.2			
		16 ft	1.7			

*Photometric calculations based on 1200lm 3500K 80 CRI fixture combination. Actual results may vary in the field.

For footcandle and output multipliers refer to the [ALW Lightplane+ IES File Multipliers Chart](#)

²³Spacing criterion refers to maximum distance luminaires can be spaced to provide uniform illumination on the working plane or surface.
 Luminaire spacing = Spacing Criterion (SC) x Mounting Height (MH) (ex. 1.14 (SC) x 10' (MH) = 11.4' Luminaire Spacing).

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S48-RW-N-N-WS-
DMX-SW-UNV-N-N

Notes:

Type:**L13-4**

LDI24-110942

**ADDITIONAL OPTIONS & SPECIFICATIONS****LED PERFORMANCE**

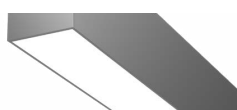
> 60,000 hours at 70% lumen maintenance, LM80 / TM-21

HOUSING

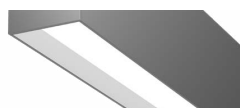
100% recyclable, extruded architectural grade 6063 aluminum with a 0.09" minimum wall thickness.

LENS & OPTICS

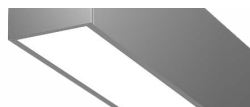
ALW offers three different lens types: Flush, ControlRoll Flush, and Regressed. A wide range of optics are available including, Lamberian, Asymmetric, Low Glare, and Widespread. See page 4 for the Lens & Optics Compatibility chart.



FN
STANDARD FLUSH



RN
REGRESSED



CN
CONTROL ROLL FLUSH



The optically engineered ControlRoll lens provides smooth, uniform, and seamless illumination for linear lengths of 250' to eliminated lens gaps. ControlRoll lens rolls out and presses into the housing channel for easy installation.

SAFETY & REGULATORY

ETL Listed (U.S. & Canada). Suitable for dry or damp locations.

For integral driver, Conforms to UL std. 1598 luminaires.

For remote driver, Conforms to UL std. 2018 luminaires.

Certified to CSA std. C22.2#250.0:2008 Ed. 3+G1;G2.

Fixtures specified with 90CRI, 2700K, 3000K, 3500K, and 4000K lamping with applicable LED drivers have the ability to conform to **California Title 24 JA8 and JA10** Appendices. EldoLED and Lutron conform to IEEE P1789 Flicker Standard: 'IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers.

OPERATING TEMPERATURE

Luminaire should be installed and operated **ONLY** in dry environments where the ambient temperature ranges from -4 °F to 122 °F (-20 °C to 50 °C). Luminaire operation in environments outside the listed temperature range voids the warranty AND may damage the product or adversely impact lamp life, lumen output and color consistency.

WEIGHT

Approximately 2lbs. per linear foot. Weight may vary depending on additional options selected.

EMERGENCY OPTIONS

Emergency options are available for various applications including 10W Emergency Batteries (EMB), EMC circuits (EMC), Generator Transfer Devices (GTD), and Automated Load Control Relays (ALC). Contact ALW for emergency component spec sheets.

EMBEDDED CONTROLS, SENSORS, & OEM COMPONENTS

ALW lighting fixtures are intended for use with a wide range of embedded OEM components (control devices, occupancy and photocell sensors, LED drivers) for use with specified building management systems. Our component portfolio is continually expanding to adopt to the latest technologies and specification needs.

ALW is your embedded controls partner, supporting integration with Acuity, Avi-on, Casambi, Cooper Wavelinx, Encelium, Enlighted, Lutron, NX Controls, Wattstopper, eldoLED, Philips, Molex PoE, NuLEDs PoE, WTEC Smartengine PoE, and more. If there's a component or system required that you don't see on the spec sheet please contact [ALW customer support](#) today so we can review your requirements.

Rev 112823

LPX2R – SPECIFICATIONS
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Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S48-RW-N-N-WS-
 DMX-SW-UNV-N-N

Notes:

Type:

L13-4E

LDI24-110942



LIGHTPLANE+ 2R

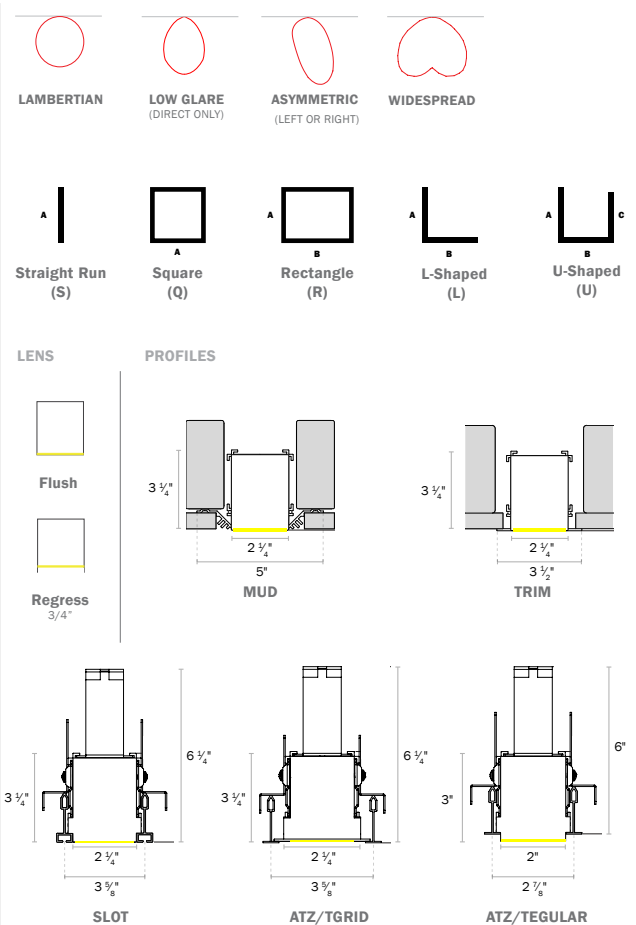
LPX2R | RECESSED



SPECIFICATIONS

PROFILE	2" Aperture, 3 1/4" height
SIZES	Individual/Straight Run sections starting at 2ft. Continuous runs & shapes
LED OUTPUT	350lm/ft - 1,200lm/ft, up to 169 lm/ft
CCT/CRI	2700K/3000K/3500K/4000K/5000K • 80 or 90+ CRI Tunable White (2700K - 6500K) • RGB and RGB+W
DIMMING/DRIVER	Integral and Remote Driver: 0-10V, Phase, DALI, DMX, eldoLED, Lutron®, PoE (Molex, NuLEDS, WTEC Smartengine). Dimming to 0% for select models.
EMBEDDED CONTROLS	Acuity nLight, Avi-on, Casambi, Cooper Wavelinx, Encelium, Enlighted, Lutron Athena, Lutron Vive, NX Controls, Wattstopper, and more
POWER	3W - 11W per ft
INPUT	120VAC, 277VAC, or 347VAC
OPTICS	Lambertian, Low Glare (UGR < 19), Asymmetric, Widespread
LENS	Standard Snap-in Flush, Regressed
FINISHES	16 standard finishes at no extra charge Custom finishes available
MATERIAL	6063-T6 Extruded Aluminum
ENVIRONMENT	Dry or damp locations
WARRANTY	11 years
WELL/UGR	See ALW WELL and BIOS pages for recommended options that contribute to meeting the WELL Building Standard™

DISTRIBUTIONS & PROFILES



Not to scale. Dimensions are nominal. Consult factory for CAD drawing





Job Name:
South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
LPX2RMD-FN-S48-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

Type:

L13-4E

LDI24-110942



PRODUCT SPECIFICATION SHEET

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----

EXAMPLE: LPX2RMDFN – S8 – 053090SLV00 – SW – UNV – EMC/2 – N – N – DC – QS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

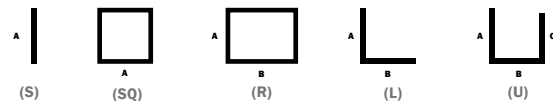
1. FAMILY	2. SIZE	3. MODEL (CHOOSE 1)	4. MOUNTING (CHOOSE 1)	5. LENS TYPE (CHOOSE 1)
QS LPX Lightplane ¹	QS 2 2'	QS R Recessed Direct	QS MD Mud	QS FN Flush Lens

- QS TM² Trim
- QS T9 TGrid 9/16
- QS T5 TGrid 15/16
- HF Hidden Flange
- ST Slot
- G9 Tegular 9/16
- G5 Tegular 15/16
- AS^{3,4} Armstrong Techzone[®] Slot
- AS^{3,4} Armstrong Techzone[®] T-grid 9/16
- AS^{3,4} Armstrong Techzone[®] T-grid 15/16
- AG^{3,4} Armstrong Techzone[®] Tegular 9/16
- AW⁵ Armstrong Woodworks[®]
- AM⁶ Armstrong Metalworks[®]

¹For install in wood, drywall, metal, etc.
²Fits Armstrong 4" TechZone[®]
³All product and company names are trademarks or registered trademarks of their respective holders. Use of them does not imply any affiliation with or endorsement by them.

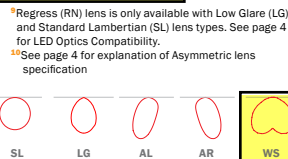
6. SHAPE/LENGTH* (CHOOSE 1 & ENTER LENGTH IN FEET) - FOR CUSTOM ANGLES, CONTACT ALW	7. LUMENS* (CHOOSE 1)	8. CCT (CHOOSE 1)
QS S48 Individual/Straight Run Section (enter length in product code above, ex. S18)	QS 03 350lm/ft	QS N Choose for RB, RW, or BO
QS Q___ Square Configuration (enter side length A, ex: Q18)	QS 05 500lm/ft	27 ⁷ 2700K
QS R___ Rectangular Configuration (enter side lengths A and B, ex. R12/24)	QS 07 750lm/ft	QS 30 3000K
QS L___ L-Shaped Configuration (enter side lengths A and B, ex. L12/24)	QS 10 1000lm/ft	QS 35 3500K
QS U___ U-Shaped Configuration (enter side lengths A, B, and C, ex. U12/12/24)	QS 12 1200lm/ft	QS 40 4000K
	RB RGB	50 ⁸ 5000K
	RB RGB + 3500K White, 80CRI	TW ⁹ Tunable White, 90CRI, 2700K - 6500K
	BO/___ ⁴ BIOS, 80CRI. Choose your lm/ft	⁷ 2700K only available in 90CRI
	CM/___ ⁵ Custom Lumens. Write in your lumens/ft (ex: 0100 = 100lm/ft).	⁸ 5000K only available in 80CRI
		⁹ Tunable White (TW) not available with BIOS. BIOS has its own tunable white option to be specified by request.

*To qualify for QS, all corners of shape must be 90°, same plane
*Lengths greater than 8' consist of multiple individual housing sections joined together. Lengths are nominal and may vary based on lamping and other specification selections. Contact ALW when exact lengths are required.



Shape orientation (Looking from the Ceiling down to the floor).

9. CRI (CHOOSE 1)	10. OPTICS (CHOOSE 1)	11. DRIVER* (CHOOSE 1)	12. FINISH* (CHOOSE 1)
QS N Choose for RB, RW, or TW	QS SL ¹⁰ Standard Lambertian	QS V00 0-10V, dim to 0%	QS SW <input checked="" type="checkbox"/> Satin White
QS 80 80	QS LG ¹⁰ Low Glare	QS V01 0-10V, dim to 1%	QS SB <input type="checkbox"/> Satin Black
QS 90 90	QS AL ¹⁰ Asymmetric Left (outside of shape)	LDE Lutron LDE1 Ecosystem, dim to 1%	QS AS <input type="checkbox"/> Aluminum Silver Anodized Effect
	QS AR ¹⁰ Asymmetric Right (inside of shape)	P01 ¹¹ ELV/TRIAC phase dim to 1%	QS TB <input type="checkbox"/> Textured Black
	QS WS Widespread	TSE ¹² Lutron T-Series Driver	
		ELO eldoLED, 0-10V dim to 0%	
		DAL DALI, dim to 0%	
		DMX DMX, dim to 0%	
		POE ¹³ POE Ready	
		CM ¹⁴ Custom driver	



¹⁰Regress (RN) lens is only available with Low Glare (LG) and Standard Lambertian (SL) lens types. See page 4 for LED Optics Compatibility.
¹⁰See page 4 for explanation of Asymmetric lens specification
¹¹See "Driver" and lamping charts for driver details
¹²Phase dim drivers are 120 VAC only
¹³For Tunable White (TW) CCT only
¹⁴Contact ALW with the POE spec details
¹⁴Contact ALW for custom driver specifications

STANDARD FINISHES
QS SW Satin White
QS SB Satin Black
QS AS Aluminum Silver Anodized Effect
QS TB Textured Black

PREMIUM FINISHES
--- See chart on page 10 for premium finishes. Manually type in the finish code (Ex: OB = Oil-Rubbed Bronze)

SPECIAL ORDER FINISHES*
RAL_____ Specify RAL Classic Color (Ex: RAL 3003)
CCM_____ Custom Color Match

*Manually type in the finish code for special order finishes types

QS = QuickShip-qualifying option. For the entire luminaire configuration to be QuickShip-eligible, ALL options specified in the configuration must be ones notated with "QS".
NOTE: Maximum 800 ft. of QuickShip-eligible product per order.

Rev 112823

LPX2R – SPECIFICATIONS
RECESSED

ALW-INC.COM
2 of 14



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S48-RW-N-N-WS-
 DMX-SW-UNV-N-N
 Notes:

Type:
L13-4E
 LDI24-110942



PRODUCT SPECIFICATION SHEET CONT'D

13. VOLTAGE (CHOOSE 1)	14. EMERGENCY CIRCUITS (OPTIONAL)	15. CONTROL OPTIONS* (OPTIONAL)	16. ADDITIONAL OPTIONS - A (OPTIONAL)
QS UNV Universal Voltage (120VAC-277VAC) 347 347 Volt (Driver options may be limited. Not available with EMB)	QS N None QS EMC/___ ¹⁵ Emergency power feed whip for connection to remote Generator Transfer Devices (Specify 1x for every 4ft or contact ALW for longer runs) QS EMB/___ 10W Integral Emergency Battery (Specify 1x for every 4ft of emergency lighting) GTD/___ Integral Generator Transfer Device/Switch Bypass - 3A (Specify 1x for every 4ft) ALC/___ Integral Automated Load Control Relay - 10A (Specify 1x for every 4ft or contact ALW for longer runs)	QS N None FACTORY CONTROLS QS OS/PH/INT/___ Integral Occupancy/Daylight sensor QS OS/PH/HV/___ Remote Occupancy/Daylight sensor NETWORK CONTROLS Embedded controls below are placeholder specs. See the ALW Controls Guide to finalize your final control spec. AY/xx Acuity AN/xx Avi-on CA/xx Casambi CW/xx/___ Cooper Wavelinx EN/xx/___ Encelium EL/xx/___ Enlighted LU/xx/___ Lutron NX/xx/___ NX Controls WA/xx/___ Wattstopper	QS N None QS CP Chicago Plenum
<p>¹⁵ No EM components provided. Choose None when designating entire fixture for EMC. When 4ft EMC sections are chosen, the power whip will be labeled as an EMC whip.</p> <p>* Quickship availability on occupancy and photocell daylight sensors may vary. Contact ALW for more information. * Contact ALW for Additional Zone specifications</p>			

17. ADDITIONAL OPTIONS - B (OPTIONAL)	18. QUICKSHIP OPTIONS
DC Living Building Challenge Declared and Red List Approved	QS Select if you want your fixture to be QS Note: To be eligible for the Quickship (QS) program, all previous selected options must also be marked QS

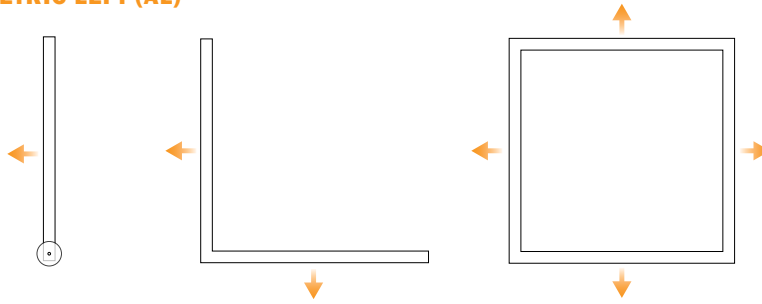
QS = QuickShip-qualifying option. For the entire luminaire configuration to be QuickShip-eligible, ALL options specified in the configuration must be ones notated with "QS".
 NOTE: Maximum 800 ft. of QuickShip-eligible product per order.



LENS & OPTICS COMPATIBILITY

		OPTICS			
		STANDARD LAMBERTIAN (SL)	LOW GLARE (LG)	ASYMMETRIC (AL, AR)	WIDESPREAD (WS)
LENS TYPES	FLUSH (FN)	●	●	●	●
	CONTROLROLL FLUSH (CN)	●	●	●	●
	REGRESSED (RN)	●	●		

ASYMMETRIC LEFT (AL)

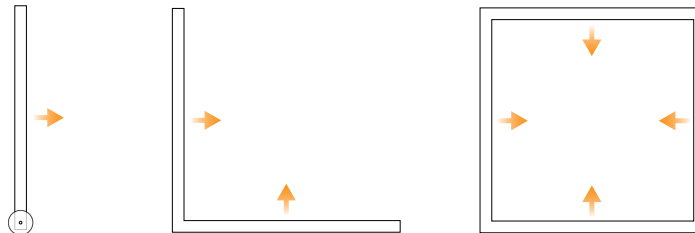


Straight Sections
 Light is thrown to left of the powerfeed
 (Can be reconfigured in field)

Shapes
 Light is thrown outside the shape
 (Cannot be reconfigured in the field because of mitered cuts)

Note: For unique applications, mark up the submittal drawings for desired asymmetric light throw.

ASYMMETRIC RIGHT (AR)



Straight Sections
 Light is thrown to right of the powerfeed
 (Can be reconfigured in field)

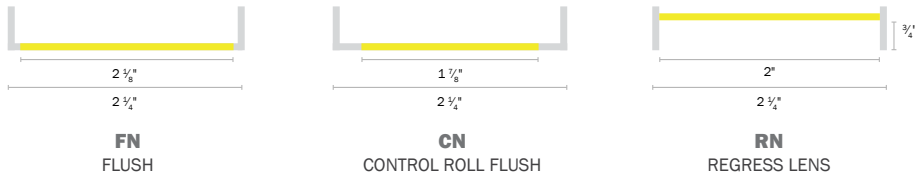
Shapes
 Light is thrown inside the shape
 (Cannot be reconfigured in the field because of mitered cuts)



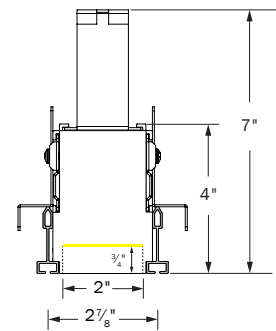
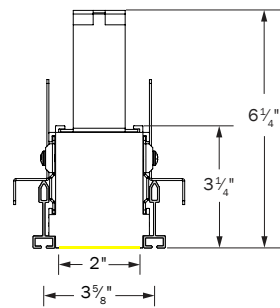
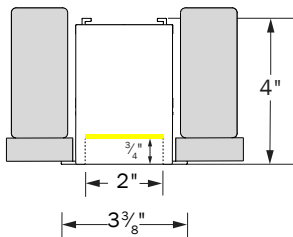
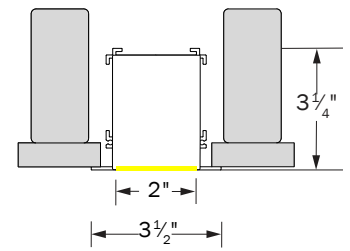
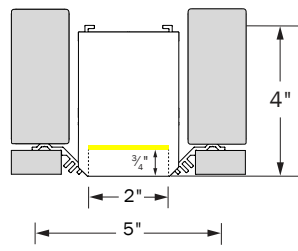
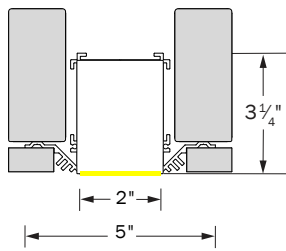
LENS DETAILS

Applicable to all models

— FIXTURE BODY — LENS

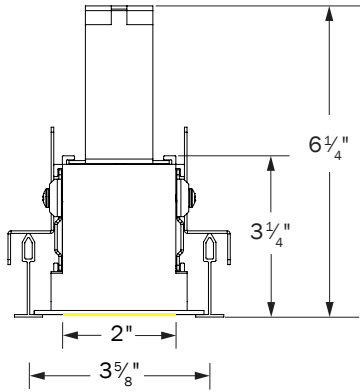


MECHANICAL DIAGRAMS

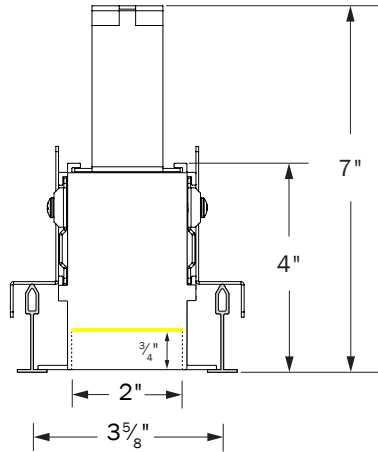




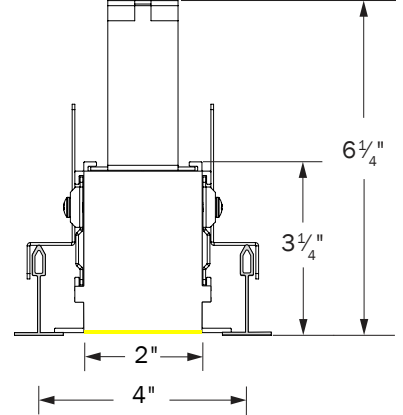
MECHANICAL DIAGRAMS CONT'D



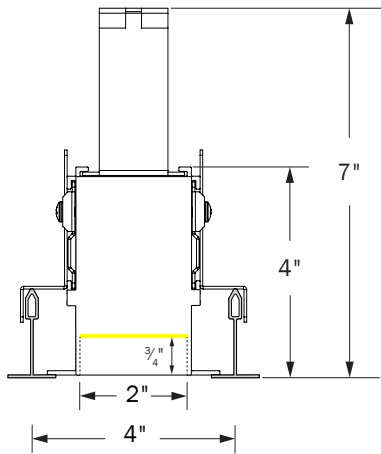
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RECESSED TGRID 9/16
FLUSH LENS



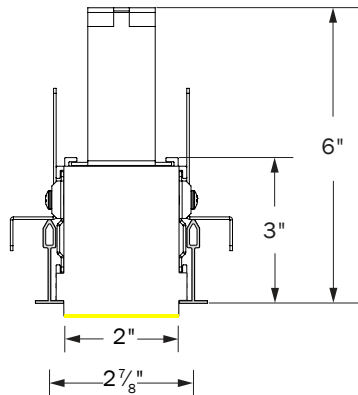
LPX2RT9RN
RECESSED TGRID 9/16
REGRESSED LENS



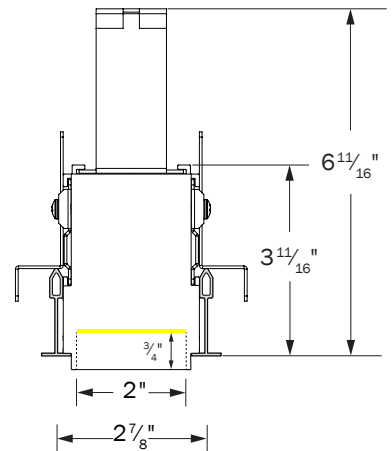
LPX2RT5FN
RECESSED TGRID 15/16
FLUSH LENS



LPX2RT5RN
RECESSED TGRID 15/16
REGRESSED LENS



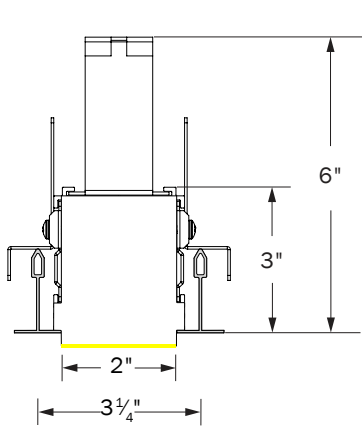
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RECESSED TEGULAR 9/16
FLUSH LENS



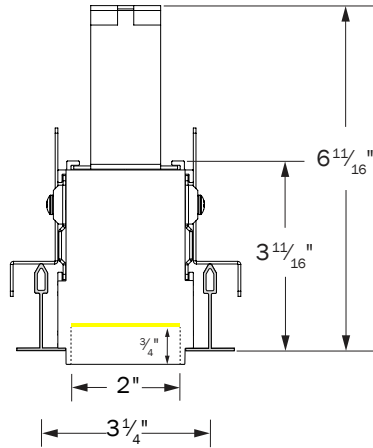
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RECESSED TEGULAR 9/16
REGRESSED LENS



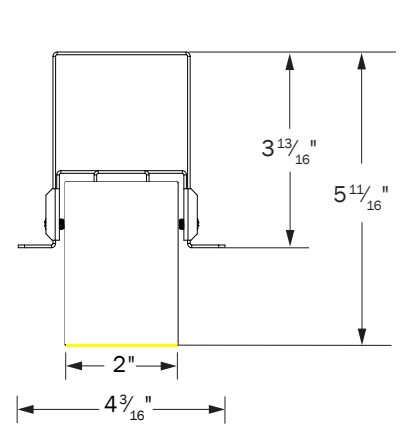
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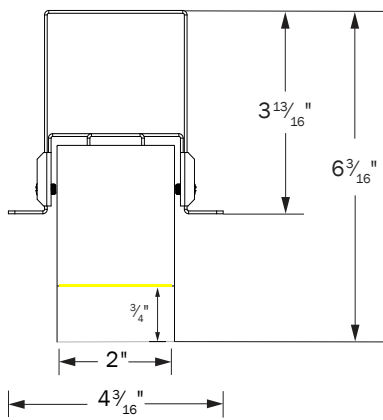
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RECESSED TEGULAR 15/16
FLUSH LENS



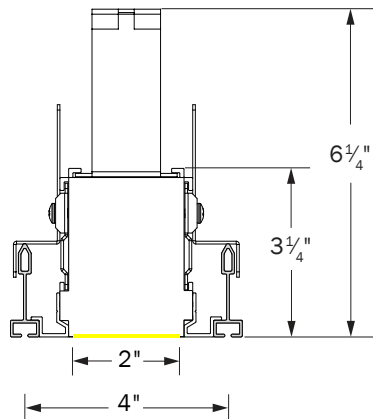
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REGRESSED LENS



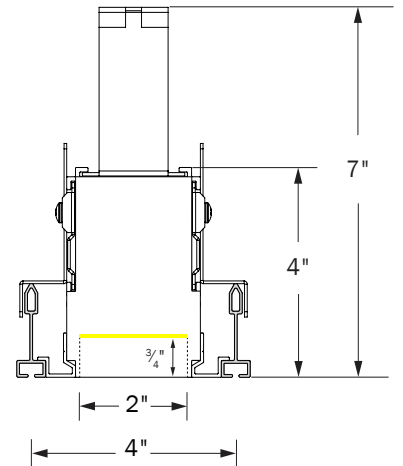
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RECESSED HIDDEN FLANGE
FLUSH LENS



LPX2RHFRN
RECESSED HIDDEN FLANGE
REGRESSED LENS



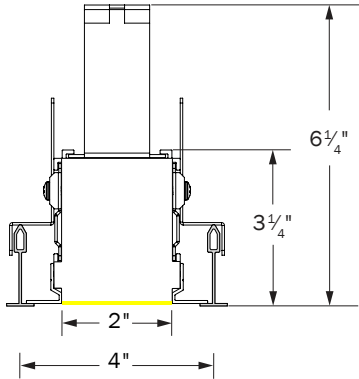
LPX2RASFN
RECESSED SLOT ARMSTRONG
TECHZONE® FLUSH LENS



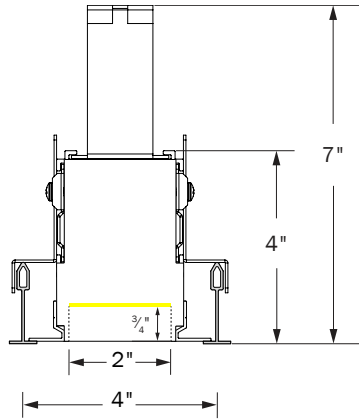
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RECESSED SLOT ARMSTRONG
TECHZONE® REGRESSED LENS



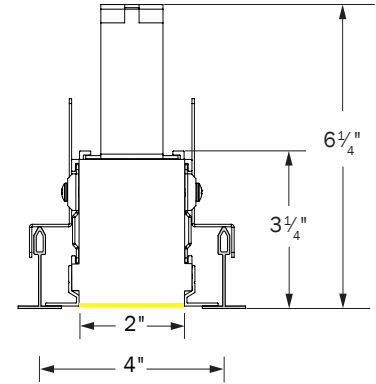
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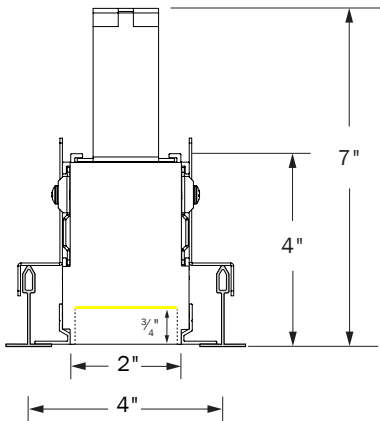
LPX2RAGFN
RECESSED TGRID 9/16
ARMSTRONG TECHZONE®
FLUSH LENS



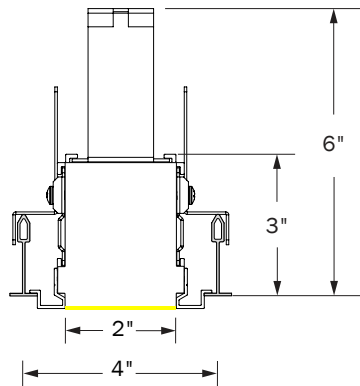
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RECESSED TGRID 9/16
ARMSTRONG TECHZONE®
REGRESSED LENS



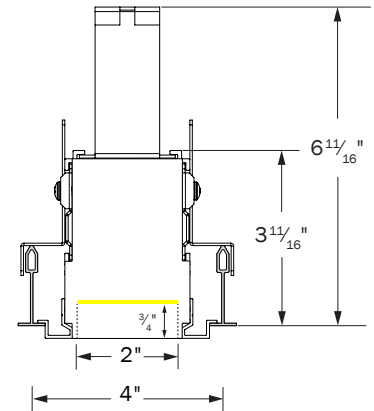
LPX2RA5FN
RECESSED TGRID 15/16
ARMSTRONG TECHZONE®
FLUSH LENS



LPX2RA5RN
RECESSED TGRID 15/16
ARMSTRONG TECHZONE®
REGRESSED LENS



LPX2RAGFN
RECESSED TEGULAR 9/16
ARMSTRONG TECHZONE®
FLUSH LENS



LPX2RAGRN
RECESSED TEGULAR 9/16
ARMSTRONG TECHZONE®
REGRESSED LENS



Job Name:

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S48-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

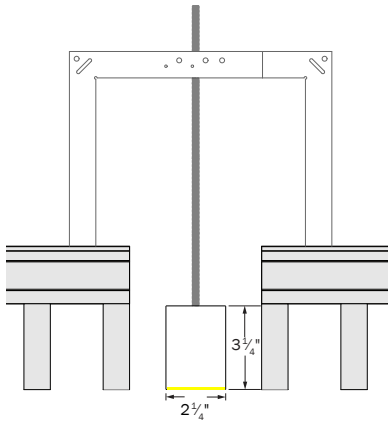
Type:

L13-4E

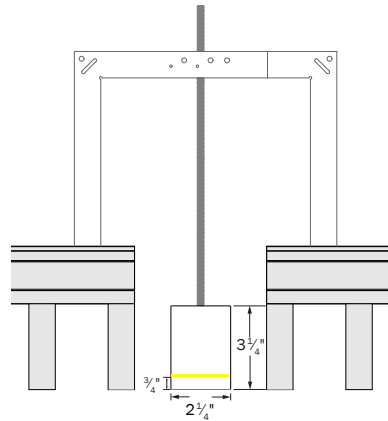
LDI24-110942



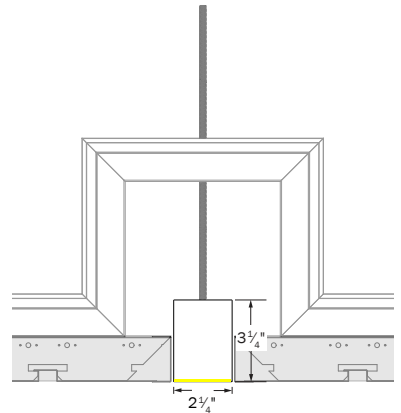
MECHANICAL DIAGRAMS CONT'D



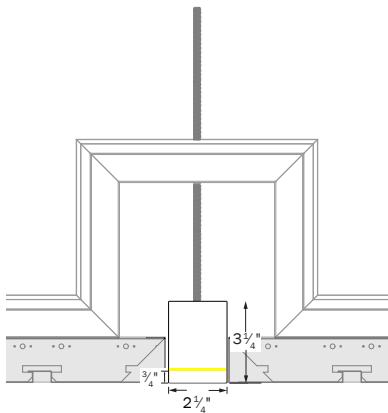
LPX2RAWFN
RECESSED ARMSTRONG
WOODWORKS® FLUSH LENS



LPX2RAWRN
RECESSED ARMSTRONG
WOODWORKS® REGRESSED LENS



LPX2RAMFN
RECESSED ARMSTRONG
METALWORKS® FLUSH LENS



LPX2RAMRN
RECESSED ARMSTRONG
METALWORKS® REGRESSED LENS



Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S48-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

Type:

L13-4E





LDI24-110942



FINISHES

Standard finishes are available at no additional charge.

STANDARD FINISHES - QS ELIGIBLE

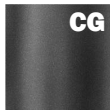
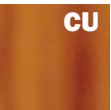

 SW	 AS	 SB	 TB
Satin White QS	Aluminum Silver Anodized Effect QS	Satin Black QS	Textured Black QS

PREMIUM FINISHES

BASIC POWDER COAT

 GW	 AW	 TW
Gloss White	Antimicrobial Gloss White White	Textured Matte White





METALLIC POWDER COAT

 CG	 CU	 BR
Charcoal Gray	Copper	Brass

SATIN ANODIZED EFFECT POWDER COAT

 OB	 DB
Oil-Rubbed Bronze	Dark Bronze

GLOSS POWDER COAT (80-95% GLOSS)

 GO	 GR	 GM	 GB
Orange RAL 2003	Red RAL 3020	Magenta RAL 4010	Blue RAL 5015

Contact ALW Quotes for sample paint finish swatches.

SPECIAL ORDER FINISHES*



RAL CLASSIC COLORS (80-95% GLOSS): RAL_ _ _ _

Most RAL Classic Colors are available for a minimum setup fee. On your specification submittal choose your RAL color by entering the 4-digit RAL code (Ex: RAL 3003). See www.alw-inc.com/resources/finishes



CUSTOM COLOR MATCH: CCM_ _ _ _

Custom powder coat color matching is available for a premium setup fee. Consult ALW for additional information.

*An individual setup fee will apply to each unique Special Order Finish per purchase order.
 (ex: RAL 5023 and RAL 2008 are specified for multiple line items on a purchase order. 2x setup fees will apply)

*Printed or on-screen colors are only approximations - consult actual Color Chip Set before specifying

**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S48-RW-N-N-WS-
DMX-SW-UNV-N-N

Notes:

Type:**L13-4E**

LDI24-110942

**PERFORMANCE DETAILS**

OUTPUT OPTION	OPTIC TYPE	DELIVERED LUMENS/FT	EFFICACY (LM/W)	WATTS/FT ¹⁵	CRI OPTIONS	CCT OPTIONS
03¹⁶	SL	359	119	3	80+ 90+	2700K 3000K 3500K 4000K 5000K
	WS	428	142			
	LG	416	138			
	AL	416	138			
05¹⁶	SL	511	117	4.4		
	WS	609	140			
	LG	593	136			
	AL	593	136			
07¹⁶	SL	764	122	6.3		
	WS	912	145			
	LG	887	141			
	AL	887	141			
10¹⁶	SL	1008	112	9		
	WS	1203	134			
	LG	1170	130			
	AL	1170	130			
12¹⁶	SL	1204	110	11		
	WS	1437	131			
	LG	1398	127			
	AL	1398	127			
TUNE	SL, WW	921	65	14.2	90	2700K - 6500K
	SL, CW	977	69			
RGB¹⁷	SL	184	17	11	N/A	
RGBW¹⁷	SL	W: 177 RGB: 184	20	17.7	W: 80 CRI	W: 3500K

¹⁵ Lumens/Watt and Watts/ft have been calculated assuming a driver efficiency of 85%. Depending on field conditions, actual measured values may fluctuate by 5-8%.

¹⁶ Performance calculations are based on LM-79 test of 1200lm output at 80 CRI and 3500K. All other output calculations are extrapolated values.

¹⁷ Performance calculations are derived from LM-79 test with all RGB LEDs illuminated (Red, Green, Blue) and White LED only illuminated

TM-30-18 DETAILS (90 CRI LAMPING)

CCT	CRI (Ra)	CRI (R9)	TM-30 Rf	TM-30 Rg	Duv
2700K	94	56	92	100	-0.0009
3000K	94	59	92	100	-0.0013
3500K	94	64	92	100	-0.0005
4000K	94	66	92	100	-0.0004

**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S48-RW-N-N-WS-
DMX-SW-UNV-N-N

Notes:

Type:**L13-4E**

LDI24-110942

**ALW****DRIVERS**

PRODUCT CODE	DESCRIPTION
V00	0-10V dimming down to 1% with electronic dim-to-off (0%).
V01	0-10V dimming down to 1%.
LDE	Lutron Hi-lume (LDE1) 1% EcoSystem LED driver with Soft-on, Fade-to-Black dimming technology.
P01	TRIAC Forward Phase 2-Wire and ELV Reverse Phase 3-Wire hybrid LED driver. Dimming down to 1%. 120VAC only.
ELO	EldoLED 0-10V SOLODrive 0.1% dimming with electronic dim-to-off (0%).
TSE	Lutron T-Series (PSQ0) 1% 2-channel tunable white driver (For use with Lutron Quantum Control Systems).
DAL	DALI flicker-free dimming down to 1% with electronic dim-to-off (0%).
DMX	DMX flicker-free dimming down to 0%.
POE/READY	Specify a PoE driver of your choice. Fixture supplied with low voltage leads and no LED driver. Contact ALW to register your project.

*Most drivers can be programmed to specific dimming levels if desired. Contact ALW for specific dimming level requests.

ALW lighting fixtures are intended for use with a wide range of sensors, lighting controls, LED drivers, and building management systems. If there are specific components required for your application that aren't listed on this spec sheet, please contact ALW customer support to specify a compatible solution of your choice.

DRIVER/LED LAMPING COMPATIBILITY						
	STD	STD/BIOS	TUNE*	RGB OR RGBW	CA TITLE 24 JA8/JA10 ¹⁸	IEEE P1789 & HD TV STUDIO ¹⁹
V00	●	●	●		●	
V01	●	●	●		●	
LDE	●	●			●	●
P01	●	●			●	
ELO	●	●	●		●	●
TSE			●		●	●
DALI	●	●	●		●	
DMX	●	●	●	●	PER REQUEST	PER REQUEST
POE/READY	PER REQUEST					

● - Indicates compatibility

* Standard lamping (STD) - 350 - 1200 lm/ft

¹⁸ Fixtures specified with 90CRI 2700K, 3000K, 3500K, 4000K, and 5000K lamping with applicable LED drivers have the ability to conform to California Title 24 JA8 and JA10 Appendices

¹⁹ The following drivers conform to IEEE P1789 Flicker Standard: 'IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers'. These drivers may also be installed in HD TV Studio applications utilizing high frequency camera equipment.

*ELO with TUNE Lamping will include an EldoLED DUALDrive 0-10V Tunable White LED Driver.



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LPX2RMD-FN-S48-RW-N-N-WS-
 DMX-SW-UNV-N-N

Notes:

Type:

L13-4E

LDI24-110942



PHOTOMETRICS

OPTIC	POLAR PLOT (CD)	MTG HEIGHT	LIGHT LEVEL (FC)	SPACING CRITERION (SC) ²⁰ (0°- 180°) (90°- 270°)	MAX INTENSITY (CD)	OUTPUT (LM/FT)
AL		6 ft	16.4	1.20 1.28	673	1398
		8 ft	9.2			
		10 ft	5.9			
		12 ft	4.1			
		14 ft	3.0			
		16 ft	2.3			
WS		6 ft	10.7	1.24 1.32	549.5	1437
		8 ft	6.0			
		10 ft	3.9			
		12 ft	2.7			
		14 ft	2.0			
		16 ft	1.5			
LG		6 ft	18.4	1.20 1.14	619.4	1398
		8 ft	10.3			
		10 ft	6.6			
		12 ft	4.6			
		14 ft	3.4			
		16 ft	2.6			
SL		6 ft	11.9	1.24 1.24	428.8	1204
		8 ft	6.7			
		10 ft	4.3			
		12 ft	3.0			
		14 ft	2.2			
		16 ft	1.7			

*Photometric calculations based on 1200lm 3500K 80 CRI fixture combination. Actual results may vary in the field.

For footcandle and output multipliers refer to the [ALW Lightplane+ IES File Multipliers Chart](#)

²³Spacing criterion refers to maximum distance luminaires can be spaced to provide uniform illumination on the working plane or surface.
 Luminaire spacing = Spacing Criterion (SC) x Mounting Height (MH) (ex. 1.14 (SC) x 10' (MH) = 11.4' Luminaire Spacing).

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

LPX2RMD-FN-S48-RW-N-N-WS-DMX-SW-UNV-N-N

Notes:

Type:**L13-4E**

LDI24-110942

**ADDITIONAL OPTIONS & SPECIFICATIONS****LED PERFORMANCE**

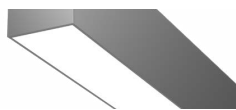
> 60,000 hours at 70% lumen maintenance, LM80 / TM-21

HOUSING

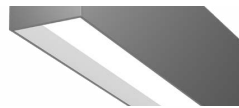
100% recyclable, extruded architectural grade 6063 aluminum with a 0.09" minimum wall thickness.

LENS & OPTICS

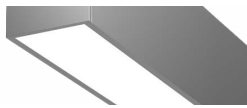
ALW offers three different lens types: Flush, ControlRoll Flush, and Regressed. A wide range of optics are available including, Lamberian, Asymmetric, Low Glare, and Widespread. See page 4 for the Lens & Optics Compatibility chart.



FN
STANDARD FLUSH



RN
REGRESSED



CN
CONTROL ROLL FLUSH



The optically engineered ControlRoll lens provides smooth, uniform, and seamless illumination for linear lengths of 250' to eliminated lens gaps. ControlRoll lens rolls out and presses into the housing channel for easy installation.

SAFETY & REGULATORY

ETL Listed (U.S. & Canada). Suitable for dry or damp locations.
For integral driver, Conforms to UL std. 1598 luminaires.
For remote driver, Conforms to UL std. 2018 luminaires.
Certified to CSA std. C22.2#250.0:2008 Ed. 3+G1;G2.

Fixtures specified with 90CRI, 2700K, 3000K, 3500K, and 4000K lamping with applicable LED drivers have the ability to conform to **California Title 24 JA8 and JA10** Appendices. EldoLED and Lutron conform to IEEE P1789 Flicker Standard: 'IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers.

OPERATING TEMPERATURE

Luminaire should be installed and operated **ONLY** in dry environments where the ambient temperature ranges from -4 °F to 122 °F (-20 °C to 50 °C). Luminaire operation in environments outside the listed temperature range voids the warranty AND may damage the product or adversely impact lamp life, lumen output and color consistency.

WEIGHT

Approximately 2lbs. per linear foot. Weight may vary depending on additional options selected.

EMERGENCY OPTIONS

Emergency options are available for various applications including 10W Emergency Batteries (EMB), EMC circuits (EMC), Generator Transfer Devices (GTD), and Automated Load Control Relays (ALC). Contact ALW for emergency component spec sheets.

EMBEDDED CONTROLS, SENSORS, & OEM COMPONENTS

ALW lighting fixtures are intended for use with a wide range of embedded OEM components (control devices, occupancy and photocell sensors, LED drivers) for use with specified building management systems. Our component portfolio is continually expanding to adopt to the latest technologies and specification needs.

ALW is your embedded controls partner, supporting integration with Acuity, Avi-on, Casambi, Cooper Wavelinx, Encelium, Enlighted, Lutron, NX Controls, Wattstopper, eldoLED, Philips, Molex PoE, NuLEDs PoE, WTEC Smartengine PoE, and more. If there's a component or system required that you don't see on the spec sheet please contact [ALW customer support](#) today so we can review your requirements.

Rev 112823

LPX2R – SPECIFICATIONS
RECESSED

ALW-INC.COM
14 of 14



Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
LD2B15D010 EU2B15NFL259035
2LBD1H HB26
Notes:

Type:
L14
LDI24-110942

Portfolio

DESCRIPTION

2- inch LED recessed downlight with excellent light control and low aperture brightness. Offered with 15°, 25°, 40°, 55° or wall wash optic producing a smooth distribution. Lumen packages ranging from 500 to 2000 with color temperatures of 2400K, 2700K, 3000K, 3500K, 4000K and 5000K, in 80, 90 or 97CRI. Dim to warm technology – similar to halogen at full power, the 3000K LED warms smoothly as dimmed to 1850K creating a rich warm glow within the space. Tunable white technology - adjust the color temperature from warm white to cool white while independently controlling intensity.

SPECIFICATION FEATURES

Lower Reflector

Round or square painted die cast aluminum or round anodized aluminum lower reflector with a lensed upper optical chamber providing superior lumen output with minimal source brightness. Anodized reflectors are offered in all Portfolio Alzak® finishes. Plaster lathing ring accessory offered for flush reflector transition.

Trim Retention

Reflector is retained with three or four pressure springs holding the flange tight to the finished ceiling surface.

Optic

TIR optic in 15°, 25°, 40, 55° or wall wash provides smooth beam without color separation. Media holder fits onto upper reflector and holds up one lens media. For non-lens trims only.

Plaster Frame / Collar

New Construction
Galvanized steel plaster frame designed for ceiling thickness from 1/2 to 1-1/4-inch.

Retrofit

Installs from below.

Universal Mounting Bracket

Accepts 1/2" EMT, C channel and bar hangers.

Junction Box

(4) 1/2" trade size pry outs positioned to allow straight conduit runs. Listed for (4) #12AWG (two in, two out) 90°C conductors and feed thru branch wiring. Lever connectors for simple push in wiring.

Thermal

Forged aluminum heat sink conducts heat away from the LED COB for optimal performance and long life.

LED

Chip on board with a multitude of highly efficient white LED's, combined with TIR optic produces an

even distribution with no pixilation. Lumen output shall not decrease by more than 10% over the minimum life of 55,000 hours (L90 > 55,000 hours). Auto resetting, thermally protected, LED's are turned off when safe operating temperatures are exceeded. Color variation within 2-step MacAdam ellipses. Flexible disconnect allows for replacement of LED engine from below ceiling. Available in 80, 90 or 97 CRI. D2W™ – dim-to-warm shifts CCT from 3000K to 1850K as fixture dims mimicking halogen sources. W2N - Tunable white CCT range 2700K to 6500K or 2000K to 5000K, 90 CRI.

Driver

Standard 120-277V 0-10V dimming driver provides flicker free dimming from 100% to 1%. Optional 120V leading edge, <1% 0-10V, Fifth Light, DMX or Lutron® Ecosystem. Driver can be serviced from above or through the aperture with standard D010 driver. Other drivers require above ceiling access. Distributed low voltage power system combines power, lighting, and controls with ease of installation.

Connected Lighting System Options

Two WaveLinX connected systems to choose from. Refer to WaveLinX system specifications and application guides for details.

WaveLinX Wireless System Tilemount Sensor Kit

- WaveLinX Wireless WTA tile mount sensor kit offers daylight dimming, PIR motion sensing, scene and zone configuration, automatic commissioning; and optional RLTS - Real Time Location Services available.

WaveLinX Lite System Tilemount Sensor Kit

- WaveLinX Lite WTK tile mount sensor kit offers daylight dimming and PIR motion sensing, scene and grouping configuration.

Catalog #	Type
Project	
Comments	Date
Prepared by	

WaveLinXTilemount Kits Application

- The WTA and WTK tilemount kits include a control module mounted on the luminaire junction box via 1/2" knock-out, and a tilemount sensor on 54-inch whip; for ceiling installation by direct-mount spring clips or via mounting bracket in octagon ceiling boxes.
- The WTA and WTK tilemount kits may be ordered as factory installed on the luminaire, or ordered separately as a field installed accessory kit.

Code Compliance

Thermally protected and cULus listed for protected damp locations with open trims and cULus listed for protected wet locations with lensed trims. EMI/RFI emissions per FCC 47CFR Part 18 Class B consumer limits. Optional City of Chicago environmental air (CCEA) marking for plenum applications. 1500 lumen and above are Non-IC rated - Insulation must be kept 3" from top and sides of housing. IC-rated up to 1000 lumens (except wall wash).

RoHS Compliant. Photometric testing completed in accordance with IES LM 79 and TM-30 standards. Lumen maintenance projections in accordance with IES LM-80-08 and TM-21-11.

Can be used to comply with California Energy Commission (CEC) Title 24 2016 & 2019 JA8 High Efficacy Lighting Requirements, reference Modernized Appliance Efficiency Database System (MAEDBS) for 2016 & 2019 JA8 High Efficacy Lighting.

- ENERGY STAR® certified, reference certified light fixtures database
- Options to meet Trade Agreements Act requirements

Warranty

5-year warranty



LD2B EU2B 2LB

500, 1000, 1500, 2000 Lumens
LED

2-inch

Spun or Die Cast Aluminum
Downlight or Wall Wash
New Construction or Retrofit
2x4 and 2x6



Can be used to comply with California Title 24 High Efficacy requirements. Certified to California Title 20 Appliance Efficiency Database. Certified to California Appliance Efficiency Database under JA8.

ENERGY

ENERGY DATA	
Sound Rating: Class A standards	
(Values at non-dimming line voltage)	
Minimum Starting Temperature: -30°C (-22°F)	
EMI/RFI: FCC Title 47 CFR, Part 15, Class B (Consumer)	
Input Voltage: UNV (120V - 277V)	
Power Factor: >0.90	
(at nominal input 120-277 VAC & 100% of Rated Output Power)	
Input Frequency: 50/60Hz	

500 Lumen D010				1000 Lumen D010			
Input Power: 7.38W	THD: <14.4%	Input Power: 11W	THD: <13.8%	Input Power: 7.38W	THD: <14.4%	Input Power: 11W	THD: <13.8%
120V Input Current: 0.06A	277V Input Current: 0.03A	120V Input Current: 0.086A	277V Input Current: 0.042A	120V Input Current: 0.06A	277V Input Current: 0.03A	120V Input Current: 0.086A	277V Input Current: 0.042A

1500 Lumen D010				2000 Lumen D010			
Input Power: 15.05W	THD: <13.0%	Input Power: 21.2W	THD: <8.6%	Input Power: 15.05W	THD: <13.0%	Input Power: 21.2W	THD: <8.6%
120V Input Current: 0.13A	277V Input Current: 0.06A	120V Input Current: 0.18A	277V Input Current: 0.081A	120V Input Current: 0.13A	277V Input Current: 0.06A	120V Input Current: 0.18A	277V Input Current: 0.081A

Lumens	120V		277V	
	Inrush (A)	Duration (ms)	Inrush (A)	Duration (ms)
500 Lumen D010	0.64	0.05	1.4	0.04
1000 Lumen D010	1.02	0.041	2.18	0.021
1500 Lumen D010	1.02	1.02	2.24	0.064
2000 Lumen D010	1.02	0.077	2.43	0.027



Job Name:
South Dade Regional Library Specifications
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
LD2B15D010 EU2B15NFL259035
2LBD1H HB26

Type:
L14

Notes:

LDI24-110942

LD2B EU2B 2LB

ORDERING INFORMATION

SAMPLE NUMBER: LD2B15D010

Domestic Preferences ¹⁷	Housing	Lumens ¹	Voltage	Driver	Options
[Blank]=Standard TAA=Trade Agreements Act	LD2B=2" New Construction Downlight LDRT12B=2" Remodel Downlight limit to 1500 lumen ¹³ LD2BCP=2" LED Downlight Nominal Aperture, Chicago Plenum ¹²	5=500 lumens ¹⁶ 10=1000 lumens 15=1500 lumens 20=2000 lumens	Blank=120-277V 3=347V 0-10V only 1000-2000 lumens	500 - 2000 Lumens D010=0-10V Dimming, 1% to 100%, 120V-277V DLV=Low voltage dimming driver (1-100%) for use with DLVP system ⁶ 1000 - 2000 Lumens D010TR=0-10V or Line Voltage Dimming, 1% to 100%, 120V-277V DE010=0-10V Linear Dimming, 0% to 100%, 120V-277V ⁶ D5LT=Fifth Light® (DALI) Logarithmic Dimming, 0% to 100%, 120V-277V ⁶ DMX=DMX/RDM Logarithmic Dimming, 0% to 100%, 120V-277V ^{6,9} DMXC5=DMX/RDM Logarithmic Dimming, 0% to 100%, 120V-277V, with RJ45 connection ^{6,9} DL2=Lutron® Hi-Lume Forward Phase Dimming, 1% to 100%, 120V Only ⁶ DLE=Lutron Ecosystem dimming 1% to 100%, 120V-277V ⁶ Tunable White D5LTW2N2050 = Fifth Light (DALI) 0-100%, 120-277V, 2000K-5000K D5LTW2N2765 = Fifth Light (DALI) 0-100%, 120-277V, 2000K-5000K DE010W2N2050 =0-10V dimming, 0-100%, 120-277V, 2000K-5000K DE010W2N2765 =0-10V dimming, 0-100%, 120-277V, 2700K-6500K	EMBOB=Bodine® Emergency Module with Remote Test Switch ⁸ EMBOD7S7=Bodine® Emergency Module with Self-Test Remote Test Switch ⁸ EM7=7W Emergency Module with Remote Test Switch ⁵ EM14=14W Emergency Module with Remote Test Switch ⁵ EMV7=7W Low Voltage Emergency Module with Remote Test Switch ⁸ EMV14=14W Low Voltage Emergency Module with Remote Test Switch ⁸ WTA = Factory installed WaveLinX sensor Kit ^{10,14} WTK = Factory installed WaveLinX Lite Sensor Kit ^{10,15}

SAMPLE NUMBER: EU2B158035

Domestic Preferences ¹⁷	Power Module	Lumen Levels / Distribution ¹ / Optic	CRI	Color
[Blank]=Standard TAA=Trade Agreements Act	EU2B=2" Universal LED Module	05SP15=500 lumen 15° IC Rated 05WW=500 lumen wall wash IC Rated ⁸ 10SP15=1000 lumen 15° IC Rated 10WW=1000 lumen wall wash Non-IC Rated ⁸ 0510NFL25=500 and 1000 lumen 25° IC Rated 0510FL40=500 and 1000 lumen 40° IC Rated 0510WFL55=500 and 1000 lumen 55° IC Rated 15NFL25=1500 lumen 25° Non IC Rated 15FL40=1500 lumen 40° Non IC Rated 15WFL55=1500 lumen 55° Non IC Rated 15WW=1500 lumen wall wash Non IC Rated ⁸ 20NFL25=2000 lumen 25° Non IC Rated 20FL40=2000 lumen 40° Non IC Rated 20WFL55=2000 lumen 55° Non IC Rated	80=80 CRI minimum 90=90 CRI minimum 97=97 CRI minimum	80 CRI 90 CRI 97 CRI 27=2700K 30=3000K 35=3500K 40=4000K 50=5000K Tunable White ¹¹ W2N902050 = 1000 lumen 40° 2000K-5000K W2N902765 = 1000 lumen 40° 2700K-6500K

SAMPLE NUMBER: 2LBD1L1

Trim ¹⁷	Reflector	Flange	Finish
2LB=2" LED	D=Round downlight spun reflector SW=Round lensed wall wash, Spun Aluminum, Splay black oculus SWW=Round lensed Wall Wash, Spun Aluminum, Splay white oculus DL=Round Downlight lensed spun reflector DC=Round Cast Downlight ² DLC=Round Lensed cast downlight ² PIN=Round Pinhole downlight black oculus ³ PINW=Round Pinhole downlight white oculus ³ DSQC=Square Cast Downlight ² DSQLC=Square Lensed cast shallow downlight ²	1=Self-flanged ⁷ 2=White Painted Self-flanged ¹¹ 3=Rimless ^{3,19} Blank=Pinhole	L=Specular Clear ⁴ H=Semi-Specular Clear Haze ⁴ WH=Warm Haze ⁴ WH=White ⁴ GPH=Graphite Haze ⁴ B=Specular Black ⁴ MW=Matte White MB=Matte Black ³ MMS=Matte Metallic Silver ³

Accessories¹⁸

RPR2=Round plaster lathing ring (order with rimless option)

Bar Hangers

HB26=Pair C-channel bar hanger, 26" long

BAA-HB26=Pair C-channel bar hanger, 26" long¹⁷

TAA-HB26=Pair C-channel bar hanger, 26" long¹⁷

RMB22=Pair wood joist bar hanger 22" long

Connected Lighting Systems¹⁰

WTA = Field installed WaveLinX sensor Kit¹⁴

WTK = Field installed WaveLinX Lite Sensor Kit¹⁵

L100 lenses - optical lenses

L110N=Diffuse Sandblasted Lens: Provides an even beam spread - especially useful in wall washing.

L111=Soft Focus Lens: Smooths irregular beam pattern while maintaining high controlled illumination levels and beam angles.

L113=Prismatic Spread Lens: Provides a symmetrical broadening of lamp beam. Suitable when a wide, uniform light distribution is required.

L115=Linear Spread Lens: Fans out the beam 55° (27-1/2° to each side) to produce a wide rectangular pattern.

L100MB=Black finished metal hexagonal-cell louver - controls light spill while retaining lamp optics.

Notes:

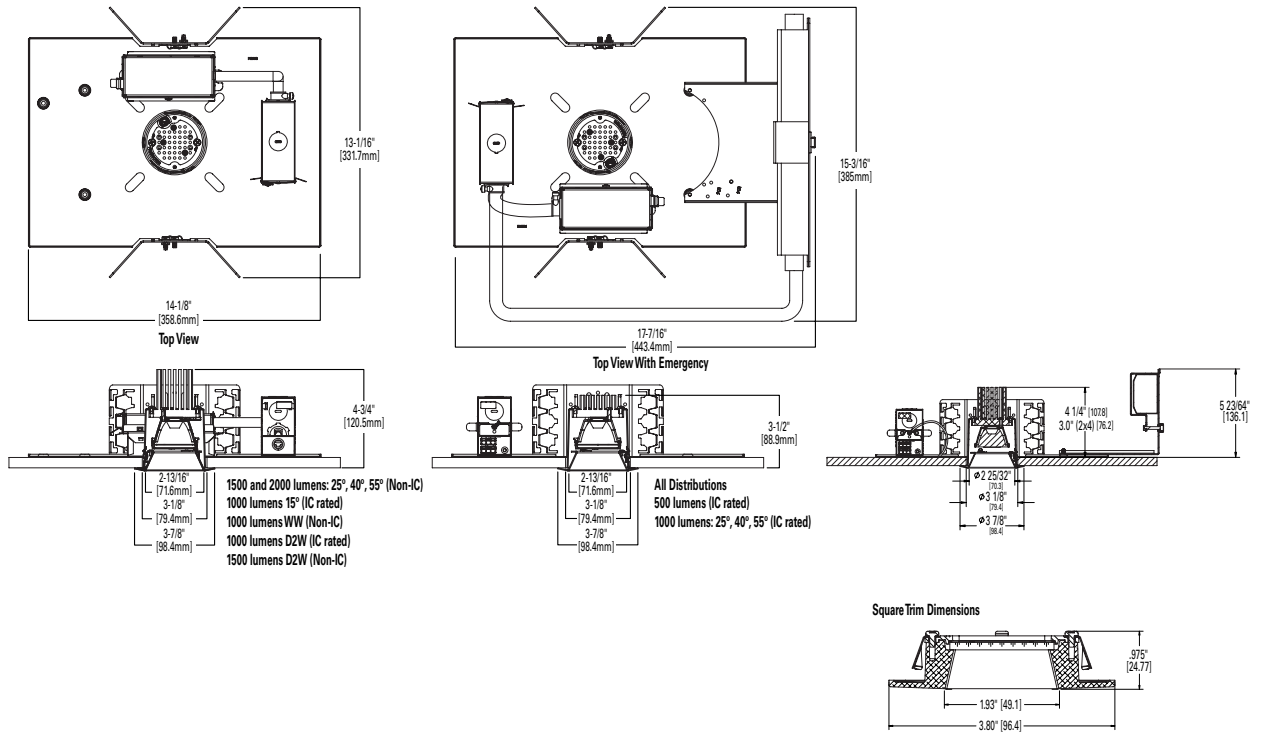
- Nominal Lumens will vary depending on selected distribution, color, driver and reflector finish.
- Only available with Matte White, Matte metallic silver and Matte Black Finishes.
- Available on DC, DLC and PIN.
- Not available on DC or PIN.
- DMX, D5LT, DE010, DLC, Lutron, connected and emergency module drivers require accessible ceiling.
- Flange is the same finish as reflector.
- Order with 2LBSW Wall Wash trim.
- DMX fixtures default to full on upon loss of DMX signal.
- Refer to system specifications for additional information, features, and benefits. Order either factory installed option or accessory. Use with 0-10V driver.
- Not available with Wall Wash.
- Limited to 1000 lumens.
- Available with D010 and D010TR driver only.
- WTA = WaveLinX wireless sensor kit for daylight dimming, PIR motion sensing, and optional RLTS - Real Time Location Services, use with 0-10V only.
- WTK = WaveLinX Lite tile mount sensor kit for daylight dimming, PIR motion sensing, use with D010 only (Refer to WaveLinX Lite system specifications)
- Limited to D010 and D010A drivers.
- Only product configurations with this designated prefix are built to be compliant with the Trade Agreements Act of 1979 (TAA). Please refer to **DOMESTIC PREFERENCES** website for more information. Components shipped separately may be separately analyzed under domestic preference requirements. Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information. Trim must be ordered with power module for TAA compliance. Example: TAA-EU2B158035-2LB
- Accessories sold separately will be separately analyzed under domestic preference requirements. Consult factory for further information.
- For use with plaster lathing ring RPR2 (required).



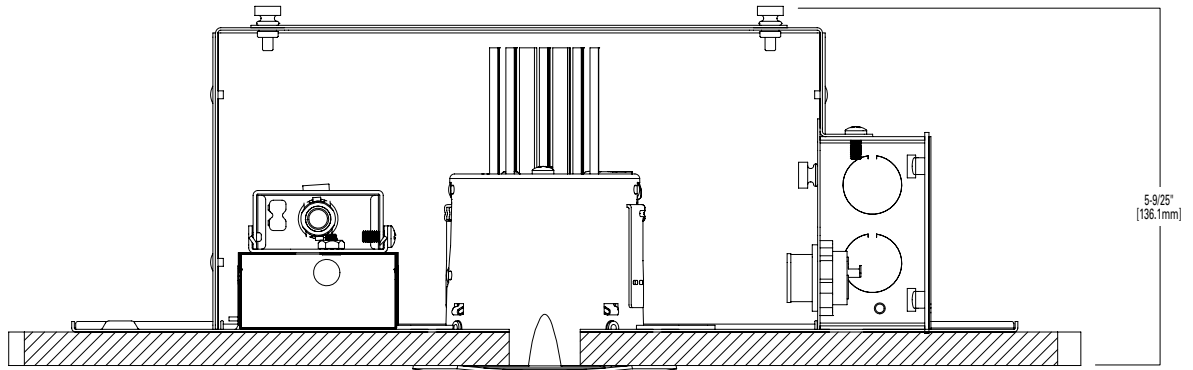
LD2B EU2B 2LB

DIMENSIONS

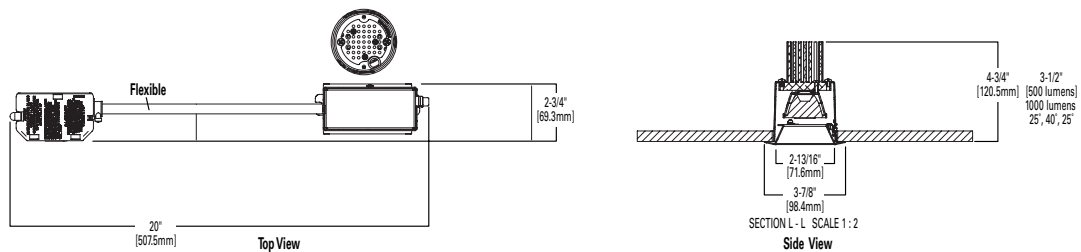
NEW CONSTRUCTION



CHICAGO PLENUM



RETROFIT





Job Name:
 South Dade Regional Library Specifications
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 LD2B15D010 EU2B15NFL259035
 2LBD1H HB26
 Notes:

Type:
L14
 LDI24-110942

LD2B EU2B 2LB

PHOTOMETRY

SPOT (15° BEAM)		CANDLEPOWER DISTRIBUTION		CONE OF LIGHT		CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Test Number	P264029					Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD2B10D010					0	9316	0-30	945	97	45	4884
Module	EU2B1010SP158035					5	7438	0-40	965	99.1	55	1720
Trim	2LBD*LI					15	976	0-60	973	99.9	65	1167
Lumens	974					25	141	0-90	974	100	75	0
Efficacy	94.6 Lm/W	35	30	90-180	0	0	85	0				
SC	0.28	45	7	0-180	974	100						
		55	2									
		65	1									
		75	0									
		85	0									
		90	0									
		D	FC	L	W							
		4'	582.2	1	1							
		7'	190.1	1.8	1.8							
		9'	115	2.4	2.4							
		13'	55.1	3.6	3.6							
		16'	36.4	4.4	4.4							

FLOOD (25° BEAM)		CANDLEPOWER DISTRIBUTION		CONE OF LIGHT		CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Test Number	P218711					Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD2B10D010					0	6104	0-30	987	96.2	45	3836
Module	EU2B0510NFL258035					5	5611	0-40	1019	99.3	55	676
Trim	2LBD*LI					15	1236	0-60	1026	100	65	0
Lumens	1026					25	229	0-90	1026	100	75	0
Efficacy	99.6 Lm/W	35	51	90-180	0	0	85	0				
SC	0.39	45	7	0-180	1026	100						
		55	1									
		65	0									
		75	0									
		85	0									
		90	0									
		D	FC	L	W							
		4'	382	1.4	1.4							
		7'	125	2.6	2.6							
		9'	75	3.4	3.4							
		13'	36	5	5							
		16'	24	6	6							

FLOOD (40° BEAM)		CANDLEPOWER DISTRIBUTION		CONE OF LIGHT		CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Test Number	P218754					Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD2B10D010					0	2577	0-30	938	90.2	45	10412
Module	EU2B0510FL408035					5	2467	0-40	1020	98.0	55	2702
Trim	2LBD*LI					15	1626	0-60	1040	99.9	65	0
Lumens	1041					25	581	0-90	1041	100	75	0
Efficacy	101 Lm/W	35	120	90-180	0	0	85	0				
SC	0.59	45	19	0-180	1041	100						
		55	4									
		65	0									
		75	0									
		85	0									
		90	0									
		D	FC	L	W							
		4'	161	2.2	2.2							
		7'	53	4	4							
		9'	32	5.2	5.2							
		13'	15	7.6	7.6							
		16'	10	9.4	9.4							

WIDE FLOOD (55° BEAM)		CANDLEPOWER DISTRIBUTION		CONE OF LIGHT		CANDELA TABLE		ZONAL LUMEN SUMMARY			LUMINANCE	
Test Number	P218801					Degrees Vertical	Candela	Zone	Lumens	% Fixture	Average Candela Degrees	Average 0° Luminance
Housing	LD2B10D010					0	1309	0-30	674	68.5	45	57541
Module	EU2B0510WFL558035					5	1250	0-40	873	88.7	55	18916
Trim	2LBD*LI					15	959	0-60	984	99.9	65	0
Lumens	985					25	644	0-90	985	100	75	0
Efficacy	95.6 Lm/W	35	313	90-180	0	0	85	0				
SC	0.73	45	105	0-180	985	100						
		55	28									
		65	0									
		75	0									
		85	0									
		90	0									
		D	FC	L	W							
		4'	82	2.8	2.8							
		7'	27	5	5							
		9'	16	6.6	6.6							
		13'	8	9.4	9.4							
		16'	5	11.6	11.6							



Job Name:
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 Architect: Forbes Architects (Coral Gables)

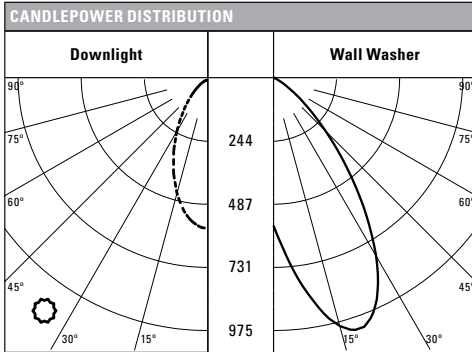
Catalog Number:
 LD2B15D010 EU2B15NFL259035
 2LBD1H HB26
 Notes:

Type:
L14
 LDI24-110942

LD2B EU2B 2LB

PHOTOMETRY

WALL WASH	
Test Number	P14828
Housing	LD2B10D010
Module	EU2B1010WW8035
Trim	2LBSW*XX
Lumens	742
Efficacy	72 Lm/W



LEGEND: 0-deg: ---
 90-deg: ---

SINGLE UNIT FOOTCANDLES					MULTIPLE UNIT FOOTCANDLES											
DD	3' FROM WALL (Distance From Fixture Along Wall)				2.5' FROM WALL (Spacing Between Fixtures)						3' FROM WALL (Spacing Between Fixtures)					
	●	1'	2'	3'	●	3'	●	●	4'	●	●	3'	●	4'	●	
1'	0.5	0.5	0.3	0.2	1.3	1.1	1.3	1.2	0.7	1.2	0.7	0.8	0.7	0.6	0.6	0.6
2'	4.3	3.3	1.4	0.5	10.7	8.7	10.7	10.2	4.9	10.2	4.8	4.6	4.8	4.5	2.9	4.5
3'	10.1	8.1	4.2	1.6	19.2	18	19.2	17.8	11.5	17.8	11.8	12.1	11.8	10.7	8.3	10.7
4'	12.2	10.2	5.9	2.8	19.3	19.9	19.3	17.5	14	17.5	15.1	16.1	15.1	13.4	11.9	13.4
5'	10.9	9.4	6.1	3.3	15.6	16.9	15.6	13.8	12.8	13.8	14.2	15.7	14.2	12.5	12.3	12.5
6'	8.6	7.6	5.4	3.2	11.7	12.9	11.7	10.2	10.4	10.2	11.8	13.2	11.8	10.3	10.7	10.3
7'	6.4	5.8	4.4	2.9	8.5	9.5	8.5	7.5	8	7.5	9.2	10.4	9.2	8.1	8.8	8.1
8'	4.7	4.4	3.5	2.4	6.3	7	6.3	5.5	6	5.5	7.1	7.9	7.1	6.3	6.9	6.3
9'	3.4	3.3	2.7	2	4.6	5.1	4.6	4.1	4.6	4.1	5.4	6	5.4	4.8	5.4	4.8
10'	2.6	2.4	2.1	1.6	3.5	3.8	3.5	3.1	3.5	3.1	4.2	4.6	4.2	3.7	4.2	3.7

**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

UEL-EM-G-1C2M-MTEBR

Type:**L15**

LDI24-110942

**UEL**

Universal Recessed Edge-lit LED Exit Sign

DATE:

COMMENTS:

PROJECT

**FEATURES**

- Super-bright, long-life LEDs
- Suitable for damp locations
- Unique pivoting housing suitable for Ceiling, Wall, or End Mount applications
- Recessed backbox kit with adjustable bar hangers included for optional recessed T-Bar or Joist mounting
- Everything you need in the package no matter the mounting configuration
- Includes single face clear lens and double face mirrored lens for versatility
- Additional single face mirrored panel optional
- 120/277 VAC field-selectable inputs
- 4.8V long life Nickel Cadmium, maintenance free battery provides 90 minute runtime
- Fully automatic solid-state, two-rate charger initiates battery charging to recharge a discharged battery in 24 hours
- Zero current low-voltage disconnect
- Energy consumption of less than 2 Watts of nominal power
- Brownout detection ensures emergency operation during periods of low line voltage
- Charge rate/power "ON" LED indicator light and push-to-test switch for mandated code compliance testing

**ORDERING INFORMATION** UEL-AC-G-1C2M-MTEBR**1. SERIES**

UEL

2. OPERATION

AC AC Only
EM Ni-Cad Battery Backup

3. ILLUMINATION

G Green
R Red

4. FACE COUNT

1C2M

1C2M Single Face, Clear Background
and Double Face Mirrored
Background

5. MOUNTING

MTEBR

MTEBR Universal Mount

ACCESSORIES; ORDER SEPARATELY

- EUNR1M = Conversion Panel, Single Face, Red Letters, Mirror Background
- EUNG1M = Conversion Panel, Single Face, Green Letters, Mirror Background
- WG 2 = Wire guard 14.0" X 10.0" X 4.5"
- WG 6 = Wire guard 20.0" X 17.0" X 12.0"

**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

UEL-EM-G-1C2M-MTEBR

Type:**L15**

Notes:

LDI24-110942

**UEL**

Universal Recessed Edge-lit LED Exit Sign

**CONSTRUCTION**

- Attractive, low profile satin extruded aluminum
- Gray injection molded end caps and canopy
- Formed sheet steel recessed backbox

INPUT POWER

- AC models: Red <2 watts; Green <3 watts
- EM models: Red <2.5 watts; Green 3 watts

LETTERS

- 6" high; 0.75" stroke

ARROWS

- Universal field installable, self-adhesive chevrons

WEIGHT

- 3.2 lb

TEMPERATURE RATING

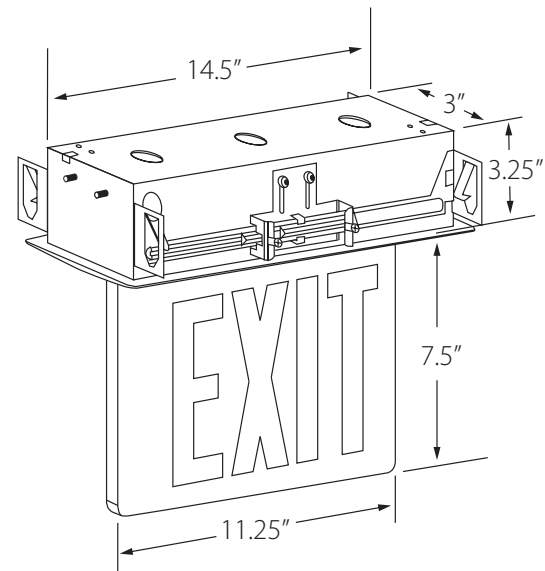
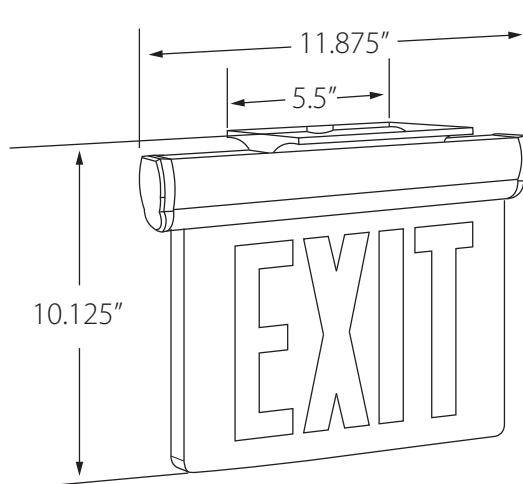
- From 50°F to 104°F

APPROVALS

- UL924
- CEC Title 20 Compliant
- NFPA 101 Life Safety Code
- NEC
- OSHA

WARRANTY

- Isolite offers a 5-year limited warranty. For further details, refer to General. Warranty and Obligations in the Isolite manual or on our website

DIMENSIONS



Job Name:
 South Dade Regional Library Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1044-24-LD-35K-CLV-MV-WM-
 PWM-ACC
 Notes:

Type:
L16
 LDI24-110942

Fixture Number	
Project Title	Type Qty
Comments	



- Slim Profile (4" High x 4" Wide)
- Extruded Aluminum Inside & Outside Walls
- Flat Matte White Acrylic Bottom Lens (plus Top Lens on Direct/Indirect Lamping)
- Multiple Cables & Power Cord; Multiple Hanging Options Available
- Up to 60" Ships Assembled

Dimensions and Lamping:

P1044-24	24" A x 192" B x 4" C x 4" DWeight: 21 lbs.
	LN LED: Direct / Indirect, Nominal 115W, 9050 Delivered Lumens
	LD LED: Direct, Nominal 70W, 6100 Delivered Lumens
P1044-36	36" A x 192" B x 4" C x 4" DWeight: 32 lbs.
	LN LED: Direct / Indirect, Nominal 170W, 13700 Delivered Lumens
	LD LED: Direct, Nominal 115W, 9800 Delivered Lumens
P1044-48	48" A x 192" B x 4" C x 4" DWeight: 42 lbs.
	LN LED: Direct / Indirect, Nominal 235W, 18800 Delivered Lumens
	LD LED: Direct, Nominal 150W, 12850 Delivered Lumens
P1044-60	60" A x 192" B x 4" C x 4" DWeight 52 lbs.*
	LN LED: Direct / Indirect, Nominal 295W, 23900 Delivered Lumens
	LD LED: Direct, Nominal 190W, 16450 Delivered Lumens
P1044-72	72" A x 192" B x 4" C x 4" DWeight 63 lbs.*
	LN LED: Direct / Indirect, Nominal 335W, 27650 Delivered Lumens
	LD LED: Direct, Nominal 235W, 20200 Delivered Lumens
P1044-96	96" A x 192" B x 4" C x 4" DWeight: 83 lbs.*
	LN LED: Direct / Indirect, Nominal 440W, 36400 Delivered Lumens
	LD LED: Direct, Nominal 315W, 27500 Delivered Lumens
P1044-108	108" A x 192" B x 4" C x 4" DWeight: 94 lbs.*
	LN LED: Direct / Indirect, Nominal 545W, 44850 Delivered Lumens
	LD LED: Direct, Nominal 380W, 32950 Delivered Lumens
P1044-144	144" A x 192" B x 4" C x 4" DWeight: 125 lbs.*
	LN LED: Direct / Indirect, Nominal 755W, 61750 Delivered Lumens
	LD LED: Direct, Nominal 505W, 44050 Delivered Lumens
P1044-192	192" A x 192" B x 4" C x 4" DWeight 166 lbs.*
	LN LED: Direct / Indirect, Nominal 1005W, 82400 Delivered Lumens
	LD LED: Direct, Nominal 670W, 58650 Delivered Lumens
P1044-216	216" A x 192" B x 4" C x 4" DWeight 187 lbs.*
	LN LED: Direct / Indirect, Nominal 1090W, 89650 Delivered Lumens
	LD LED: Direct, Nominal 755W, 65700 Delivered Lumens

* If ACC option is selected, structural support independent of the junction box is required.

LED Color Temperature:

30K	3000K	35K	3500K	40K	4000K
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Control:

CLV	Integral Power Supply, 0-10V Dimming to 1%
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Voltage:

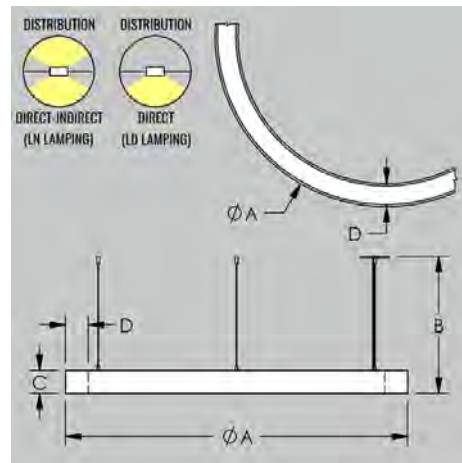
1	120V	2	277V	MV	Multi-Volt
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Diffusers:

WM:	Matte White Acrylic
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Notes:

- LN / LH (Direct/Indirect) Lamping: Uplight is not uniform. If uniform uplight is required, contact the factory.
- LN / LH (Direct/Indirect) Lamping: Minimum recommended mounting distance to ceiling is 36".
- Maximum tilt angle: 5 degrees.



Notes:

- Custom sizes and finishes available upon request.
- Camman reserves the right to make design changes without prior notice.
- Mounting is to a 4 inch octagonal junction box.
- 60" and Larger Sizes: If the ACC or ACH Hanging Option is selected, structural support independent of the junction box is required.
- Photometric information is available at cammanlighting.com.





Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
P1044-24-LD-35K-CLV-MV-WM-
PWM-ACC
Notes:

Type:
L16
LDI24-110942

Standard Finishes:

PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Hanging Options:

ACM Multiple Vertical Cables



ACC Cables to Canopy



ACH Cables to Hub



(24", 36", 48" Sizes Only)

Other Options:

OAH Overall Height (Specify in Comments)	2C 2-Circuit Wiring
REM Remote Emergency Power Supply	

Number of Cables	
P1044-24	3
P1044-36	3
P1044-48	3
P1044-60	3
P1044-72	3
P1044-96	6
P1044-108	4
P1044-144	6
P1044-192	6
P1044-216	8

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard (90CRI Available)
L70 (Projected):	>72,000 hours

Warranty	5 years (electrical components retain the component manufacturer warranty).
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Camman Plus Customizations

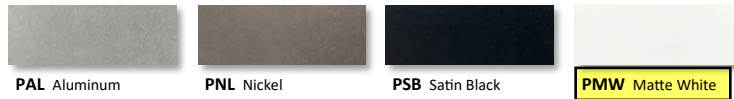


Camman **Standard Plus** products provide an extra degree of freedom to customize most standard products, including dimensions, finish, performance, and adding or removing details.

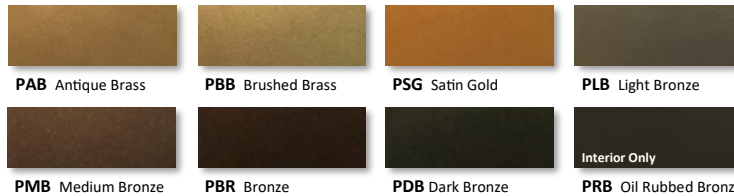
Visit www.cammanlighting.com/plus to learn more about the Plus program, and visit this fixture to see what specific options might be available.

Standard Finishes

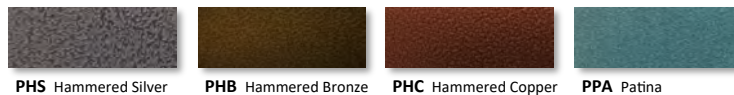
MODERN



NEUTRAL



TEXTURES



COLORS



- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.





Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 P1044-24-LD-35K-CLV-MV-WM-
 PWM-ACC
 Notes:

Type:
L16E
 LDI24-110942

Fixture Number			
Project Title	Type	Qty	
Comments			



- Slim Profile (4" High x 4" Wide)
- Extruded Aluminum Inside & Outside Walls
- Flat Matte White Acrylic Bottom Lens (plus Top Lens on Direct/Indirect Lamping)
- Multiple Cables & Power Cord; Multiple Hanging Options Available
- Up to 60" Ships Assembled

Dimensions and Lamping:

P1044-24	24" A x 192" B x 4" C x 4" DWeight: 21 lbs.
	LN LED: Direct / Indirect, Nominal 115W, 9050 Delivered Lumens
	LD LED: Direct, Nominal 70W, 6100 Delivered Lumens
P1044-36	36" A x 192" B x 4" C x 4" DWeight: 32 lbs.
	LN LED: Direct / Indirect, Nominal 170W, 13700 Delivered Lumens
	LD LED: Direct, Nominal 115W, 9800 Delivered Lumens
P1044-48	48" A x 192" B x 4" C x 4" DWeight: 42 lbs.
	LN LED: Direct / Indirect, Nominal 235W, 18800 Delivered Lumens
	LD LED: Direct, Nominal 150W, 12850 Delivered Lumens
P1044-60	60" A x 192" B x 4" C x 4" DWeight 52 lbs.*
	LN LED: Direct / Indirect, Nominal 295W, 23900 Delivered Lumens
	LD LED: Direct, Nominal 190W, 16450 Delivered Lumens
P1044-72	72" A x 192" B x 4" C x 4" DWeight 63 lbs.*
	LN LED: Direct / Indirect, Nominal 335W, 27650 Delivered Lumens
	LD LED: Direct, Nominal 235W, 20200 Delivered Lumens
P1044-96	96" A x 192" B x 4" C x 4" DWeight: 83 lbs.*
	LN LED: Direct / Indirect, Nominal 440W, 36400 Delivered Lumens
	LD LED: Direct, Nominal 315W, 27500 Delivered Lumens
P1044-108	108" A x 192" B x 4" C x 4" DWeight: 94 lbs.*
	LN LED: Direct / Indirect, Nominal 545W, 44850 Delivered Lumens
	LD LED: Direct, Nominal 380W, 32950 Delivered Lumens
P1044-144	144" A x 192" B x 4" C x 4" DWeight: 125 lbs.*
	LN LED: Direct / Indirect, Nominal 755W, 61750 Delivered Lumens
	LD LED: Direct, Nominal 505W, 44050 Delivered Lumens
P1044-192	192" A x 192" B x 4" C x 4" DWeight 166 lbs.*
	LN LED: Direct / Indirect, Nominal 1005W, 82400 Delivered Lumens
	LD LED: Direct, Nominal 670W, 58650 Delivered Lumens
P1044-216	216" A x 192" B x 4" C x 4" DWeight 187 lbs.*
	LN LED: Direct / Indirect, Nominal 1090W, 89650 Delivered Lumens
	LD LED: Direct, Nominal 755W, 65700 Delivered Lumens

* If ACC option is selected, structural support independent of the junction box is required.

LED Color Temperature:

30K	3000K	35K	3500K	40K	4000K
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Control:

CLV	Integral Power Supply, 0-10V Dimming to 1%
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Voltage:

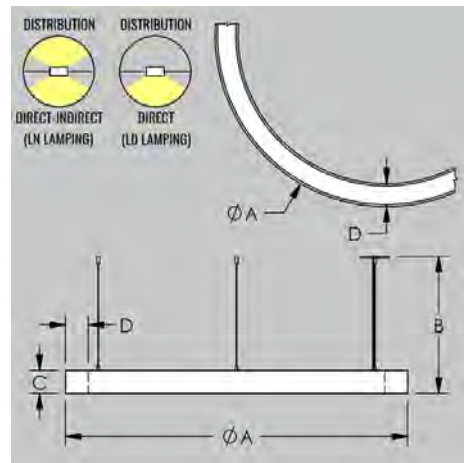
1	120V	2	277V	MV	Multi-Volt
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Diffusers:

WM:	Matte White Acrylic
------------	---------------------

Notes:

- LN / LH (Direct/Indirect) Lamping: Uplight is not uniform. If uniform uplight is required, contact the factory.
- LN / LH (Direct/Indirect) Lamping: Minimum recommended mounting distance to ceiling is 36".
- Maximum tilt angle: 5 degrees.



Notes:

- Custom sizes and finishes available upon request.
- Camman reserves the right to make design changes without prior notice.
- Mounting is to a 4 inch octagonal junction box.
- 60" and Larger Sizes: If the ACC or ACH Hanging Option is selected, structural support independent of the junction box is required.
- Photometric information is available at cammanlighting.com.





Job Name:

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

P1044-24-LD-35K-CLV-MV-WM-PWM-ACC

Notes:

Type:

L16E

LDI24-110942

Standard Finishes:

PAL Aluminum	PSB Satin Black	PRD Traffic Red (RAL 3020)
PNL Nickel	PBB Brushed Brass	POR Pure Orange (RAL 2004)
PBR Bronze	PAB Antique Brass	PYL Traffic Yellow (RAL 1023)
PLB Light Bronze	PHB Hammered Bronze	PGR Emerald Green (RAL 6001)
PMB Medium Bronze	PHC Hammered Copper	PBL Signal Blue (RAL 5005)
PDB Dark Bronze	PHS Hammered Silver	STBD To Be Determined
PRB Oil Rubbed Bronze	PSG Satin Gold	
PMW Matte White	PPA Patina	

Hanging Options:

ACM Multiple Vertical Cables



ACC Cables to Canopy



ACH Cables to Hub



(24", 36", 48" Sizes Only)

Other Options:

OAH Overall Height (Specify in Comments)	2C 2-Circuit Wiring
REM Remote Emergency Power Supply	

Number of Cables	
P1044-24	3
P1044-36	3
P1044-48	3
P1044-60	3
P1044-72	3
P1044-96	6
P1044-108	4
P1044-144	6
P1044-192	6
P1044-216	8

Additional Information

Color Temperature Adjustment	
Color Temperature	Multiplier
2700K	.967
3000K	.984
3500K	1.000
4000K	1.032

LED Performance	
Color Rendering Index	80CRI Standard (90CRI Available)
L70 (Projected):	>72,000 hours

Warranty	5 years (electrical components retain the component manufacturer warranty).
-----------------	---

Camman Plus Customizations



Camman **Standard Plus** products provide an extra degree of freedom to customize most standard products, including dimensions, finish, performance, and adding or removing details.

Visit www.cammanlighting.com/plus to learn more about the Plus program, and visit this fixture to see what specific options might be available.

Standard Finishes

MODERN



NEUTRAL



TEXTURES



COLORS



- Colors are for reference only and may vary per monitor.
- See cammanlighting.com/resources for more information, or contact your local rep for finish samples.



**Job Name:**

South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

E3MINI-250-LC-MB-FD

Notes:

Type:

INV1

LDI24-110942

**E3MINI**

Pure Sine Wave Mini Inverter

DATE:

COMMENTS:

PROJECT

FEATURES

- Field-selectable 120 or 277 VAC input/output.
- 1X normally-on and 3X configurable normally-off/switched for 125VA and 250VA models. 1X normally-on and 4X configurable normally-off/switched output types for 375VA and 550VA models.
- Microprocessor controlled pure sine wave output with less than 3% THD and crest factor up to 10X (125VA), 5X (250VA), 7.5X (375VA), and 5X (550VA).
- Advanced startup and charger/inverter diagnostics prevent failures from wiring errors, overloads, and application issues.
- Front facing module allow for easy field wiring of AC input/output wires and all system connections/interfaces.
- Advanced hysteric ultra-efficient charger improves efficiency and extends battery lifetime.
- Approved by UL 924 and CSA 22.2.
- Includes self-testing/self diagnostics.
- Optional internal DALI/0-10V dimming interface allows for up to three (125/250VA) or four (375/550VA) independent zones and allows for five different dimming presets to adjust emergency lighting levels.
- High purity, premium valve regulated lead acid (VRLA) batteries with lead-calcium plates provide long life and durability.
- Max connected load with dimmer option is 375VA for the 125VA and 250VA models, and 1,125VA for the 375VA and 550VA models (non-EM mode).



CLICK THE IMAGE TO VIEW ALTERNATE PRODUCT PHOTOS
Only available with Adobe Acrobat and Acrobat Reader

ORDERING INFORMATION E3MINI-125-LC-MB

1. SERIES	2. VA RATING	3. BATTERY TYPE	4. MOUNTING	5. OPTIONS
E3MINI	-	LC	-	-
	125 125VA 250 250VA 375 375VA 550 550VA	LC Lead Calcium	MB Back Mount MCG Ceiling Grid ^{1,2}	BLANK = NO OPTION FD 0-10V/DALI Dimming & Fire Alarm Interface RT Remote Diagnostic Status Display Panel for Back Mount Inverters AA Audible Alarm (Buzzer) CL Canada Listed EB Extended Run Time (2h) ² Z4 Seismic Zone 4 Restraints

ORDERING NOTES

- Only available with 125VA unit.
- Capacity reduced to 100VA, 200VA, 300VA, and 440VA respectively.
- Remote Diagnostic Status Display Panel (RT) included with MCG mounting.

ACCESSORIES; ORDER SEPARATELY

- E3MINI-FPS** = E3MINI 125/250/375/550 Factory Phone Startup (per unit)
NOTE: INCREASES ELECTRONICS WARRANTY TO 5 YEARS
- TLRT** = Infrared Remote Control for Industrial Products

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

E3MINI-250-LC-MB-FD

Notes:

Type:

INV1

LDI24-110942

**E3MINI**

Pure Sine Wave Mini Inverter

**SPECIFICATIONS****INPUT**

- Field-selectable 120 or 277 VAC input/output.
- Current: 1.4A (120V), or 0.6A (277V) for 125VA model.
- Current: 2.7A (120V), or 1.2A (277V) for 250VA model.
- Current: 4.10A (120V), or 1.19A (277V) 375VA model.
- Current: 5.95A (120V), or 1.98A (277V) 550VA model.
- Frequency: 60Hz +/- 2 Hz
- Protection: easy access 8A fast acting 5x20mm fuse.
- Power Factor: 0.5 lead to 0.5 lag

OUTPUT

- Voltage: 120 or 277 VAC and matches input selection.
- Current: 1.04A (120V), or 0.45A (277V) for 125VA model.
- Current: 2.08A (120V), or 0.9A (277V) for 250VA model.
- Current: 3.12A (120V), or 1.35A (277V) 375VA model.
- Current: 4.85A (120V), or 1.98A (277V) 550VA model.
- Frequency: 60Hz +/- 0.02 Hz crystal controlled during emergency mode.
- Overload: 110% will generate overload fault.
- Configurable Transfer Times: 50ms, 1s (default), or 2s
- Output Distortion: less than 3% THD
- Crest Factor: 10X for 125VA, 5X for 250VA, 7.5X for 375VA, and 5X for 550VA model
- Load Power Factor: 0.5 lead to 0.5 lag
- Output Types: 1X normally-on and 3X configurable normally-off/switched for 125VA and 250VA models. 1X normally-on and 4X configurable normally-off/switched for 375VA and 550VA models.
- Max Connected Load w/ Dimmer Option: 375VA for the 125VA and 250VA models and 1,125VA for the 375VA and 550VA models (non-EM mode).

BATTERY

- Type: premium long life valve-regulated lead acid (VRLA)
- Charger: three rate charger temperature compensation
- Recharge Time: 24 hour recharge
- Protection: automatic low voltage disconnect (LVD) set at 1.67 VPC.
- Automatic restart upon utility return.
- Runtime: 90 minutes at 25C°
- DC Voltage: 24 VDC nominal, 2.27 VPC float, temperature compensated
- DC Current: 6.12/12.4 ADC nominal (125/250VA Model)
- DC Current: 18.25/27 ADC nominal (375/550VA Model)

ENVIRONMENTAL

- Operating Temp: 20C° to 30C° (68°F to 86°F)
 - Storage Temp:
Electronics - 20C° to 70C° (68°F to 158°F)
- | BATTERY STORAGE TEMP | |
|----------------------------|----------|
| 51°F (11°C) TO 77°F (25°C) | 180 DAYS |
| 78°F (26°C) TO 92°F (33°C) | 90 DAYS |
- Relative Humidity: <95% (non-condensing)

PHYSICAL

- Cabinet: NEMA Type 1 enclosure with 16 AWG powder painted CRS.
- Cooling: natural convection – no fans
- Electrical knockouts (EKO's) for 1/2" and 3/4" conduit provided on three surfaces.

WEIGHT

- 125VA: 33 lbs.
- 125VA T-Bar: 38 lbs.
- 250VA: 68 lbs.
- 375VA: 100 lbs.
- 550VA: 120 lbs.

APPROVALS

- UL 924 certified
- New York City approved, Calendar Number 51575
- NFPA101 Life Safety Code
- NFPA70-NEC
- OSHA certified
- NEMA Type 1 enclosure
- NEMA 410 load tested up to 375VA (125/250VA Model) and 1,125VA (375/550VA Model).

WARRANTY

- Isolite warrants the E3 Series electronics assembly against defects in material and workmanship for a period of 3 years.
- Isolite warrants the lead calcium batteries for 3 years full and 7 years pro-rata limited.
- For further details, refer to General Warranty and Obligations in the Isolite manual or on our website.



Job Name:
 South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 E3MINI-250-LC-MB-FD

Notes:

Type:
INV1

LDI24-110942















E3MINI

Pure Sine Wave Mini Inverter



FRONT PANEL

NEU LINE CMD 1 CMD 2 CMD 3 N-ON OUT 1 OUT 2 OUT 3	AC INPUT 12 - 16 AWG AC OUTPUT 12 - 16 AWG	AC FUSE -8A  Replace only with little fuse 0477008.MXP	<table border="1"> <thead> <tr> <th style="color: red;">Charger Faults</th> <th style="color: red;">Inverter Faults</th> <th style="color: red;">Startup Faults</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> 1/ Over-Temperature 2/ Voltage Select Jumper 3/ AC Fuse 4/ Charger/Inverter </td> <td> <ul style="list-style-type: none"> 1/ Over-Temperature 2/ Voltage Select Jumper 3/ Back-feed 4/ Overload 5/ Inverter </td> <td> <ul style="list-style-type: none"> 1/ Incorrect AC 2/ Voltage Select Jumper 3/ Transformer Wiring 4/ Low Battery 5/ Overload 6/ Inverter 7/ Back-feed </td> </tr> </tbody> </table> <p>⚡: Red LED Strobe Qty. = Fault Type</p>	Charger Faults	Inverter Faults	Startup Faults	<ul style="list-style-type: none"> 1/ Over-Temperature 2/ Voltage Select Jumper 3/ AC Fuse 4/ Charger/Inverter 	<ul style="list-style-type: none"> 1/ Over-Temperature 2/ Voltage Select Jumper 3/ Back-feed 4/ Overload 5/ Inverter 	<ul style="list-style-type: none"> 1/ Incorrect AC 2/ Voltage Select Jumper 3/ Transformer Wiring 4/ Low Battery 5/ Overload 6/ Inverter 7/ Back-feed 	Replace only with little fuse 0297025.WXN DC FUSE-25A BATTERY
Charger Faults	Inverter Faults	Startup Faults								
<ul style="list-style-type: none"> 1/ Over-Temperature 2/ Voltage Select Jumper 3/ AC Fuse 4/ Charger/Inverter 	<ul style="list-style-type: none"> 1/ Over-Temperature 2/ Voltage Select Jumper 3/ Back-feed 4/ Overload 5/ Inverter 	<ul style="list-style-type: none"> 1/ Incorrect AC 2/ Voltage Select Jumper 3/ Transformer Wiring 4/ Low Battery 5/ Overload 6/ Inverter 7/ Back-feed 								
120 VAC 277 VAC	 120/277 VOLTAGE SELECT JUMPER 	<p>See Product Installation/Operation Manual</p> <p>Rotate DIM ADJ (5 presets) to adjust emergency-mode dimming level. Press appropriate TEST button to energize load and verify adjustment.</p> <p>DO NOT OVERLOAD</p>	E3MINI The Emergency Lighting Experts ● Chg. Inv. ● SYSTEM TEST ●	<p>NORMAL OPERATION</p> <ul style="list-style-type: none"> ● AC Present / Float Charging ● AC Present / Bulk Charging ● Emergency Power ON ● Reduced Battery Capacity ● 10% Load Change 	ON OFF REMOTE					
Emergency 0-10 / DALI Dimmer Interface		<table border="1"> <tr> <td style="background-color: red; color: white; text-align: center;"> TEST  20% 100% DIM ADJ. OUT 1 </td> <td style="background-color: blue; color: white; text-align: center;"> TEST  20% 100% DIM ADJ. OUT 2 </td> <td style="background-color: yellow; color: black; text-align: center;"> TEST  20% 100% DIM ADJ. OUT 3 </td> </tr> </table>			TEST  20% 100% DIM ADJ. OUT 1	TEST  20% 100% DIM ADJ. OUT 2	TEST  20% 100% DIM ADJ. OUT 3			
TEST  20% 100% DIM ADJ. OUT 1	TEST  20% 100% DIM ADJ. OUT 2	TEST  20% 100% DIM ADJ. OUT 3								



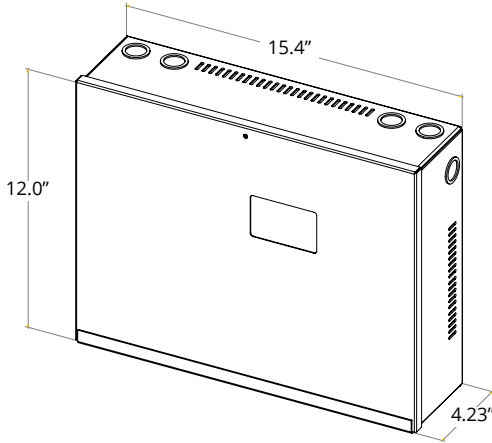
E3MINI

Pure Sine Wave Mini Inverter

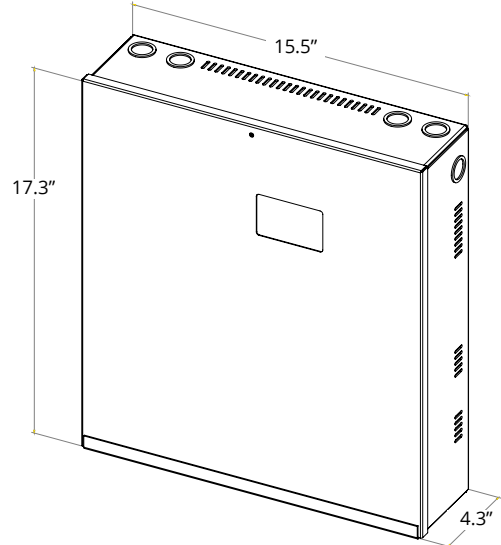


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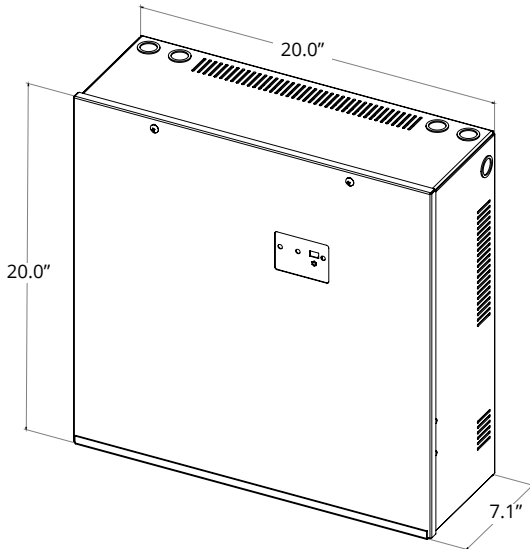
E3MINI 125W



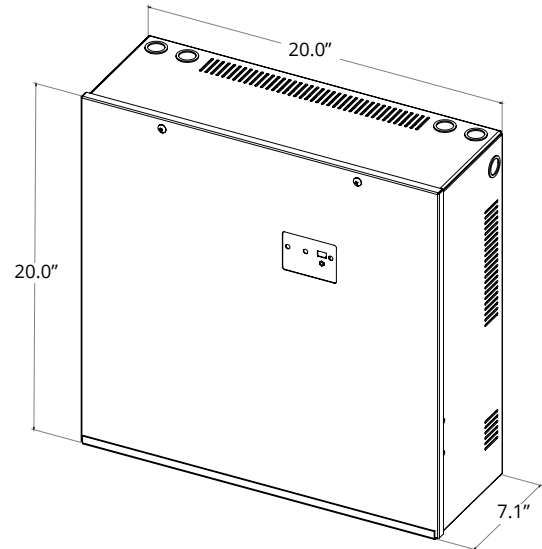
E3MINI 250W



E3MINI 375W



E3MINI 550W



WEIGHTS

MODEL	WEIGHT
125	33 lbs.
125 T-Bar	38 lbs.
250	68 lbs.
375	100 lbs.
550	120 lbs.



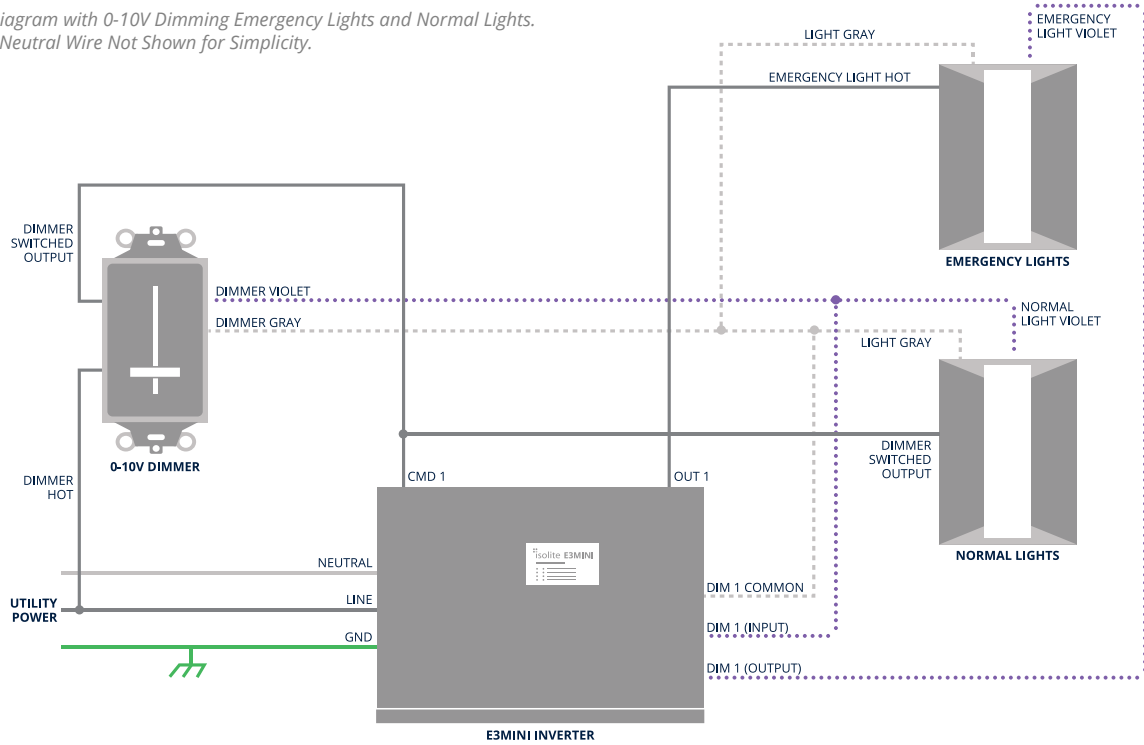
E3MINI

Pure Sine Wave Mini Inverter



MINI INVERTER WITH DIMMING INTERFACE OPTION

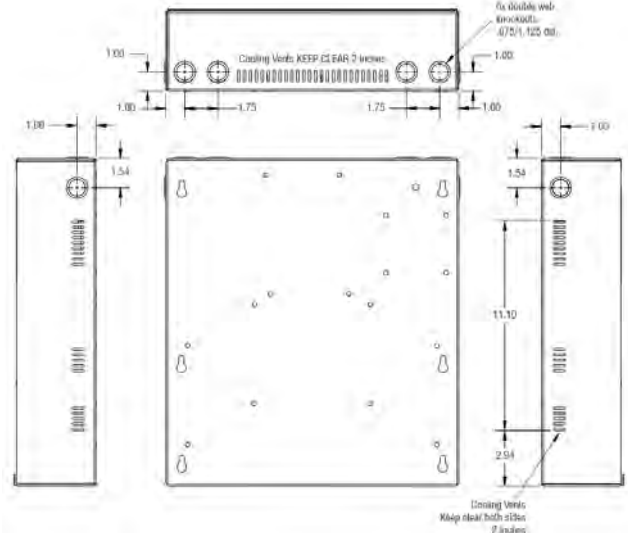
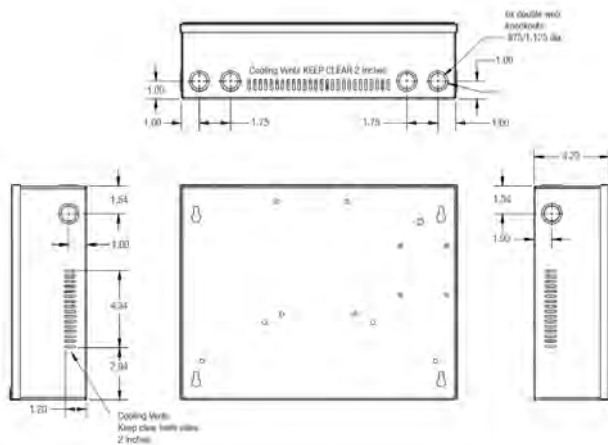
Wiring Diagram with 0-10V Dimming Emergency Lights and Normal Lights.
Lighting Neutral Wire Not Shown for Simplicity.



KNOCKOUT LOCATIONS

E3MINI 125W

E3MINI 250W





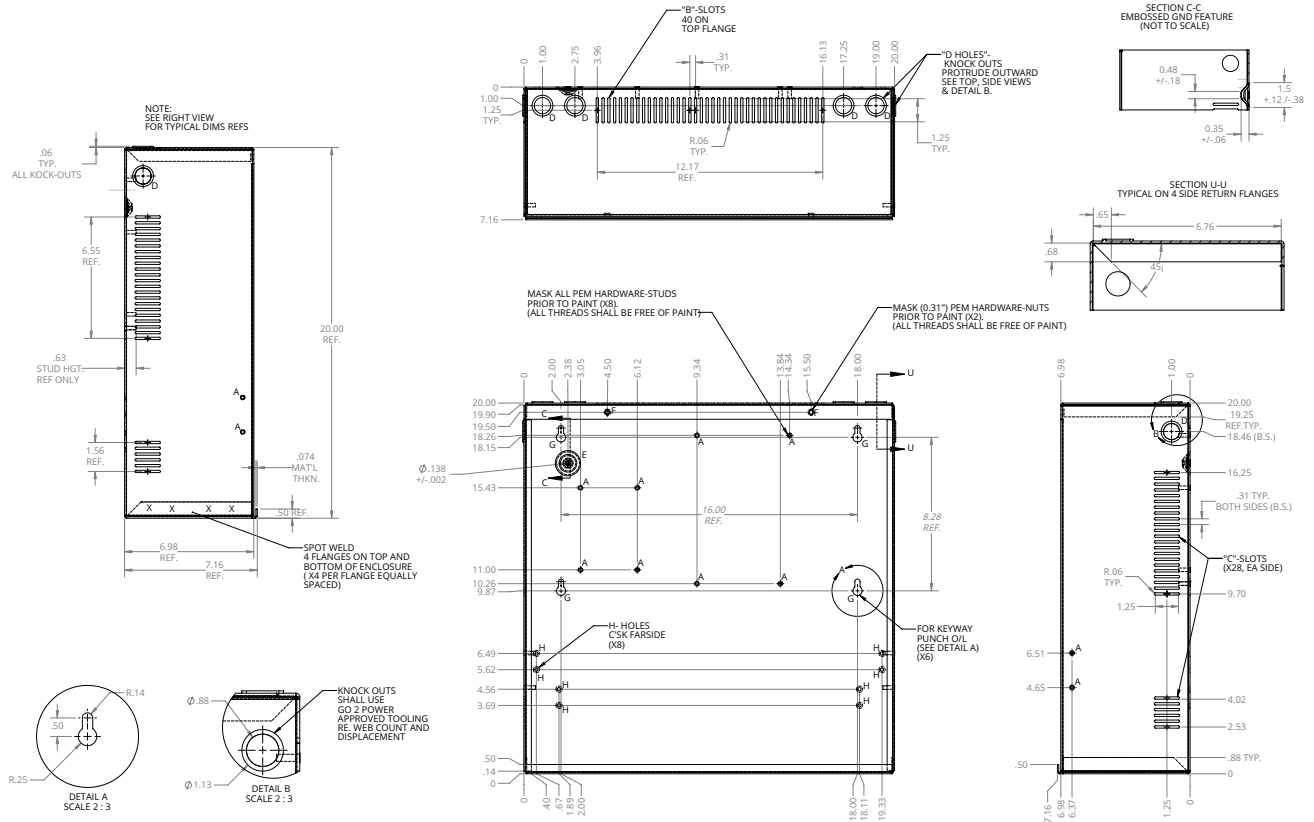
E3MINI

Pure Sine Wave Mini Inverter



KNOCKOUT LOCATIONS (CONTINUED)

E3MINI 375W / 550W





Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
E3MINI-250-LC-MB-FD

Notes:

Type:
INV1

LDI24-110942

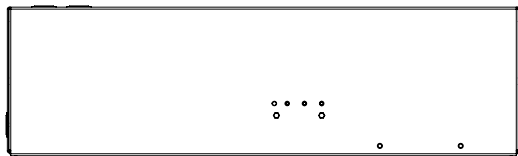
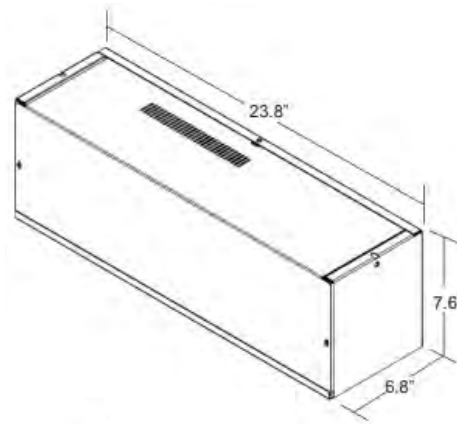
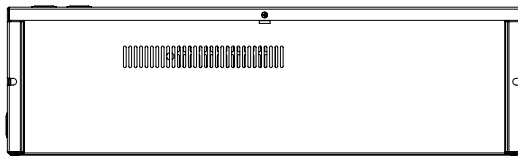
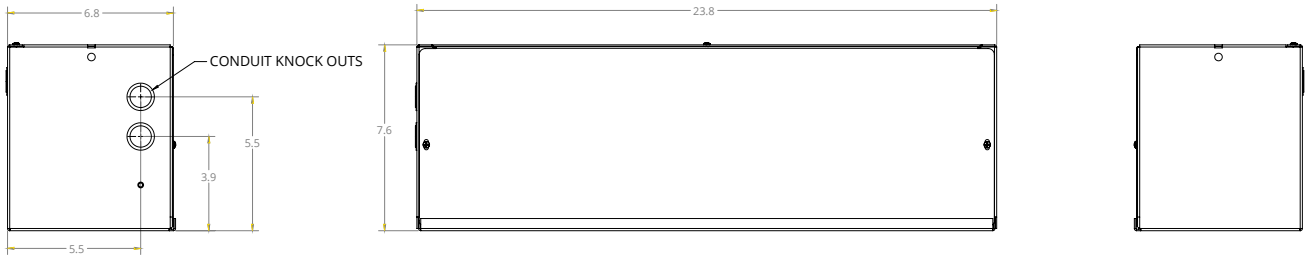


E3MINI

Pure Sine Wave Mini Inverter



CEILING GRID MOUNTING



**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

E3MINI-550-LC-MB-FD

Notes:

Type:

INV2

LDI24-110942

**E3MINI**

Pure Sine Wave Mini Inverter

DATE:

COMMENTS:

PROJECT

FEATURES

- Field-selectable 120 or 277 VAC input/output.
- 1X normally-on and 3X configurable normally-off/switched for 125VA and 250VA models. 1X normally-on and 4X configurable normally-off/switched output types for 375VA and 550VA models.
- Microprocessor controlled pure sine wave output with less than 3% THD and crest factor up to 10X (125VA), 5X (250VA), 7.5X (375VA), and 5X (550VA).
- Advanced startup and charger/inverter diagnostics prevent failures from wiring errors, overloads, and application issues.
- Front facing module allow for easy field wiring of AC input/output wires and all system connections/interfaces.
- Advanced hysteric ultra-efficient charger improves efficiency and extends battery lifetime.
- Approved by UL 924 and CSA 22.2.
- Includes self-testing/self diagnostics.
- Optional internal DALI/0-10V dimming interface allows for up to three (125/250VA) or four (375/550VA) independent zones and allows for five different dimming presets to adjust emergency lighting levels.
- High purity, premium valve regulated lead acid (VRLA) batteries with lead-calcium plates provide long life and durability.
- Max connected load with dimmer option is 375VA for the 125VA and 250VA models, and 1,125VA for the 375VA and 550VA models (non-EM mode).



CLICK THE IMAGE TO VIEW ALTERNATE PRODUCT PHOTOS
Only available with Adobe Acrobat and Acrobat Reader

ORDERING INFORMATION E3MINI-125-LC-MB

1. SERIES	2. VA RATING	3. BATTERY TYPE	4. MOUNTING	5. OPTIONS
E3MINI	-	LC	-	-
	125 125VA 250 250VA 375 375VA 550 550VA	LC Lead Calcium	MB Back Mount MCG Ceiling Grid ^{1,3}	BLANK = NO OPTION FD 0-10V/DALI Dimming & Fire Alarm Interface RT Remote Diagnostic Status Display Panel for Back Mount Inverters AA Audible Alarm (Buzzer) CL Canada Listed EB Extended Run Time (2h) ² Z4 Seismic Zone 4 Restraints

ORDERING NOTES

- Only available with 125VA unit.
- Capacity reduced to 100VA, 200VA, 300VA, and 440VA respectively.
- Remote Diagnostic Status Display Panel (RT) included with MCG mounting.

ACCESSORIES; ORDER SEPARATELY

- E3MINI-FPS** = E3MINI 125/250/375/550 Factory Phone Startup (per unit)
NOTE: INCREASES ELECTRONICS WARRANTY TO 5 YEARS
- TLRT** = Infrared Remote Control for Industrial Products

**Job Name:**

South Dade Regional Library_Specifications_110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:

E3MINI-550-LC-MB-FD

Notes:

Type:

INV2

LDI24-110942

**E3MINI**

Pure Sine Wave Mini Inverter

**SPECIFICATIONS****INPUT**

- Field-selectable 120 or 277 VAC input/output.
- Current: 1.4A (120V), or 0.6A (277V) for 125VA model.
- Current: 2.7A (120V), or 1.2A (277V) for 250VA model.
- Current: 4.10A (120V), or 1.19A (277V) 375VA model.
- Current: 5.95A (120V), or 1.98A (277V) 550VA model.
- Frequency: 60Hz +/- 2 Hz
- Protection: easy access 8A fast acting 5x20mm fuse.
- Power Factor: 0.5 lead to 0.5 lag

OUTPUT

- Voltage: 120 or 277 VAC and matches input selection.
- Current: 1.04A (120V), or 0.45A (277V) for 125VA model.
- Current: 2.08A (120V), or 0.9A (277V) for 250VA model.
- Current: 3.12A (120V), or 1.35A (277V) 375VA model.
- Current: 4.85A (120V), or 1.98A (277V) 550VA model.
- Frequency: 60Hz +/- 0.02 Hz crystal controlled during emergency mode.
- Overload: 110% will generate overload fault.
- Configurable Transfer Times: 50ms, 1s (default), or 2s
- Output Distortion: less than 3% THD
- Crest Factor: 10X for 125VA, 5X for 250VA, 7.5X for 375VA, and 5X for 550VA model
- Load Power Factor: 0.5 lead to 0.5 lag
- Output Types: 1X normally-on and 3X configurable normally-off/switched for 125VA and 250VA models. 1X normally-on and 4X configurable normally-off/switched for 375VA and 550VA models.
- Max Connected Load w/ Dimmer Option: 375VA for the 125VA and 250VA models and 1,125VA for the 375VA and 550VA models (non-EM mode).

BATTERY

- Type: premium long life valve-regulated lead acid (VRLA)
- Charger: three rate charger temperature compensation
- Recharge Time: 24 hour recharge
- Protection: automatic low voltage disconnect (LVD) set at 1.67 VPC.
- Automatic restart upon utility return.
- Runtime: 90 minutes at 25C°
- DC Voltage: 24 VDC nominal, 2.27 VPC float, temperature compensated
- DC Current: 6.12/12.4 ADC nominal (125/250VA Model)
- DC Current: 18.25/27 ADC nominal (375/550VA Model)

ENVIRONMENTAL

- Operating Temp: 20C° to 30C° (68°F to 86°F)
 - Storage Temp:
Electronics - 20C° to 70C° (68°F to 158°F)
- | BATTERY STORAGE TEMP | |
|----------------------------|----------|
| 51°F (11°C) TO 77°F (25°C) | 180 DAYS |
| 78°F (26°C) TO 92°F (33°C) | 90 DAYS |
- Relative Humidity: <95% (non-condensing)

PHYSICAL

- Cabinet: NEMA Type 1 enclosure with 16 AWG powder painted CRS.
- Cooling: natural convection – no fans
- Electrical knockouts (EKO's) for 1/2" and 3/4" conduit provided on three surfaces.

WEIGHT

- 125VA: 33 lbs.
- 125VA T-Bar: 38 lbs.
- 250VA: 68 lbs.
- 375VA: 100 lbs.
- 550VA: 120 lbs.

APPROVALS

- UL 924 certified
- New York City approved, Calendar Number 51575
- NFPA101 Life Safety Code
- NFPA70-NEC
- OSHA certified
- NEMA Type 1 enclosure
- NEMA 410 load tested up to 375VA (125/250VA Model) and 1,125VA (375/550VA Model).

WARRANTY

- Isolite warrants the E3 Series electronics assembly against defects in material and workmanship for a period of 3 years.
- Isolite warrants the lead calcium batteries for 3 years full and 7 years pro-rata limited.
- For further details, refer to General Warranty and Obligations in the Isolite manual or on our website.



Job Name:
 South Dade Regional Library_Specifications_
 110942_1st_Out_2024.06.28_PG
 Architect: Forbes Architects (Coral Gables)

Catalog Number:
 E3MINI-550-LC-MB-FD

Notes:

Type:
INV2

LDI24-110942






E3MINI

Pure Sine Wave Mini Inverter



FRONT PANEL

NEU LINE CMD 1 CMD 2 CMD 3 N-ON OUT 1 OUT 2 OUT 3	AC INPUT 12 - 16 AWG AC OUTPUT 12 - 16 AWG	AC FUSE -8A  Replace only with little fuse 0477008.MXP	<table border="1"> <thead> <tr> <th style="color: red;">Charger Faults</th> <th style="color: red;">Inverter Faults</th> <th style="color: red;">Startup Faults</th> </tr> </thead> <tbody> <tr> <td> ● LED 1 1/ Over-Temperature 2/ Voltage Select Jumper 3/ AC Fuse 4/ Charger/Inverter </td> <td> ● LED 2 1/ Over-Temperature 2/ Voltage Select Jumper 3/ Back-feed 4/ Overload 5/ Inverter </td> <td> ● LED 1 & 2 1/ Incorrect AC 2/ Voltage Select Jumper 3/ Transformer Wiring 4/ Low Battery 5/ Overload 6/ Inverter 7/ Back-feed </td> </tr> </tbody> </table> <p>⚡: Red LED Strobe Qty. = Fault Type</p>	Charger Faults	Inverter Faults	Startup Faults	● LED 1 1/ Over-Temperature 2/ Voltage Select Jumper 3/ AC Fuse 4/ Charger/Inverter	● LED 2 1/ Over-Temperature 2/ Voltage Select Jumper 3/ Back-feed 4/ Overload 5/ Inverter	● LED 1 & 2 1/ Incorrect AC 2/ Voltage Select Jumper 3/ Transformer Wiring 4/ Low Battery 5/ Overload 6/ Inverter 7/ Back-feed	Replace only with little fuse 0297025.WXN DC FUSE-25A BATTERY			
Charger Faults	Inverter Faults	Startup Faults											
● LED 1 1/ Over-Temperature 2/ Voltage Select Jumper 3/ AC Fuse 4/ Charger/Inverter	● LED 2 1/ Over-Temperature 2/ Voltage Select Jumper 3/ Back-feed 4/ Overload 5/ Inverter	● LED 1 & 2 1/ Incorrect AC 2/ Voltage Select Jumper 3/ Transformer Wiring 4/ Low Battery 5/ Overload 6/ Inverter 7/ Back-feed											
120 VAC 277 VAC	 120/277 VOLTAGE SELECT JUMPER 	<p>See Product Installation/Operation Manual</p> <p>Rotate DIM ADJ (5 presets) to adjust emergency-mode dimming level. Press appropriate TEST button to energize load and verify adjustment.</p> <p>DO NOT OVERLOAD</p>	E3MINI The Emergency Lighting Experts ● Chg. ● Inv. ● SYSTEM TEST ●	ON OFF REMOTE									
Emergency 0-10 / DALI Dimmer Interface		<table border="1"> <thead> <tr> <th style="background-color: red; color: white;">TEST</th> <th style="background-color: blue; color: white;">TEST</th> <th style="background-color: yellow; color: black;">TEST</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"> 20% 100% DIM ADJ. </td> <td style="text-align: center;"> 20% 100% DIM ADJ. </td> <td style="text-align: center;"> 20% 100% DIM ADJ. </td> </tr> <tr> <td style="background-color: red; color: white; text-align: center;">OUT 1</td> <td style="background-color: blue; color: white; text-align: center;">OUT 2</td> <td style="background-color: yellow; color: black; text-align: center;">OUT 3</td> </tr> </tbody> </table>			TEST	TEST	TEST	 20% 100% DIM ADJ.	 20% 100% DIM ADJ.	 20% 100% DIM ADJ.	OUT 1	OUT 2	OUT 3
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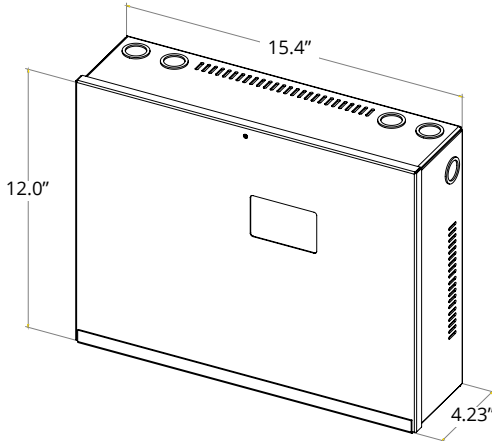
E3MINI

Pure Sine Wave Mini Inverter

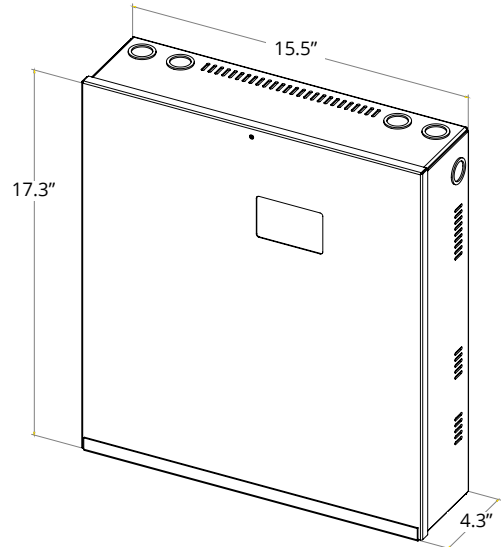


DIMENSIONS

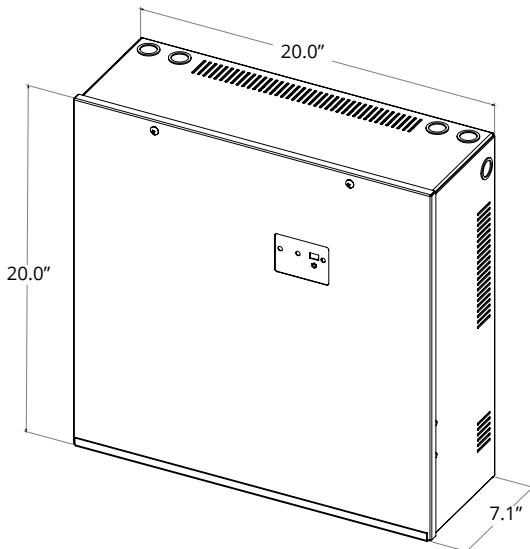
E3MINI 125W



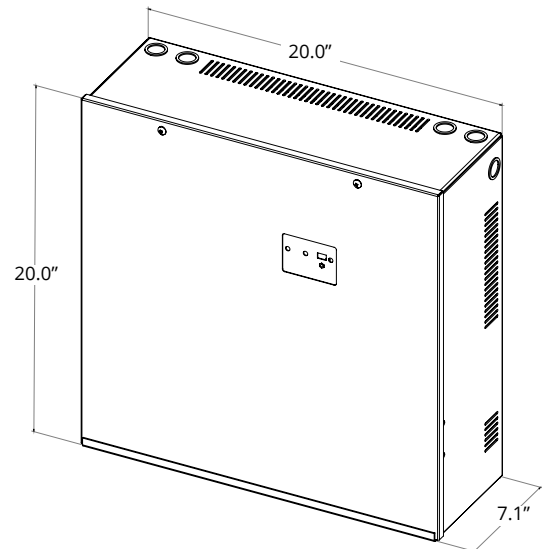
E3MINI 250W



E3MINI 375W



E3MINI 550W



WEIGHTS

MODEL	WEIGHT
125	33 lbs.
125 T-Bar	38 lbs.
250	68 lbs.
375	100 lbs.
550	120 lbs.



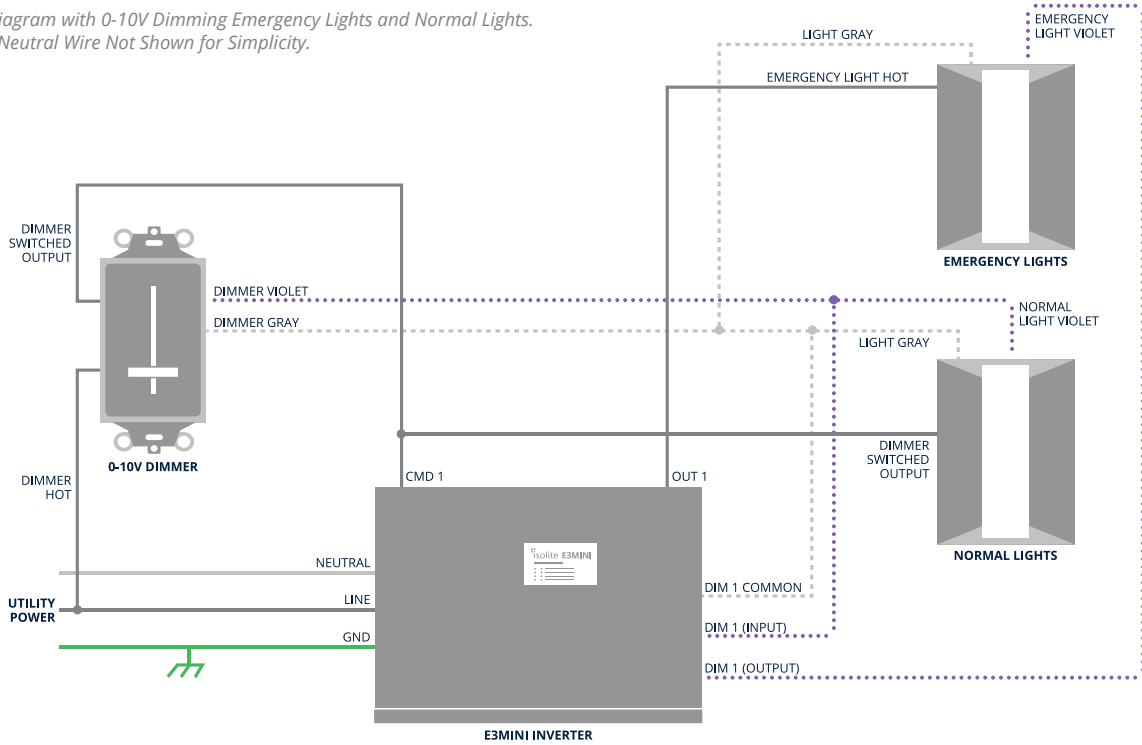
E3MINI

Pure Sine Wave Mini Inverter



MINI INVERTER WITH DIMMING INTERFACE OPTION

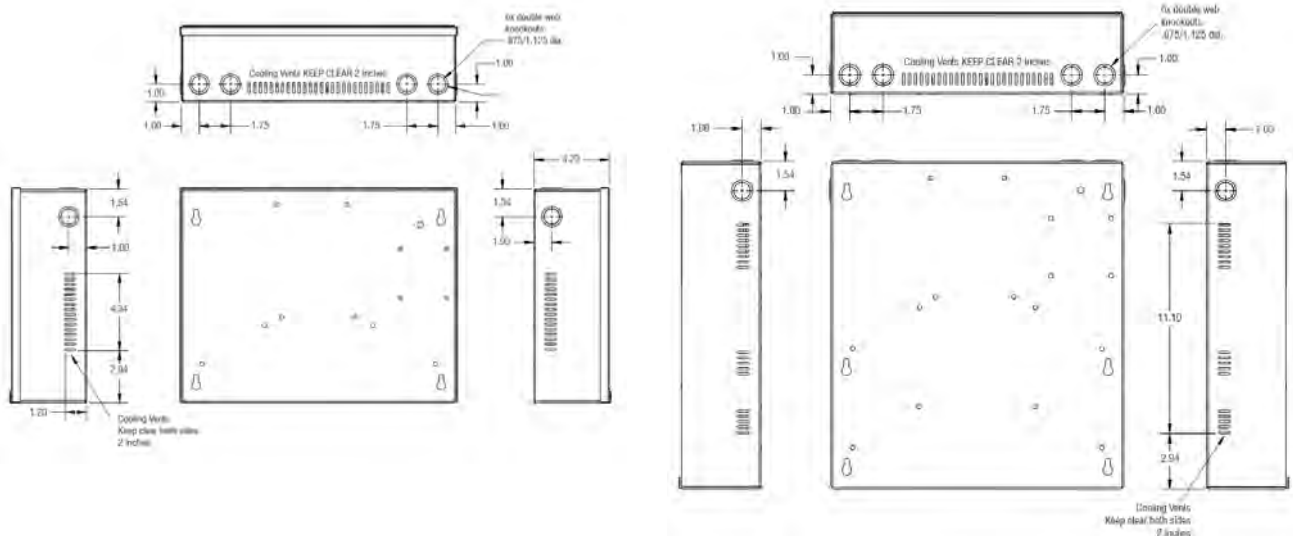
Wiring Diagram with 0-10V Dimming Emergency Lights and Normal Lights.
Lighting Neutral Wire Not Shown for Simplicity.



KNOCKOUT LOCATIONS

E3MINI 125W

E3MINI 250W





Job Name:
South Dade Regional Library_Specifications_
110942_1st_Out_2024.06.28_PG
Architect: Forbes Architects (Coral Gables)

Catalog Number:
E3MINI-550-LC-MB-FD

Notes:

Type:
INV2

LDI24-110942

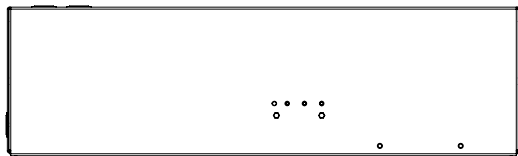
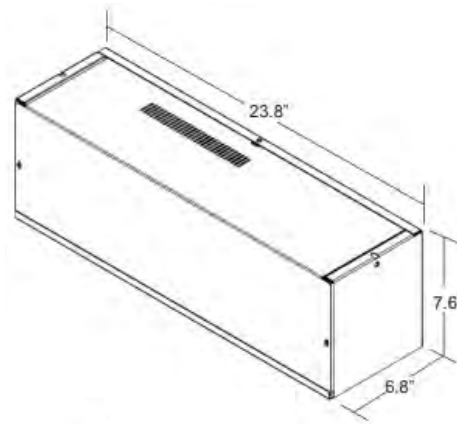
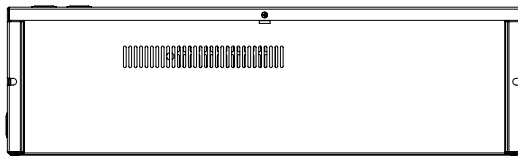
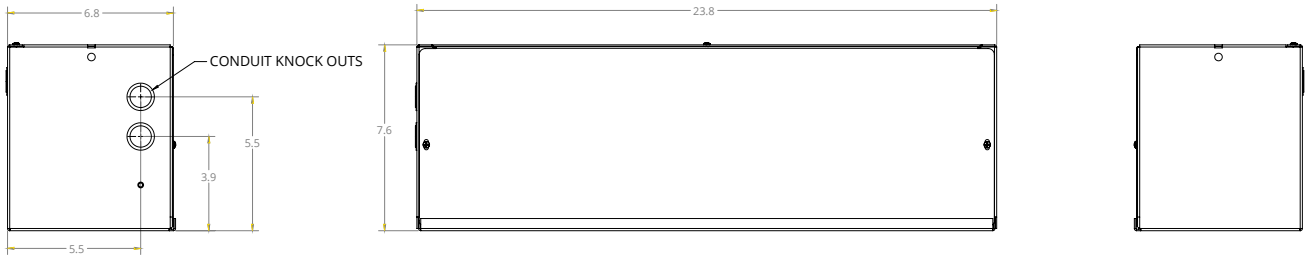


E3MINI

Pure Sine Wave Mini Inverter



CEILING GRID MOUNTING



MIAMI-DADE PUBLIC LIBRARY SYSTEM
VOLUME II
PROJECT MANUAL
DIVISION 27- COMMUNICATIONS

**Low Voltage & Audiovisual
(Design-Build Component Standards)**

South Dade Regional Library Interior Renovations

C23-MDPLS-01-ESP



271000	Structure Cabling Standards
274000	Audiovisual Design Requirements
272133	Wireless Access Points



**SECTION 271000
STRUCTURE CABLING**

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ART 1 - GENERAL SPECIFICATIONS

1.1 SCOPE

- A. This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling at new or remodeled buildings for the end user. Backbone and horizontal cabling comprised of copper and fiber cabling, and support systems (new building projects & floor/building retrofit) are covered under this document.
- B. The types of installation work covered under this document are defined as New Builds, Projects, and Moves Adds and Changes (MAC). New build is defined as a project where the building is a new build from the ground up. A Project is defined as anything that is greater than 10 drops and is inside of an existing facility. MACs are defined as projects where there are 10 or less drops to be installed, removed, or changed. MACs should be kept to the standard of the current cable plant that is installed at that site.
- C. The Horizontal (workstation) Cabling System may have multiple types of outlets in each end user office including, but not limited to wall-mounted voice/data, floor-mounted voice/data, furniture-mounted voice/data, and ceiling mounted data. Product specifications for each type of work area outlet are noted in the Products Section. Only one cable will be ran for each outlet.
- D. The horizontal cables shall be 4-pair plenum or riser rated UTP Category 6 for all data terminations. The cables shall be installed from the Work Area Outlet to the appropriate Telecommunications Room (TR) and routed to the appropriate, 48-port patch panels, serving that area and terminated as specified in this document. The standards recommend (2) Category 6A for each WAP unless otherwise noted.
- E. The Data Backbone shall consist of minimum 12-strand interlocking armored, plenum rated tight buffered, multi-mode 50/125 um. The data backbone shall be designed with an OM4 minimum standard capable of accommodating 10G uplinks to IDF's. Fiber strand count should be the greater quantity of either 12 strands or 200% of initial minimum required strand count. Fiber optic strands shall be terminated with LC connectors at each end, within a rigid fiber enclosure. Wherever possible, the box should be mounted at the top of the data rack.
- F. The Audio-visual Cabling will be provided by the A/V design and install vendor. Coordination with the Audio-visual contractor will be necessary for determination of pathways and spaces.
- G. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document and shall meet or exceed local codes.



- H. The Cable Pathway Systems consist of ladder racks, trade size 4" sleeves, cable hangers and wire basket tray that conceal, protect, support, and provide access to telecommunication cables between MDF/IDF and the user's workspace.
- I. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. **If the bid documents are in conflict, this document takes precedence, but discrepancies must be reviewed with the end user or their owner representative.** The successful vendor shall meet or exceed all requirements for the cable system described in this document.

1.2 REGULATORY REFERENCES:

- A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code, ANSI/TIA or ISO standards and present manufacturing standards.
- B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
- C. All category 6 and 6A components (i.e. modular jacks, patch cords and patch panels) performance shall be verified (not just tested) by a third party (ETL) to be component and channel compliant.
- D. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards.
- E. If this document and any of the documents listed are in conflict, then the more stringent requirement shall apply. All documents referenced are believed to be the most current releases. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
- F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.



1.3 APPROVED VENDORS

- A. The Telecommunications Contractor must be an approved Ortronics, a Legrand brand, Certified Contractor at the Certified Installer Plus (CIP) tier. Where CIP contractors are not available, the approved Telecommunication Contractor may be CIP with written approval from Legrand and the end user. The approved Telecommunication Contractor will adhere to all CIP protocols. A copy of the CIP protocols is attached in appendix A for reference. A current copy of the telecommunications contractor's certificate and a letter from Legrand stating that the Contractor Company's certification at the CIP tier is current and in good standing must be submitted with the quote in order for such quote to be valid. For the Telecommunications Contractor to be current with Legrand, the training must be current at the time of quoting the project. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Legrand Contractor Certification Program. The Telecommunications contractor must also register the project and submit test data for approval, per the requirements of the nCompass™, Legrand and Superior Essex certification program guidelines. Once approved, Legrand will extend an nCompass Limited Lifetime Warranty to the end user.

1.4 APPROVED PRODUCTS

- A. Approved 4-pair UTP Cable manufacturer: Superior Essex
- B. Approved Optical Fiber Cable manufacturers: Superior Essex
- C. Approved UTP connector product manufacturer: Legrand
- D. Approved Fiber Optic cabinet product manufacturer: Legrand
- E. Approved Fiber Optic connectors/splices/couplers manufacturer: Legrand
- F. Approved Rack and Cabinet manufacturer: Legrand
- G. Approved Cable Management and Ladder Rack manufacturer: Legrand
- H. Approved Copper Patch Panel manufacturer: Legrand
- I. Approved UTP Patch Cord manufacturer: Legrand
- J. Approved Fiber Optic Patch Cord manufacturer: Legrand
- K. Approved Cable Tray or Basket Tray or Wire-mesh manufacturer: Cablofil, a Legrand brand



- L. All products must be able to provide documentation for sustainability. LEED or WELL accreditation may be necessary. Documentation to include PEP (Product Environmental Profile), EPD (Environmental Product Declaration) or HPD (Health Product Declaration) will be necessary.
- M. Legrand is the manufacturer of Ortronic racks, cabinets, copper and fiber connectivity, Wiremold pathways, poke-thru and floor boxes, Cablofil cable tray and J Hooks as well as Server Tech and Raritan PDUs.

1.5 WORK INCLUDED

- A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system whether specifically addressed in the technical specifications or not. All materials shall be new. Used or refurbished equipment is not permitted. Provide equipment in the original packaging wherever practical.
- B. The work shall include, but not be limited to the following:
 - 1. Furnish and install a complete telecommunications wiring infrastructure.
 - 2. Furnish, install, and terminate all UTP and Optical Fiber cable
 - 3. Furnish and install all wall plates, jacks and patch panels.
 - 4. Furnish and install all required cabinets and/or racks as required and as indicated.
 - 5. Furnish any other material required to form a complete system.
 - 6. Perform permanent link or channel testing (100% of horizontal and/or backbone links/channels) and certification of all components. If testing in a channel configuration, patch cord used for testing must be left in place after testing to maintain original channel that was tested.
 - 7. Furnish test results of all cabling to the owner on disk, listed by each closet, then by workstation ID.
 - 8. Adhere and comply with all requirements of Legrand Certification program.
 - 9. Provide owner all documentation including testing for 100 % of the links/channels in approved tester's original electronic format and As-built drawings.
 - 10. A warranty certificate shall be provided to owner for project. Project will not be considered completed until certificate is received and may delay final payment until certificate is received.

1.6 SUBMITTALS

- A. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:
 - 1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
 - 2. Submit proof from manufacturer of contractor's good standing in manufacturer's program.



3. Submit appropriate cut sheets and samples for all products, hardware and cabling.
- B. Work shall not proceed without the owner or owner's representative approval of the submitted items.

1.7 QUALITY ASSURANCE

- A. The Legrand CIP telecommunications contractor shall be a company specializing in communication cabling installation. At least 3 of the Certified Contractor's technicians on their installation and termination crew must be certified by Legrand, or BICSI with a Technicians or ITS Installer 2 level of training.
- B. Delivery and receipt of products shall be at the site described in the Scope Section of the specific project documents.
- C. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If necessary, cable shall be stored off site at the contractor's expense.
- D. During the installation, and up to the date of final acceptance, the Telecommunications Contractor shall be under obligation to protect his finished and unfinished work against damage and loss. The Telecommunication Contractor shall also be under obligation to protect the finished work of other contractors while the communication installation is underway.
- E. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the owner.
- F. Installation Reference Standards (all codes and standards compliance will be to the most current revision available), including applicable addendums. Cable installation shall comply with the following:
 1. NEC® 2020, National Electric Code, 2020. Use the most current revision for the location.
 2. ANSI/TIA-568.0: Generic Communication Cabling for Customer Premises.
 3. ANSI/TIA-568.1: Commercial Building Telecommunications Infrastructure Standard.
 4. ANSI/TIA-568.2: Balanced Twisted Pair Telecommunications Cabling and Components Standard.
 5. ANSI/TIA-568.3: Optical Fiber Cabling Standard.
 6. ANSI/TIA-569: Telecommunications Pathway and Spaces.
 7. ANSI-TIA-606: Administration Standard for Telecommunications Infrastructure.
 8. ANSI/TIA-607: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.



9. ANSI/TIA-758: Customer Owned Outside Plant Telecommunications Infrastructure Standard.
10. ANSI/TIA-526-7: Optical Power Measurements of Installed Single Mode Fiber Cable.
11. TIA-526-14: Optical Power Loss Measurements of Installed Multimode Fiber Cable.
12. TIA-598: Optical Fiber Cable Color Coding.
13. BICSI-TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual.

1.8 DRAWINGS

- A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.
- B. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.
- C. Prior to submitting the bid, the telecommunications contractor shall call the attention of the Engineer to any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work omitted.
- D. As Built CAD Drawings shall be submitted at the final completion of the project prior to final payment. The drawings shall show all pathways, outlet locations and outlet labeling. Provide in both hard and soft copy to the owner.

1.9 WARRANTY

- A. All projects will be installed and tested to fulfill the requirements for an nCompass™ Limited Lifetime Product and Application Assurance Warranty. This warranty will be required as described below for the following systems or system components.
 1. Superior Essex Communications LP and Legrand warrant to the owner that the nCompass CAT 6 U/UTP, Copper certified network cabling system installations will meet the defined TIA-568 series industry specifications in effect at the time of product purchase for (40) years from date of product installation. Wireless access points will be tested to Category 6A standards and warranted for a Limited Lifetime (40 years).
 2. The nCompass Limited Lifetime Product and Application Assurance Warranty will be extended to include the entire channel provided that the applicable Legrand patch cords and Legrand equipment cords are utilized, and all products are installed within areas protected from outside elements. Channel warranties will support current or future applications that are approved by industry recognized organizations (IEEE, ANSI/TIA) for transmission over structured cabling systems defined by the TIA-568 standard in effect at the time of the installation. Channel warranties will perform to the specifications listed in the nCompass system data sheets in effect at the start of the



installation. Legrand will carry the warranty on the nCompass Limited Lifetime Product and Application Assurance Warranty for (40) years from the installation of the nCompass cabling System.

- B. Telecommunication Contractor must submit the following to Legrand:
 - 1. Warranty Application properly completed online.
 - 2. Test results submitted only in electronic format for the copper systems. (Note: hard copies will not be accepted.) The test results must be submitted in original native tester format.
 - 3. All tests must result in a PASS. Pass* (marginal pass) and Fail are not acceptable test results.
 - 4. Each permanent link or channel in the network must be field tested in accordance with the TIA-568 series industry standard AND nCompass testing requirements in force at the time of purchase (nCompass testing requirements take precedence over TIA when differences exist). The installed permanent links and channels must have passed all applicable TIA and nCompass performance requirements. Minimum testing for copper systems Includes Wire Map, Length, Attenuation, Near End Crosstalk, Far End Crosstalk, Return Loss, PSNEXT, ELFEXT, PSELFEXT.
 - 5. Minimum testing for Fiber Optic links Includes horizontal and backbone, Bi-Directional Dual Wavelength, Insertion Loss and Length.
- C. The warranty must be submitted on the Legrand ConCert portal for review.
- D. Once the materials are reviewed, the telecommunication contractor will be notified in writing of acceptance or rejection. If the project is accepted, the Contractor will receive a copy of the signed warranty certificate for the owner. At that time, the telecommunications contractor shall forward the signed warranty registration certificate to the end user.

PART 2 - PRODUCTS

2.1 EQUIVALENT PRODUCTS

- A. Due to the nature and type of communications, all products for the purpose of this document, including but not limited to the following, shall have no substitutions allowed.
 - 1. Faceplates, jacks, patch panels, patch / equipment cords and horizontal cable management shall be manufactured by Legrand
 - 2. Fiber optic connectors and splices shall be manufactured by Legrand
 - 3. Fiber optic enclosures and adapters shall be manufactured by Legrand or equivalent manufacturer
 - 4. Racks and vertical cable management shall be manufactured by Legrand or equivalent.



5. Copper cable products shall be manufactured by Superior Essex
6. Fiber optic cable shall be manufactured by Superior Essex
7. Power Distribution Unit (PDU) shall be manufactured by Server Technology

2.2 WORK AREA OUTLETS

The following types of communication outlets shall conform to meet the type of desired mounting application.

Install all outlets in accordance with the construction drawings and configurations shown below.

The T568B wiring scheme shall be used for voice and data jack termination.

A. Wall-Mounted Work Area Outlets (WAO)

1. The WAO shall consist of one flush mount, single gang TracJack, Fog White faceplate with TracJack modules used for data and voice transmission. For White faceplates, -88 is added to the part number to signify white.
2. Approved surface mount box may be used where appropriate.
3. Unused jack positions in faceplate or surface mount box shall have blank covers inserted, color-matched to faceplate.
4. Acceptable part numbers:

Part Number	Color	Description
OR-40300548	Fog White	Single gang, 2-module TracJack faceplate
OR-40300546	Fog White	Single Gang, 4-module TracJack faceplate
OR-404TJ2	Fog White	Surface housing for TracJack - holds 2 modules
OR-40300633	Fog White	Furniture Plate (4 port)
OR-TJ600	Fog White	TracJack category 6 module
OR-TJ600-36	Blue	TracJack Category 6
OR-42100002	Fog White	Blanks (10/package)



- B. Wall mounted voice and data WAO, Category 6
 - 1. The WAO will consist of one flush mount, single gang TracJack faceplate in FogWhite with minimum of (2) Category 6 modules – **Blue** or **fog white** module as determined by Miami Dade County ITD.
- C. Modular furniture voice and data workstation outlets
 - 1. For areas of furniture, and where indicated in project documentation, flush mount faceplate configurations will be used.
 - 2. Steelcase furniture and all other furniture locations shall use surface mount box.
 - 3. Acceptable jack part numbers listed above are the same as Section B.

2.3 PATCH PANELS

The following types of modular patch panels shall be installed in accordance with the construction drawings and configurations defined and shown below.

- A. Patch Panels for data/voice applications shall
 - 1. Be used for termination of data station cables
 - 2. Data patch panels will be located at the within the rack. All data locations shall be sequential with wireless access points also within the patch panel and sequential as well.
 - 3. Patch panel for data terminations will be flat patch panels unless otherwise noted by Miami Dade County ITD. Where flat panels are used, horizontal management must also be utilized within the racks.
 - 4. Rear cable management bars must be installed, and cables neatly routed and secured to bars included with patch panels. There shall be one rear cable management bar for every 24 modular patch panel ports.
 - 5. Labeling shall be clearly marked using the labeling scheme determined by the end user.

Part Number	Description
OR-PHD66U24	24 port flat patch panel, 1 RU
OR-PHD66U48	48 port flat patch panel, 2 RU
OR-PHA66U48	48 port angled patch panel, 2 RU



2.4 RACKS, CABINETS, AND CABLE MANAGEMENT

The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack. Waterfall cable management may be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels, adding protection and to maintain proper bend radius and cable support. Horizontal cable management shall also be mounted where noted on project drawings and/or where specified on racks and above or below equipment on the rack.

Rack shall be black in color. Racks must also be available in white at the owner’s discretion.

All rack, cabinet and cable management installations shall strictly adhere to BICSI, ANSI and TIA installation guidelines to insure maximum performance, protection, space usage and power and thermal management efficiencies.

Rack selection is based on size of space and application as defined on plans and acceptance from Miami Dade County ITD Engineer.

Free Standing Racks, Vertical Managers and Accessories

A. Free-Standing Racks and Vertical Management

Free-standing Racks shall:

1. Provide the necessary strain relief, bend radius and cable routing for proper installation of high-performance cross connect products, meeting all specifications of ANSI/TIA-568 current standard.
2. Be self-supporting and secured to the floor
3. Have EIA hole pattern on front and rear.
4. Be available in BOTH black and white
5. Be correctly bonded and grounded
6. The racks shall be as specified here:

Part Number	Description	Manufacturer
OR-MM20706-B	7'H x 6.5"D, Channel Rack, Black	Legrand
OR-MM200710-B	7'H x 10.5"D, Channel Rack, Black	Legrand
OR-MM20716-B	7'H x 16"D , Channel Rack, Black	Legrand
OR-MM20PDUMB1D1W-B	PDU Button Mount Bracket	Legrand



B. Cable Management – Vertical Between Racks and End of Row

1. A minimum 6.4” wide vertical cable manager with cover shall be utilized and installed between racks and at each end of the row.
2. Black, single-sided vertical cable management with switch-gate door/cover
3. Like manufacturer shall be used for Rack and Cable Management
4. Dual Hinged designed for right or left door opening
5. Must come with Cable Management Spools to manage excess cables in the manager.
6. The acceptable vertical cable management at the recommended 40% fill rate:

Part Number	Description	Manufacturer
OR-MM20VMD706-B	7’h x 6.5”w x 10.25”d front vertical manager with latching door. Fill rate capacity 600 Category 6 cables	Legrand
OR-MM20VMD710-B	7’h x 10.5”w x 15”d front vertical manager with hinged cover. Fill rate capacity 980 Category 6 cables	Legrand
OR-MM20VMD712-B	7’h x 12.5w x 15”d front vertical manager with latching door. Fill rate capacity 1120 Category 6 cables	Legrand
OR-MM20VMD716-B	7’h x 16.25”wx 15”d front vertical manager with latching door. Fill rate capacity 1640 Category 6 cables.	Legrand

C. Cable Management – Horizontal Patch Cord Manager

1. 2 Rack Unit, black horizontal, single sided cable manager with hinged cover.
2. Use with flat copper patch panels, fiber optic enclosures and other areas where horizontal patch cord management is required.
3. The acceptable part number shall be

Part Number	Description	Manufacturer
OR-MM6HM6D2RU	2 RU Horizontal Manager, 3.5”H x 19”W, double sided	Legrand
OR-MM6HM62RU	2 RU, Horizontal Manager, 3.5” H x 19” W, single sided	Legrand



2.5 CABLE SUPPORT

Data and voice cable pathways shall run above the ceilings and shall be supported by cable hanger systems, ladder rack or wire mesh tray.

All backbone fiber shall be armored. The end user may determine to have horizontal fiber non armored.

The pathway design should allow for a minimum of two cable runs per individual workspace. Please see drawing for specific requirements and cable routing plan and design accordingly.

A. J Hooks

1. If Miami Dade County ITD determines that J Hooks are necessary, they will be hung using appropriate hardware as per local code.
2. Installation will meet the requirements of Legrand and Superior Essex for Category 6 cable standards. All J Hooks must be free of possible burrs. 2" J Hooks fill capacity of 60 Category 6 cables and 4" fill capacity of 150 Category 6 cables
- 3.

Part Number	Description	Manufacturer
CJ32HP.	2" plastic coated metal J Hook	Cablofil/LeGrand
CJ64HP	4" plastic coated metal J Hook	Cablofil/LeGrand

B. Ladder Rack

1. Ladder-racks are the standard for Miami Dade County ITD. The Ladder Rack issued for supporting cables in the MDF & IDF. Typical applications are 12" wide ladder-rack as needed, black in color.
2. Provide all connection and supports for the ladder-rack as required.
3. The ladder-rack shall be grounded and bonded as required by Article 250 of the NFPA 70 and adhere to local codes

Part Number	Description	Manufacturer
OR-TRT10-12B	12" Ladder-rack	Legrand
OR-P128240HB	Wall Angle Assembly	Legrand
OR-P820147H	Corner Clamp Kit	Legrand
OR-P987527H	J-Bolt Kit	Legrand
OR-TRP11-CM	Transition Pan	Legrand
OR-P820127H	Straight Clamp Kit	Legrand
OR-RCBK-6	Threaded Ceiling Kit	Legrand
OR-P982078H	Vertical Wall Bracket	Legrand
OR-P820527HB	Cable Bracket for pathway for power	Legrand
OR-MM20CRB16-B	Runway Bracket	Legrand
OR-GS-8	Grounding Kit	Legrand



C. Wire Mesh Tray

1. Where wire mesh tray is used in lieu of ladder rack, the tray shall be 2"x12" wire grid in nature and sized per NEC. Standard color is silver. Tray and splices shall be UL classified and fire resistant per E90 classification.
2. Products shall be Cablofil (a Legrand company). This includes all fittings which must be Cablofil original parts to support the program. No substitutions are allowed.
3. Wire Mesh Cable Loading

Tray Size	2X4	2X6	2X12	4X4	4X6	4X8
Part Number	CF54/100	CF 54/150	CF54/300	CF105/100	CF105/150	CF105/200
Cat 6 (0.23)	96	144	288	190	288	382
Cat 6A (0.25)	80	122	244	162	242	324



D. Cable Tie Wraps

1. Velcro or equivalent hook and loop cable tie wraps shall be used to manage and support cables every 3-5'. It shall be installed snug around data/voice cables without distorting cable jacket.
2. Velcro or equivalent hook and loop cable tie wraps shall be used for roper bundling of all cables in the MDF and IDF's.

2.6 HORIZONTAL DISTRIBUTION CABLE

All horizontal data station cable and voice cable shall terminate on modular patch panels (copper or fiber), or patch/splice cabinets (fiber) in their respective Telecommunications Room or Equipment Room as specified on the drawings and individual project scope.

Data cables shall be 4 pair, 23 AWG, 100-OHM UTP, plenum, category 6. The data module in a workspace outlet shall be served by one 4-pair cable. The outer jacket of the cable shall be in white in color. Part number is listed below.

Traditional voice services may be provided via VOIP (voice over IP) services. As such only a single data/voice cable is required to provide both voice and data services to the desktop. This single data cable shall be 4 pairs 23 AWG, 100-OHM UTP, plenum, category 6 all horizontal cabling. A total of four cables should be ran to comply with current ITD/AOC standards and allow for additional capabilities at the desktop.

All wireless access points shall have two (2) Category 6 cables to each WAP. The cables shall be 4 pair, 23 AWG, 100 OHM UTP, plenum, Category 6. The plenum cable shall be 0.23" in diameter. The cable must have a guaranteed margin of at least 7dB when installed as a system with Legrand jacks and patch cords. For installation of cables/cords, a two-port surface mount box (OR-404HDJ2) can be utilized. Cabling outer jacket shall be blue in color. Part Numbers are listed below.

A. 100 OHM UNSHIELDED TWISTED PAIR CABLE (UTP)

1. Design Make:

- a) Superior Essex Category 6 NextGain UTP

Part Number	Color
54-246-2B	Blue BrakeBox (CMP) Plenum
54-246-2A	Blue BrakeBox (CMR) Riser



2.7 BACKBONE CABLE

Multi-Mode or Single mode Fiber Optic Cable will be designed for the backbone. Multi-Mode fiber are 6/12/24-strand laser optimized 50/125 μm plenum rated, armored, tight buffered with Kevlar tensile strength membranes. Single mode fiber will be available in 6/12/24-strand. All fiber shall be UL listed OFNP unless otherwise determined by the owner or owner's representative.

A. Multimode Fiber: Optical Fiber Non-conductive Plenum (OFNP) Tight Buffered With 10 Gigabit Laser Optimized 50/125 Optical Fibers;

There are three distinct types of fiber; selection is based on site application. The color of the outer jacket will vary depending on type selected.

1. Each Multimode Fiber shall be:
 - a) Graded-index optical fiber wave-guide with nominal 50/125 μm -core/cladding diameter.
 - b) Laser optimized multi-mode fibers shall have a minimum effective modal bandwidth of 2000 MHz•km characterized using FOTP-220
 - c) Optical Fiber shall be laser optimized and guaranteed for 10 Gigabit Ethernet distances of 300m/300m for 850nm and 1300nm respectively
 - d) Optical Fiber shall be laser optimized and guarantee 1 Gigabit Ethernet distances of 1000m/600m for 850nm and 1300nm respectively
2. Physical Characteristics:
 - a) Shall be suitable for use in indoor applications.
 - b) Shall be suitable for use in risers, plenums and horizontal applications.
 - c) Shall be available with a fiber strand count range from 6 to 144 fibers.
 - d) Shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating.
 - e) Shall comply with the requirements of ICEA S-83-596.
 - f) Strength members shall be dielectric and may be either FGE/aramid/yarn.
 - g) Buffered fibers shall be color coded in accordance with ANSI/TIA-598 with an overall aqua jacket.
 - h) Shall have a ripcord for overall jacket.
 - i) Suitable for operation between -20°C to +75°C.
 - j) Shall be of an all-dielectric design.
3. Design Make:
 - a) Products being specified are at least OM4 rated and are differentiated by the link length (in meters) supported.
 - b) Acceptable part numbers are:



Part Number	Description
L4006P401	SPSX 6-strand multi-mode 50-micron OM4 interlocking-armored CMP fiber
L4012P401	SPSX 12-strand multi-mode 50-micron OM4 interlocking-armored CMP fiber
L4024P401	SPSX 24-strand multimode 50 micron OM4 interlocking armored fiber

- B. Single mode Fiber: If determined by Miami Dade County, single mode fiber will be installed instead of or in addition to the multimode fiber listed above. The standard will be Tight Buffer unless otherwise noted. All fiber strands shall be surrounded by synthetic yarn for added strength and crush resistance. The fiber core shall be 8.3 um typical. Jacket color will be yellow. Fiber color coding shall be in accordance with ANSI/TIA-598-D. Supporting distances must meet minimum of 5000m for 10GBase-LR and 10,000m for 10GBase-ER.

Single Mode Fiber Part Number	Description
44006K101	OFNP 6 strand
44012K101	OFNP 12 strand
44024KK01	OFNP 24 strand
43006K101	OFNR 6 Strand
43012K101	OFNR 12 Strand
43024KK01	OFNR 24 Strand

2.8 FIBER OPTIC CONNECTOR OPTIONS

1. Each LC Fiber Connector shall:
 - a) Be a Legrand pre-polished fiber connector
 - b) Be available in single mode and multimode versions
 - c) Have a domed zirconia ferrule.
 - d) Be a PC polish type connector.
 - e) Accept a nominal fiber diameter of 125 micrometers
 - f) Have a typical insertion loss of 0.1 dB for multimode and 0.1 dB for single mode
 - g) Connectors must be reusable
 - h) Have an insertion loss change of less than 0.2 dB after 500 reconnects.
 - i) Be stable over an operating range of -40°C to +75°C.
2. Design Make:

Part Number	Description
OR-205KNT9GA-50T	Multimode LC reusable fiber connector
OR-205KNT9SA-09	Single Mode LC reusable fiber connector



Note: It is the responsibility of the installation vendor to utilize the updated fiber tool kits for precision installation.

3. Fusion Splice on Connectors may be used in lieu of pre polished mechanical connectors. The splice on connectors must have an elongated boot that completely covers and protects the fusion splice area.
4. Design Make:

Part Number	Description
OR-205KNF9GA-50E	Multimode: LC Style Fusion Splice on Connector
OR-205KNF9SA-09	Single mode: LC Style Fusion Splice on Connector

2.9 FIBER OPTIC CONNECTING HARDWARE

1. Fiber optic coupler enclosures used may be 2U or 4U, depending on fiber density. Each Fiber Optic Coupler Enclosure shall:
 - a) Be available in rack mount 1U, 2U and 4U options
 - b) Be a Legrand enclosure or equivalent.
2. Coupler panels shall support 12 fibers in a duplex footprint. Each Fiber Coupler Panel shall be:
 - a) Available with LC or SC options (LC shall be used unless specified by site manager)
 - b) Support both multimode and single mode applications
 - c) Contain application specific alignment sleeves to ensure optimal performance
 - d) Be available with ceramic sleeves to support high-bandwidth systems
 - e) Be Legrand coupler panels or equivalent manufacturer used for fiber optic coupler enclosure.
 - f) Coupler panels (HDFP) are specific to these enclosures.
3. Acceptable part numbers are the following. Refer to drawings and owner for specific enclosure size to use in each location.

Part Number	Description
INFC01U-M4	1 RMU rack mount fiber enclosure
INFC02U-M4	2 RMU rack mount fiber enclosure
INFC04U-M4	4 RMU rack mount fiber enclosure
HDFP-LCD12LC	Multimode 12 fiber LC adapter panel, aqua
HDFP-LCQ24LC	Multimode 24 fiber LC adapter panel, aqua
M4LCD12-50ESA1	Multimode 12 Fiber Splice Cassette, aqua
M4LCD12-50E	Multimode 12 fiber LC Cassette, aqua
M4LCQ24-50EA3A1	Multimode 24 fiber LC Cassette, Aqua



2.10 COPPER CABLE PROTECTION UNITS

- A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TC ground point.

2.11 PATCH CORDS

- A. If required, the contractor shall provide Legrand factory terminated and tested UTP patch cords and equipment cords for the complete cabling system. The UTP patch cables shall meet the requirements of ANSI/TIA-568-D for patch cord testing. The end user may choose to handle the installation of the patch cords.
- C. Patch cord labeling shall match the end users' standards and provided drawings. Coordinate with end user IT to create Cable Termination charts and labeling.
- D. Copper (UTP) patch cords shall:
 - 1. Use 8 position connector with impedance matched contacts and designed using dual reactance.
 - 2. Standard Patch Cords shall be constructed of 100 ohm, 4 pair, 24 AWG, stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA-568.2-D standard.
 - 3. Reduced Diameter patch cords shall be 100 ohm, 4 pair, 28 AWG, stranded conductor. The end user will determine the use of reduced diameter cords when the possibility of PoE+ exists. When using PoE+ the cable bundles should not exceed 48 cables.
 - 4. Meet TIA category 6 component specifications in ANSI/TIA-568.2-D -100% factory tested to meet category performance of product and -ETL or any other nationally recognized 3rd party verification
 - 5. Be capable of universal T568A or T568B wiring schemes.
 - 6. Modular connector shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
 - 7. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
 - 8. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA-606-C labeling specifications.
 - 9. Have "snag less" protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief
 - 10. Be available in same colors as installed jack
 - 11. Be available in 3 foot, 5 foot, 7 foot, 9 foot, 10 foot, 15 foot and 25 foot standard lengths
 - 12. Be backwards compatible
 - 13. Be manufactured by Legrand
 - 14. Design Make:



Note: The patch cord color shall match the color of the installed jack unless specified.

Category 6 Standard (24AWG)	Category 6 Reduced Diameter (28AWG)	Description
MC605-06	RDC-605-06	Cat6, stranded UTP, Blue, 5'
MC607-06	RDC607-06	Cat6, stranded UTP, Blue, 7'
MC609-06	RDC609-06	Cat6, stranded UTP, Blue, 9'
MC615-06	RDC615-06	Cat6, stranded UTP, Blue, 15'



D. Optical Multimode Fiber patch cords shall:

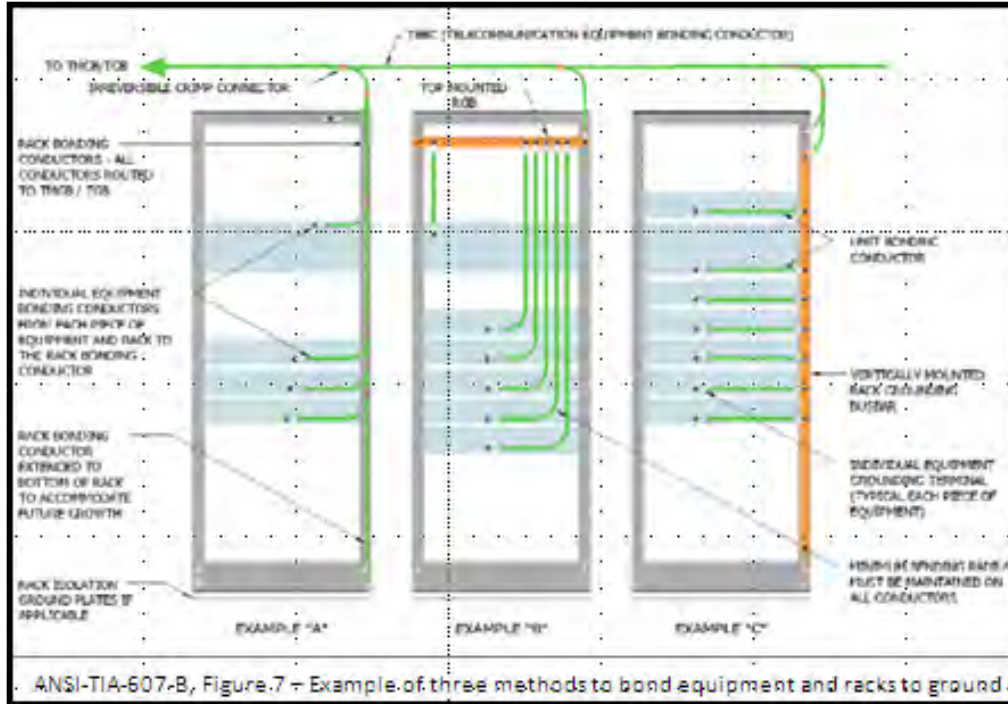
1. Be a Legrand Patch Cord with LC connectors
2. Contain two (2) multi-mode optical fibers.
3. Use multi-mode, graded-index fibers with a 50 micron core.
4. Be capable of transmission at both 850 nm and 1300 nm wavelengths.
5. Include listing of actual loss of patch cord when packaged
6. Be manufactured in standard lengths of 3 ft, 6 ft, 9 ft, as well as special ordered in any other lengths.
7. Design Make:

Part Number	Description
L3-0101B2EA21XXX	OM4, LOMF, OFNR, Field Reversible Polarity, XXX=length, Y=unit (Meter-M/Feet-F)

Note: "xxx" = length in feet. This part number is field reversible.

2.12 GROUNDING AND BONDING

- A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA-607-C Telecommunications Bonding and Grounding Standard.
- B. The main entrance facility/equipment room in each building shall be equipped with a Primary Bonding Busbar (PBB) formerly known as the telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a Secondary Bonding Busbar (SBB) formerly known as the telecommunications ground bus bar (TGB). The PBB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.
- C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR (IDF) or ER (MDF) shall be grounded to the respective PBB or SBB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. Metallic items longer than 30 feet, cable trays, wireways, shall be grounded at regular intervals to reduce impedance of the system. All racks, metallic strength members, splice case, cable trays, etc. should be tested for grounding effectiveness. Data shall be recorded and provided with documentation for installation approval.



- D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.
- E. All racks that sit on conductive surfaces, such as cement floors with steel reinforcement, shall have isolation pads under them, Part Number OR-IPK.

Bonding Products			
OR-GB4X12TMGBKIT	PBB	Primary	4"x12"
OR-GB4X20TMGBKIT	PBB	Primary	4"x20"
OR-GB2X12GBKIT	SBB	Secondary	2"x12"
OR-GBV36KIT	RBB	Vertical	5/8"x36"
OR-GBV72KIT	RBB	Vertical	5/8"x72"
OR-GBH19KIT	RBB	Horizontal	1"x19.25"
OR-60400010	Rack Lug kit	Rack bonding	Ground lug
OR-IPK	Rack pad	Isolation	Isolation Pad



2.13 FIRESTOP

- A. A fire stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Fire stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.
- C. All smoke walls must be fire stopped using a 1-hour F rated UL system.
- D. Fire stop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed fire stop system, shall be provided to the Owner's Technical Representative prior to installing the fire stop system(s).
- E. All areas that have the fire stop compromised due to MAC work (Moves, Adds and Changes) must be restored to the original rating of the firewall (or floor). It is preferred that the products used in the original UL System are used to restore it. If the UL system will no longer restore that penetration to the original rating, the new system used must be approved by the end user or their owner's representative.



PART 3 – EXECUTION

- 3.1 FIBER BACKBONE—STRANDS OF FIBER WILL VARY DEPENDING ON PROJECT
- A. For installations that the backbone cabling is not already installed, install (1) Superior Essex 6/12/24 strand OFNP rated 50/125 micron (OM4) Armored Multimode optical fiber backbone cabling from each of the floors to the MDF, terminate both ends on LC Style Connectors. Terminate backbone optical fiber cabling in Legrand rack mounted panels.
- 3.2 COPPER BACKBONE
- A. For installations that need a copper backbone, install Category 6A plenum cables from each TR (IDF) to the ER (MDF). Tie cables will terminate onto rack mounted 24 port patch panels at both ends and will be used for extending analog lines or circuits to the floors.
- 3.3 WORK AREA OUTLETS
- A. For furniture system outlets, route cables, destined through the poke-through or stub-up in the cavity of wall or column to the junction box, terminate cables following the manufacture instruction.
- B. For floor-mount outlets, route cables to the poke-through thru the floor below and terminate cables onto the modules as required.
- C. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess cable can be stored in the wall. No more than 12" of UTP and 36" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
- D. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA-568-D standard, manufacturer's recommendations and best industry practices.



- E. Pair untwist at the termination shall not exceed 12 mm (one-half inch). The cable twist should not be altered from the manufacturer orientation. Keep the twist to as close to zero as possible while still allowing for the termination.
- F. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the cable.
- G. The cable jacket shall be maintained to within 25mm (one inch) of the termination point. The cable jacket shall not push on the stuffer caps of the jacks at any time.
- H. When installing faceplates with more than one port, data jacks, unless otherwise noted in drawings, shall be located in the top modular position(s) of each face plate with any blanks installed in the bottom locations.

3.4 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

- A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- C. Cable raceways shall not be filled greater than the ANSI/TIA-569 maximum fill for the particular raceway type.
- D. When J-Hooks are used, installation practices must be compliant with ANSI/TIA-569 and NEC 300.17. It is the responsibility of the cabling contractor to review fill ratios with the Authority Having Jurisdiction before installation.
- E. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- F. Where transition points or consolidation points are allowed, they shall be located inaccessible locations and housed in an enclosure intended and suitable for the purpose.
- G. The cabling shall not be painted. Painting the cable voids the warranty and must be replaced.
- H. If J-hooks are used to support cable bundles, all horizontal cables shall be supported at a maximum of 48 to 60 inch intervals. The J hooks should be placed randomly. This will avoid degradation in performance in higher category cabling. At no point shall cable(s) rest on acoustic ceiling grids or panels.



- I. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
- J. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- K. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.
- L. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the end user.
- M. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA-606. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- N. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
- O. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.
- P. When using conduits, it is recommended that a maximum of (2) 90° bends. If a third 90° bend is necessary, the fill ratio must be decreased by 15%. Conduit cable fill percentages, 2 cables=31% fill. 3 cables or more = 40% fill.
- Q. Service loops (slack storage) should be stored in a Figure 8 pattern.
- R. Refer to Appendix A for distance limitations to avoid EMI interference.

3.5 HORIZONTAL CROSS CONNECT INSTALLATION

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA-568.0 standard, manufacturer's recommendations and best industry practices.
- B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).



- C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- E. The cable jacket shall be maintained as close as possible to the termination point.
- F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at allocation that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.6 OPTICAL FIBER TERMINATION HARDWARE

- A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.
- B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
- C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.
- D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.
- E. All spare strands shall be installed into spare splice trays.



3.7 BACKBONE CABLE INSTALLATION

- A. Backbone cables shall be installed separately from horizontal distribution cables
- B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- C. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits
- D. Where backbone cables are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.
- E. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- F. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
- G. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- H. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
- I. Large bundles of cables and/or heavy cables shall be attached using metal clamp sand/or metal banding to support the cables.

3.8 COPPER TERMINATION HARDWARE

- A. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA-568-D standard, manufacturer's recommendations and best industry practice.
- B. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
- C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- D. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.



- E. The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.
- F. Each cable shall be clearly labeled on the cable jacket behind the patch panel at allocation that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.9 RACKS

- A. Racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by local codes.
- B. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 2.11 of this document.
- C. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
- D. All racks should have a minimum of 36-inch clearance from the walls on all sides of the rack(s) unless local or state codes require otherwise. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of rack and from the wall at the end of row unless local or state codes require otherwise.

3.10 FIRESTOP SYSTEM

- A. All fire stop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.11 GROUNDING SYSTEM

- A. The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the TIA-607 standard, and shall be installed in accordance with best industry practice.
- B. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by a licensed electrical contractor.

3.12 IDENTIFICATION AND LABELING

- A. All labeling shall match the end user standards and provided drawings. Coordinate with the end user IT to create Cable Termination charts and labeling.
- B. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA-606.



- C. All label printing will be machine generated. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Work Area Outlet and patch panel labels shall be installed on, or in, the space provided on the device. The wiring scheme shall be determined by the end user.

3.13 TESTING AND ACCEPTANCE

A. General

- 1. All testing shall be performed to the satisfaction of Ortronics, a Legrand brand, so the Limited Lifetime Applications Assurance Warranty can be extended to the end user. Refer to the Legrand website for current approved software and testers at www.legrand.us.
- 2. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA-568-D. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
- 3. All cables shall be tested in accordance with this document, the ANSI/TIA standards, the Legrand Certification Program Information Manual and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Channel Testing

- 1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Horizontal cabling shall be tested using a Level III test unit for the installed cabling system performance level, category 5e or category 6 performance compliance as specified in ANSI/TIA-568.2-D.



2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA-568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

4. Category 6 performance

Follow the Standards requirements established in:

- ANSI/TIA-568.2

A Level III or better test unit is required to verify category 6 performances.

The basic tests required are:

- Wire Map
- Length
- Attenuation
- NEXT (Near end crosstalk)
- Return Loss
- ELFEXT Loss
- Propagation Delay
- Delay skew
- PSNEXT (Power sum near-end crosstalk loss)
- PSELFEXT (Power sum equal level far-end crosstalk loss)

5. Approved UTP Testing Equipment

- A. UTP testing equipment shall be Fluke DSX-5000 Certified tester approved by Legrand for category 6 and/or 5e Link and Channel Testing using the tester's manufacturers approved patch cords and connectors only.



C. Fiber Testing

1. All fiber testing shall be performed on all fibers in the completed end to end system. There shall be no splices unless clearly defined in an RFP. Testing shall consist of an end-to-end power meter testing. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. Single direction testing is acceptable for certification and warranty.
2. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm(or 1310 and 1550 nm for single mode).
3. Test set-up and performance shall be conducted in accordance with ANSI/TIA-526-14 Standard, Method B(single jumper test), for multimode.
4. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. ONLY LINK TEST IS REQUIRED. The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA Standard.
5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.

3.14 APPROVED FIBER OPTIC TESTING EQUIPMENT

Fiber Optics testing equipment shall be Fluke DSX-5000 Certified Tester for Fiber Optic Cable Testing.

3.15 APPROVED TESTING EQUIPMENT

- A. UTP Testing Equipment
 - a. Fluke DSX-5000 certified tester approved by Legrand for Category 6 Link and Channel Testing using the tester's manufacturer approved patch cords and connectors only.
- B. Fiber Optic Testing Equipment
 - b. Fluke DSX-5000 certified tester approved by Legrand for Fiber Optic Cable Testing.

3.16 SYSTEM DOCUMENTATION

- A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.



- B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.
- C. The end user may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.17 PROGRESS DOCUMENTATION

- A. Contractor must provide digital picture in the following sequence
 - a. 25% completion: 30% Telecommunications Room, 20% of Work Station Outlets
 - b. 100% completion: 20% of Telecommunication Room and 10% of the Work Station Outlets.

3.18 TEST RESULTS

- A. Test documentation shall be provided electronically within three weeks after the completion of the project. If a hard copy is also required, it shall be clearly marked with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
- B. The field test equipment shall meet the requirements of ANSI/TIA-568-D including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify category 6 cabling systems.
- C. Testing generated for each cable by the copper (or fiber) test instrument shall be submitted as part of the documentation package, in electronic format. The telecommunications contractor must furnish this information in electronic form on a CD-ROM or in a format designated by the end user.



- D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

3.19 AS-BUILT DRAWINGS

- A. The drawings are to include cable routes, sleeve penetrations and sizes, and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floorplans in paper and electronic (DWG, AutoCAD rel. 14 or newer) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.
- B. The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD) form.



4 WARRANTY AND SERVICES

4.1 WARRANTY

- A. The nCompass Warranty combines a Limited Lifetime Extended Product and Application Assurance warranty. Legrand and Superior Essex (Manufacturer) provides the warranty directly to the Miami Dade County ITD.
- B. An Extended Product Warranty shall be provided, which warrants functionality of all components used in the system for a Limited Lifetime up to 40 years from the date of registration. The Extended Product Warranty shall warrant the installed horizontal and/or backbone copper, and both the horizontal and the backbone optical fiber portions of the cabling system.
- C. A warranty will remain in effect if the cable installed from switch to end user is manufactured by both a Legrand approved manufacturer and Legrand patch cords are installed. If, in that path there are cables manufactured by two different approved cable manufacturers and Legrand patch cords are used, this solution could be covered by the appropriate warranty. The applicable warranty that would apply depends upon the lowest performance cable installed in the path between the switch and the end user.
- D. The contractor shall provide a warranty on the physical installation.



4.2 CONTINUING MAINTENANCE

- A. MACs shall be performed by a Legrand Certified Contractor at the CIP level (preferred). The moves, adds and changes shall be added to the nCompass™ warranty when registered with Legrand.

4.3 CLOSE OUT PACKAGE FORMAT

- A. Closeout package shall include the nCompass Limited Lifetime Applications Assurance Warranty. Refer to www.nCompass-system.com for specific guidelines.

4.4 PAYMENT

- A. Payments for this project will be at the direction of the construction manager. Final payment will be tied to the job completion and acceptance of on-time receipt of all submittals including the closeout package.

4.5 APPROVAL REQUESTS

- A. All approval requests/submittals shall be provided to the construction manager and the end user at least three (3) days minimum, preferably two (2) weeks, prior to work being performed. This will allow the construction manager and the end user to respond to requests in a prompt manner.

4.6 FINAL ACCEPTANCE & SYSTEM CERTIFICATION

- A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from Legrand registering the installation.



APPENDIX A - DISTANCE LIMITATIONS

Raceway Installation

1. Separation from EMI Sources:
 - a. Comply with BICSI TDMM 13th edition and ANSI/TIA-569-D for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - b. Separation between open communications cables or cables in **non-metallic raceways** and unshielded power conductors and electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2kVA: A minimum of (5") five inches.
 - 2) Electrical Equipment Rating between 2 and 5kVA: A minimum of (12") twelve inches.
 - 3) Electrical Equipment Rating More Than 5kVA: A minimum of (24") twenty-four inches.
 - c. Separation between communications cables in **grounded metallic raceways** and unshielded power lines or electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating less than 2KVA: A minimum of (2-1/2") two and one-half inches.
 - 2) Electrical Equipment Rating between 2 and 5KVA: A minimum of (6") six inches.
 - 3) Electrical Equipment Rating More Than 5KVA: A minimum of (12") twelve inches.
 - d. Separation between Communications Cables and **Fluorescent Fixtures**: A minimum of (5") five inches.



APPENDIX B – PART NUMBERS

	Part Number	Description
Bonding	OR-60400010	Rack bonding lug kit
	OR-GB2X12GBKIT	SBB, 2"x12"
	OR-GB4X12TMGBKIT	PBB, 4"x12"
	OR-GB4X20TMGBKIT	PBB, 4"x20"
	OR-GBH19KIT	RBB, Horizontal, 1"x19.25"
	OR-GBV36KIT	RBB, Vertical, 5/8"x36"
	OR-GBV72KIT	RBB, Vertical, 5/8"x72"
	OR-IPK	Rack Isolation Pad
Cable - Copper	54-246-2A	Category 6, NextGain, Blue BrakeBox (CMR) Riser
	54-246-2B	Category 6, NextGain, Blue BrakeBox (CMP) Plenum
Copper Patch Cord	MC605-06	Cat6, stranded UTP, BLUE, 5'
	MC607-06	Cat6, stranded UTP, BLUE, 7'
	MC609-06	Cat6, stranded UTP, BLUE, 9'
	MC615-06	Cat6, stranded UTP, BLUE, 15'
	RDC605-06	Cat6, stranded UTP, BLUE 5', Reduced Diameter
	RDC607-06	Cat6, stranded UTP, BLUE, 7', Reduced Diameter
	RDC609-06	Cat6, stranded UTP, BLUE, 9', Reduced Diameter
	RDC615-06	Cat6, stranded UTP, BLUE, 15', Reduced Diameter
Faceplate	OR-40300548	Single gang, 2-module TracJack faceplate, Fog White
	OR-40300546	Single Gang, 4-module TracJack faceplate, Fog White
	OR-42100002	Blanks (10/package), Fog White
Fiber Cable	L4006P401	SPSX 6-strand multi-mode 50-micron OM4 interlocking- armored CMP fiber
	L4012P401	SPSX 12-strand multi-mode 50-micron OM4 interlocking- armored CMP fiber
	L4024P401	SPSX 24 fiber multimode OM4 interlocking armor CMP fiber
Fiber Accessories	HDFP-LCD12LC	Multimode 12 fiber LC adapter panel, aqua
	HDFP-LCQ24LC	Multimode 24 fiber LC adapter panel, aqua
	M4LCD12-50ESA1	Multimode 12 Fiber Splice Cassette, aqua
	M4LCD12-50E	Multimode 12 Fiber Cassette, Aqua
	M4LCQ24-50EA3A1	Multimode 24 Fiber Cassette, Aqua
Fiber Connector	OR-205KNF9GA-50E	Multimode: LC Style Fusion Splice on Connector
	OR-205KNF9SA-09	Single mode: LC Style Fusion Splice on Connector
	OR-205KNT9GA-50T	Multimode LC reusable fiber connector
	OR-205KNT9SA-09	Single Mode LC reusable fiber connector
Fiber Enclosure	INFC01U-M4	1 RMU rack mount fiber enclosure
	INFC02U-M4	2 RMU rack mount fiber enclosure
	INFC04U-M4	4 RMU rack mount fiber enclosure
Fiber Patch Cord	QFJ-4242-269A-xxx	Field Reversible, Single-mode, OS2,OFNR, xxx=feet of cord
	QFJ-4242-28CA-xxx	Field Reversible, OM4, LOMF, OFNR, xxx=feet of cord



	Part Number	Description
Furniture Module	OR-40300633	Furniture Plate (4 port), Fog White, TJ
Grounding	OR-GS-8	Grounding Kit
Horizontal Manager	OR-MM6HM62RU	2 RU, Horizontal Manager, 3.5" H x 19" W, single sided
	OR-MM6HM6D2RU	2RU Horizontal Manager, 3.5"H x 19"W, double sided
J-Hooks	CJ32HP	2" plastic coated metal J Hook
	CJ64HP	4" Plastic coated metal J Hook
Jack	OR-TJ600	TracJack category 6 module , Fog White
	OR-TJ600-36	TracJack Category 6, Blue
Ladder Rack	OR-MM20CRB16-B	Runway Bracket
	OR-P128240HB	Wall Angle Assembly
	OR-P820127H	Straight Clamp Kit
	OR-P820147H	Corner Clamp Kit
	OR-P820527HB	Cable Bracket for pathway for power
	OR-P982078H	Vertical Wall Bracket
	OR-P987527H	J-Bolt Kit
	OR-RCBK-6	Threaded Ceiling Kit
	OR-TRP11-CM	Transition Pan
	OR-TRT10-12B	12" Ladder-rack
Patch Panel	OR-PHD66U24	24 port high density flat patch panel, 6 port modules. 1 RU
	OR-PHD66U48	48 port high density flat patch panel, 6 port modules, 2 RU
	OR-PSA66U48	48 port high density angled patch panel, , 6 port modules, 2 RU
Racks	OR-MM200710-B	7'H x 10.5"D, Channel Rack, Black
	OR-MM20706-B	7'H x 6.5"D, Channel Rack, Black
	OR-MM20716-B	7'H x 16"D , Channel Rack, black
Rack Accessories	OR-MM20PDUMB1D1W-B	PDU Button Mount Bracket
Surface Mount Plate	OR-404TJ2	Surface housing for TracJack - holds 2 modules, Fog White
Vertical Manager	OR-MM20VMD706-B	7'h x 6.5"w x 10.25"d front vertical manager with latching door.
	OR-MM20VMD710-B	7'h x 10.5"w x 15"d front vertical manager with hinged cover.
	OR-MM20VMD712-B	7'h x 12.5w x 15"d front vertical manager with latching door.
	OR-MM20VMD716-B	7'h x 16.25"wx 15"d front vertical manager with latching door.



SECTION 274000 AUDIOVISUAL DESIGN REQUIREMENTS

AUDIOVISUAL DESIGN REQUIREMENTS

DESIGN PACKAGE TO INCLUDE:

- PROJECT SCHEDULE
- COMMISSIONING OF CONFERENCE ROOMS PER FLOOR PLANS
- IT CLOSET & EQUIPMENT RACK
- ADD MICROSOFT TEAMS AND ZOOM VIDEO CONFERENCING IN MEETING ROOMS
- ADD CAMERAS LOOKING AT PRESENTER AND AUDIENCE

An all-in-one presentation system with a video and control capabilities to include a lectern, microphones (wireless), speakers, projector, and mechanical projection screen in each of the auditorium and presentation spaces. This system must be able to integrate/work with both zoom and Microsoft teams, this will require 2 video-conferencing cameras in the room. One facing the lectern/speaker and one facing the audience. The projectors and screens shall be laser and ceiling mounted. The screen needs to retract. Lighting should be dimmable in this space and if there are windows to the exterior mechanically controlled shading devices are required.

- PA SYSTEM
- DURING CONSTRUCTION ADMIN. VENDOR TO PROVIDES UPTO DATE EQUIPMENTLIST

APPROVED HARDWARE

- CRESTRON
- LEGRAND
- AMX
- BIAMP SYSTEMS
- CISCO

FOR REFERENCE:

NEW CONSTRUCTION DESIGN/BUILD CRITERIA

TELECOMMUNICATIONS SYSTEMS AND REQUIREMENTS

- A. The Design/Builder shall include as part of the team a wide range of professional services in support of enterprise software, enterprise storage, enterprise (high-end) computing, networking and communications, and mobile and wireless. The Design/Builder must have the expertise necessary to design, build, and maintain complex network infrastructures in support of today's information dependent applications. The Design/Builder must be able to perform storage needs assessments and design, implement, and manage IT infrastructure solutions that provide consolidated environments that supports critical data flows over multiple networks.



- B. The Design/Builder must have a proven logistics and integration practice available that can handle all equipment from warehouse and storage to integration and testing, and finally, to deployment.
- C. Maintenance and Ongoing Support: The Design/Builder must offer onsite maintenance support and call support for their product solutions and provides onsite engineering support to provide hands on training for a period of 3 years extending beyond the 1 year warranty period.
- D. Meeting Rooms (Open meeting room and enclosed Large Meeting Room) –
 - 1. Include, as a minimum, a projection display system for the auditorium with a built-in ceiling mounted digital projector. Images shall be projected onto a built-in motorized projection screen. The projector shall be ceiling mounted and built-in to the proposed finished acoustical ceiling as to provide for both a finished look while simultaneously allowing for ease of maintenance. The proposed mounting solution must avoid the presenter from interfering with the projected image and prevent both the audience and presenter from casting shadows on the projection screen. The Design/Builder can offer, if deemed necessary by the proposed design, additional synchronized displays on motorized wall mounts to support viewers in the more distant seats. These motorized mounts will allow the displays to be folded against the wall when their use is not required and will be controlled from the lectern mounted panel. Provide proper backing (mounting boards) secured to the building structure and locate stub-up conduit and electrical service to support the installation of these displays.
 - 2. Lectern & Lectern Equipment – Provide a lectern to house source equipment used during presentations. This includes a Blu-Ray player, a client furnished dedicated PC and gooseneck microphone for speech reinforcement. The lectern shall include a laptop or mobile device connection for displaying content on the system. Support for HDMI, VGA, DisplayPort, and Video shall be provided to give users a variety of options to choose from. Also provide wireless presentation gateway device and wireless access point that will allow presenters to use wireless tablets, cell phones or any other wireless device running “iOS”, “Android” or Windows Operating Systems. Additionally, presentation content can be shared with the audience for viewing and saving on their personal wireless devices.
 - 3. Coordinate and obtain approval of color selections of lectern and room finishes with Owner. The lectern will house most of the A/V equipment to be used in the Auditorium. This will decrease the required number and amount of wiring to be passed through the available customer installed conduit between the lectern location and the equipment rack. There will be additional rack space available in the lectern for future equipment installation. The color touch panel controller will be permanently mounted to and housed on the lectern. All system wiring between the lectern, main A/V system and displays shall be CATx based.



4. Video Infrastructure
 - a. Provide a system to support video distribution of all connected video sources throughout the library. All input wall plates and video displays will be connected to this switch so that either multiple video sources or a single video source can be viewed on a single display or all the displays. This allows a presentation from the Auditorium to be sent to other areas of the library for overflow purposes. This video infrastructure supports all video formats up to and including High Definition or higher. All video sources connected to the system will be scaled so that the native resolution and aspect ratio are retained.
5. Audio
 - a. The Auditorium audio system shall consist of multiple self-powered, beam steerable, array type column speakers providing surround sound for program audio playback supplemented by a distributed in-ceiling speaker system of full range speakers installed into the ceilings.
 - b. The column speakers will project sound in a very controlled pattern for maximum coverage and minimize reflections off the floors and ceiling to the extent possible.
 - c. Provide, as part of the scope of Work, analysis of the space using data gained from site plans, manufacturers' performance data and specialized modeling software to ensure correct response of the installed audio system. During installation the audio system will be electronically "tuned" to site-specific conditions and criteria to ensure the optimum operation and response.
 - d. Provide two wireless microphones (lapel and hand held) for presenters that are NOT going to use the lectern.
 - e. Provide a multi-channel Audio Video Bridge (AVB) and Acoustic Echo Cancellation (AEC) enabled audio Digital Signal Processor (DSP) to handle the Library's distributed audio system. Also include mic / line inputs with AEC, and standard mic/line inputs. In addition, the Design/Builder will add line level outputs to feed multi-zoned audio throughout the facility. Audio source and audio zone selection and control is via touch panel located on the Auditorium lectern and individual small form factor audio control touch panels located conveniently throughout the facility. A channel mic / line AVB enabled expander is located in the lectern for microphone and program audio transport from the lectern to the main distributed audio system over standard wiring. A dedicated port AVB enabled Ethernet switch will be located in the main system rack to provide for easy future expansion of the Library's audio system.



- f. The audio DSP that manages all of the program and speech audio shall be connected up to two (2) traditional analog phone lines (POTS) and up to two (2) VOIP (Voice Over IP) lines, which will allow for the mics to be used to connect to other sites in an audio only conference.
 - g. Control - The Design/Builder will include a push-button control system, installed and programmed that includes a rack mounted processor and a lectern-mounted touch panel. The touch panel will be permanently mounted to the lectern using the included table top stand.
 - h. The system will be programmed to control the following:
 - i. System Power ON/OFF
 - ii. Routing of Sources to Displays
 - iii. Volume Control and Muting
 - iv. Blu-Ray Player Control
 - v. Audio Call Control (If enabled)
- E. Rack, Cabling, Hardware, and Accessories
- 1. Provide the necessary Rack Unit slide out and rotating equipment racks that will be installed in the designated space. The main system rack and the lectern racks rack will feature series mode surge protection and power distribution as well as a backup UPS to enable the safe shutdown of the system in the event of a power failure. Include all cabling, connectors, adapters, and all cable management accessories.
- F. Digital Signage
- 1. Provide a High Definition, networked Digital Signage Server appliance. The server will be connected to the Digital Media switch located in the Auditorium so that its output can be distributed to any of the displays located in other areas and the Meeting Rooms. The distributed Digital Signage system must be centrally administrated.
- G. Small Interactive Conference Rooms
- 1. Provide a featured Video and Audio Teleconferencing suites. The conference room will feature a wall mounted INTERACTIVE display in the front that connects to the table and provides VGA + Audio and HDMI connectivity to the screen. USB connections will be extended to the table so that users may interact with their PC's content from the display. Audio will be supported by the displays internal amplifier and speakers. A multi-format, multi-input 3- Series Digital Media Presentation System will be included to process and control audio and video system inputs. This presentation system will be integrated with a system control processor and is interfaced by a flip top color touch panel located in the table. A High definition video camera will be installed and interfaced with a High Definition video screen. The conference room can connect to separate sites. The Conference Room will contain an "A/V Bridge" conferencing device that enable



the use of the room's video camera and microphones with the participant's laptop or PC with their own personal Video Conferencing clients such as Skype, Google Talk or other compatible services. In addition to the wired interfaces located at the table, a Wireless Presentation Gateway and a dedicated Wireless Access Point (WAP) will be included to allow users of these rooms to present or serve content from any wireless device such as tablets and cell phones. Audio and Video Conferencing participants' audio will be captured by ceiling mounted gooseneck microphones. Program audio will be reproduced by the display speakers while Audio and Video Conferencing will be reproduced by ceiling mounted speakers. Microphone processing is handled by a dedicated Digital Signal Processor (DSP), which includes a single analog telephone line interface (POTS). All system control functions will be available from the color touch panel located at the table such as audio and video source routing, dialing functions, and room volume control including microphone level and muting.

H. Room Scheduling

1. Provide wall mounted screen outside the conference room and the auditorium, which will depict the schedule of events for that particular room. The panel will connect through a software, that will connect back to the Library's Email to display who has booked the room and when. Provide software to allow control and scheduling by authorized Library personnel only.

I. Common Area / Reading Area

1. Provide wall mounted or ceiling mounted LED/LCD displays at convenient locations throughout these areas, i.e. Children's Reading, Adult Reading, etc. The Library typically will use these displays for providing information or as signage. When not being used as digital signage, Library staff shall be able to connect devices with either a VGA or HDMI output for transmitting video and audio through the display equipment. Each display shall be capable to provide both independent programming and simultaneous programming. These displays will contain a scheduling function that can be set to turn the display on or off at predetermined times of the day. The input plates are auto-sensing for signal type and do not require the use of the displays' remote controls. Overall volume setting of the displays will be controlled by the source device plugged in to the wall plates.
 - a. When this area is to be used for a performance such as a book reading or other type of presentation, a small rolling equipment rack is supplied with additional equipment that turns this space in to a dual display multimedia center and Public Address system. The small rack contains a mounted Audio / Video input plate that supports both Standard Definition (SD) and High Definition (HD) video inputs on standard RCA and HDMI connections which enables the use of a wide variety of audio and video sources.



- b. The video inputs are auto-sensing and require no intervention other than plugging in the source device to the appropriate connector on the front panel and the two HDMI outputs on the rear of the rack to the wall plates under each display. A single channel wireless microphone system will be supplied with both a handheld and lapel microphone for use by a single presenter. These microphones will also be paired with a secondary receiver (located in the Auditorium) so that the presenter can be heard over the background ceiling speakers in the Main area should the audience extend beyond the range of the column speakers used at the performance space. These column speakers are set to only reproduce audio within the immediate area of the performance space. Connection to these column speakers is via two speaker level audio cables connected between the small rack and an input plate located at the performance space wall.
 - c. When not in use, the cables are stored with the small rack and the rack itself rolled away and stored in a secure location. Overall volume control of the system is adjusted by an intuitive touch panel with LCD screen that is mounted to the front of the small rack above the A/V input panel.
 - d. Background Audio System, Ceiling Speakers - The Main Area contains a multi-zoned, multi-speaker background audio system with paging ability. The area must be divided in separately adjustable "zones" between the front and rear of the Main Area starting behind the reception desk. Each zone can be turned on or off and volume level adjusted to meet the changing needs or requirements of the space. When required, each of these zones can be incorporated with the performance space's wireless microphone. Each of the zones has a wired and wall mounted control pad with a small display showing available choices and controls available for each zone. A single desktop style, with a push to talk button is supplied for paging functions within the Main Area.
- J. Outdoor Audio System
- 1. Provide an outdoor sound system to serve the outdoor zones with sufficient speakers to serve the area. The source for the audio will be Library furnished and be the same as the background audio system located in the Main Area as well as the paging system. These zones may also reproduce audio from the Performance Area wireless microphone when required. Additional control pads with a small display showing available choices and controls for each zone are supplied. The amplifiers will be mounted inside the equipment rack and cabled to each zone of in-ground speakers.



2. These speakers will be design to blend in with the landscaping and provide maximum 360-degree coverage.
3. Provide wall mounted or ceiling mounted weatherproofed LED/LCD displays at convenient locations throughout the outdoor area. The Library typically will use these displays for providing information or as signage. When not being used as digital signage, Library staff shall be able to connect devices with either a VGA or HDMI output for transmitting video and audio through the display equipment. Each display shall be capable to provide both independent programming and simultaneous programing. These displays will contain a scheduling function that can be set to turn the display on or off at predetermined times of the day. The input plates are auto-sensing for signal type and do not require the use of the displays' remote controls. Overall volume setting of the displays will be controlled by the source device plugged in to the wall plates.
4. When this area is to be used for a performance such as a book reading or other type of presentation, a small rolling equipment rack is supplied with additional equipment that turns this space in to a dual display multimedia center and Public Address system. The small rack contains a mounted Audio / Video input plate that supports both Standard Definition (SD) and High Definition (HD) video inputs on standard RCA and HDMI connections which enables the use of a wide variety of audio and video sources.
5. The video inputs are auto-sensing and require no intervention other than plugging in the source device to the appropriate connector on the front panel and the two HDMI outputs on the rear of the rack to the wall plates under each display. A single channel wireless microphone system will be supplied with both a handheld and lapel microphone for use by a single presenter. These microphones will also be paired with a secondary receiver (located in the Auditorium) so that the presenter can be heard over the background ceiling speakers in the Main area should the audience extend beyond the range of the column speakers used at the performance space. These column speakers are set to only reproduce audio within the immediate area of the performance space. Connection to these column speakers is via two speaker level audio cables connected between the small rack and an input plate located at the performance space wall.
6. When not in use, the cables are stored with the small rack and the rack itself rolled away and stored in a secure location. Overall volume control of the system is adjusted by an intuitive touch panel with LCD screen that is mounted to the front of the small rack above the A/V input panel.

K. Customer Support Agreement

1. The Design/Builder shall provide as part of the scope of Work a customer service agreement to cover all site visits and equipment repair or replacement associated with the audiovisual systems in the spaces described in their proposal.



2. Help Desk Support
 - a. Provides Tier 1 technical support for integrated systems and video conferencing equipment
 - b. Provides Tier 2 technical support via TI specialists or selected vendor partners
 - c. Provides company-wide technician dispatch to support on-site problem resolution
 - d. Documents and tracks all help requests via our event ticketing database system
3. Preventative Maintenance Visits
 - a. Include a schedule with pre-determined site visits to provide preventive maintenance, firmware upgrades, and systems operation check.
 - b. Perform preventive maintenance that includes inspection, cleaning, alignment, and replacement of consumable items per the manufacturer's recommended schedule
 - c. Evaluate and install applicable manufacturer provided firmware/software corrections and operational upgrades
 - d. Perform systems operation check that includes a complete functionality test and performance verification of video and audio systems
 - e. Answer system operation questions or provide informal basic end user/operator training
 - f. Provide a copy of the system checkout results to client, identifying needed action items
4. Unlimited-Unscheduled Service Visits
 - a. Arrive on-site within 8 business hours after determination on-site service is required
 - b. Perform necessary systems diagnostics to isolate the issue(s) within the system
 - c. Correct problems related to equipment configuration, set-up, or connectivity
 - d. Escalate equipment failures to determine the most expeditious method required to restore normal system operation
 - e. Schedule return visits as needed for equipment replacement
- L. Telecommunications System
 1. The Design/Builder will provide all materials needed for the job. The Design/Builder will be providing the electrical as well as any conduit needed to pass copper cabling within the open areas. All telecommunication cables for this project must be rated Category 6X or higher and terminated using T568-B standards unless otherwise noted. All subfloor data cables are to be jell filled Cat6 cable and all plenum Data cables should be according to the Miami Dade County standards at time of construction. All CATV cables must follow the Miami Dade County standards. All conduits are to meet NEC standards and not exceed 40% fill. All wiring is to be guaranteed for 10 years.



2. The Design/Builder will include wiring of all data/voice outlets. All low voltage sleeves must have plastic bushings on ends prior to running cable and be fire stopped upon completion of all runs. Review DATA room rack placement and installation with Library staff prior to performing.
 - a. The Design/Builder shall work in agreement and coordinate all the telecommunications items of work with ITD Project Manager to facilitate the installation and wiring of all the equipment associated with the voice and data systems.
 - b. The Design/Builder must coordinate with AT&T and Cable Company to run the wiring underground to on site main telephone/data room.
 - c. Typically for data/VOIP cabling provide 3/4" inch conduit with pull wire/string extended 8" above ceiling space
 - d. 3/4" conduit and a 3/4" x 18" x 18" fire retardant plywood shall be provided to all WAP location
 - e. 3/4" conduit shall be provide to CCTV cameras location from the Master Distribution Facility (MDF).
 - f. Cabling shall be provide to accommodate Access Points and CCTV cameras, indoor and outdoor providing coverage to all Library areas.
 - g. VOIP/data wiring and power wiring shall run in separate conduits.
 - h. Each node shall have two cables run to the telecom room patch panel.
 - i. Low Voltage conduit and cabling shall be provide to accommodate the Audio Visual Systems
 - j. Low voltage conduit and cabling shall be provide to accommodate the Digital Signage System.
 - k. All conduit and cables in finished areas shall be concealed from view and terminate at approved connection/plug-in points.

M. DATA Rooms

1. Mount backer board to all MDF interior wall.
2. Install the free standing racks in DATA room at least 3' from wall.
3. Wall mount a power strip
4. Run 4 drops to each of the areas marked on the floor plan as wireless "w". These drops are to be terminated in surface mount boxes located within the plenum space as per drawings or flush mount faceplates that are to be installed on columns at 96" above finished floor.
5. Label all drops in sequential order to corresponding patch panels A through F. Please label the jacks as follows: for the first patch panel all drops should be label A1...A48, for the second patch panel B1...B48 and so forth until the last patch panel K1...Kxx



6. Provide a 10-year warranty on all cable installations and provide as-built and cable speed certification test results for all copper and fiber runs to Library staff.
- N. Project Management Plan
1. Information Technology Department (ITD) will monitor all aspects of the contract, from initiation of a task to final solution delivery, while maintaining open communication channels between staff, management, and project personnel. ITD will work with project leads to ensure that the project is completed on-time with appropriate personnel. Using a work breakdown structure method to prepare and monitor task deliverables. The Design/Builder will execute based on a current, detailed overview of the work requirements of the project's task areas at all times.
- O. Miscellaneous Telecommunication
1. At a minimum, Design/Builder shall provide connection nodes (made up of two electrical outlets and four data connections) as indicated below:
 - a. Children's Lounge
 - i. 9 wall nodes
 - ii. 8 floor nodes
 - iii. 3 high wall nodes, possibly TV
 - iv. 2 nodes on the ceiling
 - b. Main lobby
 - i. 8 floor nodes
 - ii. 4 wall nodes
 - iii. 2 ceiling nodes
 - c. Private Offices
 - i. 3 wall nodes
 - d. Adult reading
 - i. 16 floor nodes
 - ii. 20 wall nodes
 - iii. 2 ceiling nodes
 - e. Work Area (Room)
 - i. 2 wall nodes in breakroom
 - ii. 2 wall nodes in office
 - iii. 8 floor nodes in work room
 - iv. 6 wall nodes in work room
 - v. 2 ceiling nodes in work room
 - f. Receiving
 - i. 2 wall nodes
 - g. Meeting Room
 - i. 8 floor nodes
 - ii. 8 wall nodes
 - iii. 4 ceiling nodes
 - iv. High wall nodes on three walls
 - v. 1 electrical and switch connections on main wall for screen



- h. Courtyard Lobby
 - i. 2 floor nodes, LTBD
 - ii. 4 wall nodes
 - iii. 3 wall nodes high, possible TV
 - iv. 2 ceiling nodes (possible WiFi)
 - i. Innovation Rooms
 - i. 6 wall nodes
 - ii. 4 floor nodes
 - iii. 1 ceiling node
 - j. Roof Patio
 - i. At least ten electrical outlets along exterior wall aligned to furniture set up
 - ii. At least ten floor monuments for electricity to tables.
 - iii. Dedicated data/telecommunications room for wiring.
 - k. Telephone system (IP) to include at least a public address system and single dialing to all units from each location, caller ID and message recording built-in.
 - l. CCTV
 - i. Depending on the layout of the floorplan, 30 cameras. Currently utilizing Cat6 wiring but would need to use the industry standard at the time of installation. CCTV cameras would cover all public areas, work area, electrical, data, and mechanical rooms; courtyard area, entrances and external areas, including drop off driveway, and parking lot.
2. CAT 6 wiring herein proposed is as a minimum standard and may not be the industry standard at the time of construction. Design/Builder shall include in his proposal the costs for providing latest state-of-the-art industry standard wiring at the time of construction.
 3. The final location of all nodes is to be determined during design.
 4. The D/B shall work in agreement and coordinate all the telecommunications items of work with MDPLS Project Manager and Library's IT staff to facilitate the installation and wiring of all the equipment associated with the voice and data systems.



SECTION 272133 WIRELESS ACCESS POINTS

Interior Access Points

The library uses Meraki MR45 and MR46 model access points for the interior of library locations.

- MR45/46 Datasheet –
https://documentation.meraki.com/MR/MR_Overview_and_Specifications/MR46_Datasheet
- Installation Guide –
https://documentation.meraki.com/MR/MR_Installation_Guides/MR46_Installation_Guide
- Access Points can be mounted either on the ceiling or on the wall, 8 inches below the ceiling line
 - o For drop ceilings, access points mount on the T-rails, data wiring can be run free wire back to telecom area if ceiling is accessible, if not accessible, $\frac{3}{4}$ inch conduit runs for data wiring back to the telecom area are needed
 - o For hard ceilings, access points require single gang outlet boxes, flush mounted with the ceiling and the associated $\frac{3}{4}$ inch conduit runs for data wiring back to the telecom area are needed and must be grounded
 - o For wall mounted, access points require single gang outlet boxes, flush mounted with the wall
 - If ceiling is accessible, data wiring can be run free wire back to telecom area from outlet box $\frac{3}{4}$ inch conduit whiptail into ceiling area
 - If ceiling is not accessible, the associated $\frac{3}{4}$ inch conduit runs for data wiring back to the telecom area are needed and must be grounded
 - o At least 10 inches of clearance are needed around the outlet boxes to facilitate installation



Exterior Access Points

The library uses Meraki MR86 model access points for the exterior of library locations.

- MR86 Datasheet –
https://documentation.meraki.com/MR/MR_Overview_and_Specifications/MR86_Datasheet
- Installation Guide –
https://documentation.meraki.com/MR/MR_Installation_Guides/MR86_Installation_Guide
- Access Points are usually mounted on the wall 8-12 feet from the ground
- Access Points require double gang outlet boxes, flush mounted with the wall and the associated $\frac{3}{4}$ inch conduit runs for data wiring back to the telecom area are needed and **must be grounded**
- Access Points utilize 1 of 3 different types of antenna model styles, depending on the needs of the site
 - o Omni Antenna (most commonly used)
 - At least 1 ft of clearance are needed around the outlet boxes to facilitate installation
 - Factsheet –
<https://meraki.cisco.com/product-collateral/dual-band-omni-antennas-4-7-dbi-datasheet/?file>
 - o Dual Band Antenna
 - At least 2 ft of clearance are needed around the outlet boxes to facilitate installation
 - Factsheet –
https://meraki.cisco.com/lib/pdf/meraki_datasheet_antenna_dual_band_patch_8dBi_6dBi.pdf
 - o Directional Dish Antenna
 - At least 3 ft of clearance are needed around the outlet boxes to facilitate installation
 - Factsheet –
<https://www.cisco.com/c/en/us/td/docs/wireless/antenna/installation/guide/ant2513p4mn.htm>

MIAMI-DADE PUBLIC LIBRARY SYSTEM
VOLUME II
PROJECT MANUAL
DIVISION 28- ELECTRONIC SAFETY AND SECURITY

Burglar Alarm & CCTV
(Design-Build Component Standards)

South Dade Regional Library Interior Renovations

C23-MDPLS-01-ESP




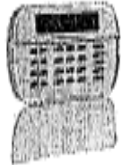


281600	Intrusion Detection
282000	Electronic Surveillance
283111	Digital, Addressable Fire-Alarm System

**SECTION 281600
INTRUSION DETECTION**

EQUIPMENT LIST




1 of 7

			Sealed Lead Acid Battery; 7 Ah Capacity, 3.7 in Ht, 5.94 in Wd, 2.56 in Dp, ABS <ul style="list-style-type: none"> Item #2UKJ4 Mfr. Model #2UKJ4 		
			Flair Surface Mount Contact 2.5 Inch - Brown PART NUMBER VIP39BRN		
			DSC HS32-119CP01 PowerSeries Neo Control Panel Kit With CP-01		
			Full Message LCD Hardwired Security Keypad DSC HS2LCDPENG N		



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			<p>FLAIR VIP 4" Surface Mount Magnetic Contact Item # VIP1000-37GY Manufacturer Item # VIP1000-37 GRY</p>		
			<p>FLAIR ELECTRONICS VIP100-1 WHT Magnetic Contact, Surface Mount,</p>		
			<p>MANUFACTURER - DSC Camlock Lock & Key 544 Set for All PowerSeries Panels</p>		
			<p>New Revere RRJ31X-SET UL RJ31X Block with Cord Communication Circuit Accessory</p>		

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			DSC HSM2300 NEO 1A Power Supply Module		
			Dsc HSM2108 NEO 8zn Expander Module		
			NEPTUNE POWER PRODUCTS NPP1640P 16.5V 40 VA TRANSFORMER		

4-0F-7

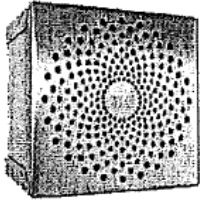
			<p>CABLE WAREHOUSE</p> <p>Plenum Cat5e Ethernet Cable, Solid Copper, Gray, Pullbox 1000ft</p> <p>Cat5e Plenum Solid Copper Ethernet Cable, Gray, UTP (Unshielded Twisted Pair), CMP, 24 AWG, Pullbox, 1000 foot - Part #: 11X6-021TH</p>		
			<p>BRAND SOUTHWIRE</p> <p>SKU: 51112-55-01</p> <p>Coleman Cable 500' 22/4 Stranded Unshielded Alarm Wire - COIL - White</p>		



6 - of - 7

			Amseco Garage Door Magnetic Contact Model ODC59A		

7-0P-7

			Elk 150RT Heavy Duty Siren and Stainless Steel Enclosure		



SECTION 282000 ELECTRONIC SURVEILLANCE

Interior Access Points

The library uses Meraki MR45 and MR46 model access points for the interior of library locations.

- MR45/46 Datasheet –
https://documentation.meraki.com/MR/MR_Overview_and_Specifications/MR46_Datasheet
- Installation Guide –
https://documentation.meraki.com/MR/MR_Installation_Guides/MR46_Installation_Guide
- Access Points can be mounted either on the ceiling or on the wall, 8 inches below the ceiling line
 - o For drop ceilings, access points mount on the T-rails, data wiring can be run free wire back to telecom area if ceiling is accessible, if not accessible, ¾ inch conduit runs for data wiring back to the telecom area are needed
 - o For hard ceilings, access points require single gang outlet boxes, flush mounted with the ceiling and the associated ¾ inch conduit runs for data wiring back to the telecom area are needed and must be grounded
 - o For wall mounted, access points require single gang outlet boxes, flush mounted with the wall
 - If ceiling is accessible, data wiring can be run free wire back to telecom area from outlet box ¾ inch conduit whiptail into ceiling area
 - If ceiling is not accessible, the associated ¾ inch conduit runs for data wiring back to the telecom area are needed and must be grounded
 - o At least 10 inches of clearance are needed around the outlet boxes to facilitate installation



Interior Cameras

The library uses Meraki MV12W and Meraki MV22X model cameras for the interior of library locations.

- MV22X Datasheet –
<https://meraki.cisco.com/product-collateral/mv22-datasheet/?file>
- MV12W Datasheet –
https://meraki.cisco.com/wp-content/uploads/2020/05/meraki_datasheet_mv12.pdf
- Cameras can be mounted either on the ceiling or on the wall, 8 inches below the ceiling line
 - o For drop ceilings, cameras mount on the T-rails, data wiring can be run free wire back to telecom area if ceiling is accessible, if not accessible, ¾ inch conduit runs for data wiring back to the telecom area are needed
 - o For hard ceilings, cameras require single gang outlet boxes, flush mounted with the ceiling and the associated ¾ inch conduit runs for data wiring back to the telecom area are needed and must be grounded
 - o For wall mounted, cameras require single gang outlet boxes, flush mounted with the wall
 - If ceiling is accessible, data wiring can be run free wire back to telecom area from outlet box ¾ inch conduit whiptail into ceiling area
 - If ceiling is not accessible, the associated ¾ inch conduit runs for data wiring back to the telecom area are needed and must be grounded
 - o At least 6 inches of clearance are needed around the outlet boxes to facilitate installation
 - o Mounting Options and Guidelines Factsheet –
https://documentation.meraki.com/MV/Physical_Installation/MV_Mounting_Options_and_Guidelines



Exterior Cameras

The library uses Meraki MV72X and Meraki MV63X model cameras for the exterior of library locations.

- MV72X Datasheet –
<https://meraki.cisco.com/product-collateral/mv72-datasheet/?file>
- MV63X Datasheet –
<https://meraki.cisco.com/product-collateral/mv63-cloud-managed-smart-camera/?file>
- Cameras can be mounted either on an overhang ceiling or on the wall, 8-12 feet from the ground
 - o For ceiling mounted, cameras require double gang outlet boxes, flush mounted with the ceiling and the associated $\frac{3}{4}$ inch conduit runs for data wiring back to the telecom area are needed and **must be grounded**
 - o For wall mounted, cameras require double gang outlet boxes, flush mounted with the wall and the associated $\frac{3}{4}$ inch conduit runs for data wiring back to the telecom area are needed and **must be grounded**
 - Wall mount arms are also available from Meraki, if desired
 - Wall Mount arm dimensions
 - https://files.mtstatic.com/site_13505/10913/0?Expires=1648730862&Signature=sHK6t2nRHE5Qdb079YB0o7kUhFbtKvlltDONHSf-~opgEbcTfBIPQA8Gqx5FQDqCGguPFXitjHMmgArsECSACmZ95ma7PCEmTIXcYlDiZ-ndTiEE4hZqOf7mZ90givwWZ1tA8ObmqIXoxs~GF~qrXgfo86KZozp7~6wPfe1WY_&Key-Pair-Id=APKAJ5Y6AV4GI7A555NA
 - <https://meraki.cisco.com/product/security-cameras/security-cameras-accessories/conduit-back-box-63-93/>
 - <https://meraki.cisco.com/product/security-cameras/security-cameras-accessories/wall-mount-bracket-63-93/>
 - <https://meraki.cisco.com/product/security-cameras/security-cameras-accessories/wall-mount-l-bracket-mv63-mv93/>
 - o At least 6 inches of clearance are needed around the outlet boxes to facilitate installation
 - o Mounting Options and Guidelines Factsheet –
https://documentation.meraki.com/MV/Physical_Installation/MV_Mounting_Options_and_Guidelines



Exterior Access Points

The library uses Meraki MR86 model access points for the exterior of library locations.

- MR86 Datasheet –
https://documentation.meraki.com/MR/MR_Overview_and_Specifications/MR86_Datasheet
- Installation Guide –
https://documentation.meraki.com/MR/MR_Installation_Guides/MR86_Installation_Guide
- Access Points are usually mounted on the wall 8-12 feet from the ground
- Access Points require double gang outlet boxes, flush mounted with the wall and the associated ¾ inch conduit runs for data wiring back to the telecom area are needed and **must be grounded**
- Access Points utilize 1 of 3 different types of antenna model styles, depending on the needs of the site
 - o Omni Antenna (most commonly used)
 - At least 1 ft of clearance are needed around the outlet boxes to facilitate installation
 - Factsheet –
<https://meraki.cisco.com/product-collateral/dual-band-omni-antennas-4-7-dbi-datasheet/?file>
 - o Dual Band Antenna
 - At least 2 ft of clearance are needed around the outlet boxes to facilitate installation
 - Factsheet –
https://meraki.cisco.com/lib/pdf/meraki_datasheet_antenna_dual_band_patch_8d_Bi_6dBi.pdf
 - o Directional Dish Antenna
 - At least 3 ft of clearance are needed around the outlet boxes to facilitate installation
 - Factsheet –
https://www.cisco.com/c/en/us/td/docs/wireless/antenna/installation/guide/ant251_3p4mn.html



SECTION 283111
DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Nonsystem smoke detectors.
 - 5. Heat detectors.
 - 6. Notification appliances.
 - 7. Firefighters' two-way telephone communication service.
 - 8. Magnetic door holders.
 - 9. Remote annunciator.
 - 10. Addressable interface device.
 - 11. Digital alarm communicator transmitter.
 - 12. Radio alarm transmitter.
 - 13. System printer.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.
- B. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 SUBMITTALS

- A. General Submittal Requirements:
 - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 - 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level IV minimum.
 - c. Licensed or certified by authorities having jurisdiction.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.



2. Include voltage drop calculations for notification appliance circuits.
 3. Include battery-size calculations.
 4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
- D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.
- E. Qualification Data: For qualified Installer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software.
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 5. Manufacturer's required maintenance related to system warranty requirements.
 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
 7. Copy of NFPA 25.
- H. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.



2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.7 PROJECT CONDITIONS

1. Notify Owner no fewer than two days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

1.8 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
 4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
 5. Keys and Tools: One extra set for access to locked and tamperproofed components.
 6. Audible and Visual Notification Appliances: One of each type installed.
 7. Fuses: Two of each type installed in the system.



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. GE Infrastructure; a unit of General Electric Company.
 - 2. Gentex Corporation.
 - 3. Johnson Controls, Inc.
 - 4. NOTIFIER; a Honeywell company.
 - 5. Siemens Building Technologies, Inc.; Fire Safety Division.
 - 6. SimplexGrinnell LP; a Tyco International company.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Duct smoke detectors.
 - 5. Verified automatic alarm operation of smoke detectors.
 - 6. Automatic sprinkler system water flow.
 - 7. Heat detectors in elevator shaft and pit.
 - 8. Fire-extinguishing system operation.
 - 9. Fire standpipe system.
- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances.
 - 2. Identify alarm at fire-alarm control unit and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Unlock electric door locks in designated egress paths.
 - 5. Release fire and smoke doors held open by magnetic door holders.
 - 6. Activate voice/alarm communication system.
 - 7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 - 8. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
 - 9. Activate stairwell and elevator-shaft pressurization systems.
 - 10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - 11. Recall elevators to primary or alternate recall floors.
 - 12. Activate emergency lighting control.
 - 13. Record events in the system memory.
 - 14. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - 1. Valve supervisory switch.
 - 2. Low-air-pressure switch of a dry-pipe sprinkler system.
 - 3. Elevator shunt-trip supervision.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
 - 1. Open circuits, shorts, and grounds in designated circuits.



2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.

- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

- C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style E.
 - b. Notification Appliance Circuits: Style Z.
 - c. Signaling Line Circuits: Style 6.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
2. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
 - a. Initiating Device Circuits: Style C.
 - b. Notification Appliance Circuits: Style X.
 - c. Signaling Line Circuits: Style 4.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
3. Serial Interfaces: Two RS-232 ports for printers.



- D. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.
 - 1. Pressurization starts when any alarm is received at fire-alarm control unit.
 - 2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.
- E. Smoke-Alarm Verification:
 - 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - 2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - 3. Record events by the system printer.
 - 4. Sound general alarm if the alarm is verified.
 - 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- F. Elevator Recall:
 - 1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoistway.
 - 2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
 - 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- G. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.
- H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
- I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- J. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the fire command center.
 - 1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.



- c. Standard digitally recorded messages for "Evacuation" and "All Clear."
- d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.
- 2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
- 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- L. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- M. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Vented, wet-cell pocket, plate nickel cadmium.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 3. Station Reset: Key- or wrench-operated switch.
 - 4. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - 5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors shall be two-wire type.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.



4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
 7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
 - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
 - c. Provide multiple levels of detection sensitivity for each sensor.
- B. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- C. Ionization Smoke Detector:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
 4. Each sensor shall have multiple levels of detection sensitivity.



5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 NONSYSTEM SMOKE DETECTORS

A. Single-Station Smoke Detectors:

1. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device.
2. Auxiliary Relays: One Form A and one Form C, both rated at 0.5 A.
3. Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet (3 m) according to UL 464.
4. Visible Notification Appliance: 177-cd strobe.
5. Heat sensor, 135 deg F (57 deg C) combination rate-of-rise and fixed temperature.
6. Test Switch: Push to test; simulates smoke at rated obscuration.
7. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
8. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
9. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
10. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Single-Station Duct Smoke Detectors:

1. Comply with UL 268A; operating at 120-V ac.
2. Sensor: LED or infrared light source with matching silicon-cell receiver.
3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.
 - a. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.7 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.



2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- D. Continuous Linear Heat-Detector System:
1. Detector Cable: Rated detection temperature 155 deg F (68 deg C). NRTL listed for "regular" service and a standard environment. Cable includes two steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short- circuit wires at the location of elevated temperature.
 2. Control Unit: Two-zone or multizone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for fire-alarm control unit.
 3. Signals to Fire-Alarm Control Unit: Any type of local system trouble shall be reported to fire-alarm control unit as a composite "trouble" signal. Alarms on each detection zone shall be individually reported to central fire-alarm control unit as separately identified zones.
 4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.8 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- B. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
- E. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
1. Mounting: Wall mounted unless otherwise indicated.
 2. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 3. Flashing shall be in a temporal pattern, synchronized with other units.
 4. Strobe Leads: Factory connected to screw terminals.
 5. Mounting Faceplate: Factory finished, white.
- F. Voice/Tone Notification Appliances:
1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
 2. High-Range Units: Rated 2 to 15 W.
 3. Low-Range Units: Rated 1 to 2 W.
 4. Mounting: Flush or surface mounted and bidirectional.
 5. Matching Transformers: Tap range matched to acoustical environment of speaker location.



2.9 FIREFIGHTERS' TWO-WAY TELEPHONE COMMUNICATION SERVICE

- A. Dedicated, two-way, supervised, telephone voice communication links between fire-alarm control unit, the fire command center, and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:
1. Common-talk type for firefighter use only.
 2. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously.
 3. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is activated, it causes audible signal to sound and high-intensity lamp to flash.
 4. Selector panel controls shall provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
 5. Display: Graphic to indicate location of caller.
 6. Remote Telephone Cabinet: Flush- or surface-mounted cabinet as indicated, factory-standard red finish, with handset.
 - a. Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designating "Fire Emergency Phone."
 - b. With "break-glass" type door access lock.
 7. Remote Telephone Jack Stations: Single-gang, stainless-steel-plate mounted plug, engraved "Fire Emergency Phone."
 8. Handsets: 3 push-to-talk-type sets with noise-canceling microphone stored in a cabinet in the fire command center.

2.10 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 3. Rating: 24-V ac or dc.
- B. Material and Finish: Match door hardware.

2.11 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.12 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.



2.13 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - 1. Verification that both telephone lines are available.
 - 2. Programming device.
 - 3. LED display.
 - 4. Manual test report function and manual transmission clear indication.
 - 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Address of the supervisory signal.
 - 3. Address of the trouble-initiating device.
 - 4. Loss of ac supply or loss of power.
 - 5. Low battery.
 - 6. Abnormal test signal.
 - 7. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.14 RADIO ALARM TRANSMITTER

- A. Transmitter shall comply with NFPA 1221 and shall be listed and labeled by an NRTL.
- B. Comply with 47 CFR 90.
- C. Description: Manufacturer's standard commercial product; factory assembled, wired, tested, and ready for installation and operation.
 - 1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
 - 2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
 - 3. Normal Power Input: 120-V ac.
 - 4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
 - 5. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
 - 6. Antenna-Cable Connectors: Weatherproof.



7. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.
- D. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:
1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
 2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
 3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
 4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
 5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
 6. Local Fire-Alarm-System Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

2.15 SYSTEM PRINTER

- A. Printer shall be listed and labeled by an NRTL as an integral part of fire-alarm system.

2.16 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 1. Factory fabricated and furnished by manufacturer of device.
 2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Equipment Mounting: Install fire-alarm control unit on concrete base with tops of cabinets not more than **72 inches (1830 mm)** above the finished floor. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."
 1. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 2. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 3. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than **72 inches (1830 mm)** above the finished floor.
- D. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed **30 feet (9 m)**.
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
 5. HVAC: Locate detectors not closer than **3 feet (1 m)** from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than **12 inches (300 mm)** from any part of a lighting fixture.
- E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- F. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- G. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- H. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- I. Audible Alarm-Indicating Devices: Install not less than **6 inches (150 mm)** below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least **6 inches (150 mm)** below the ceiling.
- K. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- L. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than **72 inches (1830 mm)** above the finished floor.
- M. Annunciator: Install with top of panel not more than **72 inches (1830 mm)** above the finished floor.
- N. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that will resist **100-mph (160-km/h)** wind load with a gust factor of 1.3 without damage.

3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than **3 feet (1 m)** from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.



1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Supervisory connections at elevator shunt trip breaker.
10. Supervisory connections at fire-pump engine control panel.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm



Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION