

# PROJECT MANUAL

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## ***ANN ARBOR FIRE DEPARTMENT STATION NO. 1 RENOVATIONS***

*111 North 5<sup>th</sup> Avenue  
Ann Arbor, Michigan*

**NSA**  
ARCHITECTURE  
23761 Research Dr., Farmington Hills, MI 48335  
248-477-2444      [www.nsa-architecture.com](http://www.nsa-architecture.com)

**PROJECT NO. 221015.00**

**February 15, 2022  
Issued for Bids**

# PROJECT MANUAL

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**NSA**  
ARCHITECTURE

23761 Research Dr., Farmington Hills, MI 48335  
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**DOCUMENT SET**

The Contract Drawings that accompany this Project Manual and with it form the Document Set are identified by the same Architect Project No. as this Project Manual.

Verification of Document Set Verify that the Document Set transmitted is complete. Compare Drawings received with lists. Documents in the Project Manual, except standard pre-printed Documents, are terminated with "END OF ..." statement.

The Document Set will include additional Documents, if any, that are issued in conjunction with addenda and bulletins.

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## **SECTION 002600 - PROCUREMENT SUBSTITUTION PROCEDURES**

### **1.1 DEFINITIONS**

- A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.
- B. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 012500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

### **1.2 QUALITY ASSURANCE**

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

### **1.3 PROCUREMENT SUBSTITUTIONS**

- A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.
- B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise, requests will be returned without action:
  - 1. Extensive revisions to the Contract Documents are not required.
  - 2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
  - 3. The request is fully documented and properly submitted.

### **1.4 SUBMITTALS**

- A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing by prime contract Bidder only in compliance with the following requirements:
  - 1. Requests for substitution of materials and equipment will be considered if received no later than 7 days prior to date of bid opening.
  - 2. Submittal Format: Submit one electronic copy of each written Procurement Substitution Request, using form bound in Project Manual.
    - a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
    - b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:

- 1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
  - 2) Copies of current, independent third-party test data of salient product or system characteristics.
  - 3) Samples where applicable or when requested by Architect.
  - 4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
  - 5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - 6) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.
  - 7) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.
- c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.
  - d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.
- B. Architect's Action:
1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.
- C. Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT 002600

**PRIME CONTRACTOR'S SUBSTITUTION REQUEST SUBMITTAL**

(Use separate form for each request)

Refer to Specification Section 002600 Procurement Substitution Procedures.

Date when bids for this item is to be received: \_\_\_\_\_.

TO: NSA Architecture  
Attn: Construction Administration  
23761 Research Drive  
Farmington Hills, MI 48335  
Phone: (248) 477-2444  
[rfi@nsa-architecture.com](mailto:rfi@nsa-architecture.com)

We request acceptance of the proposed substitution that is generally described as follows:

If accepted, the proposed substitution would revise the following Specifications (All other requirements would remain unchanged): \_\_\_\_\_.

We are attaching to this request the following items:

- Copies of pertinent product data that are noted and highlighted to indicate the exact product(s) proposed in .pdf format.
- Copies of Contract Drawing details and Contract Specification pages, noted to indicate all revisions that are necessary in order to accommodate the proposed substitution in .pdf format.

The condition(s) that produce this request are as follows (refer to acceptable conditions described in 002600):

We certify that in every significant respect, the proposed substitution is equal to, or better than, that required by the Contract Documents, and that the proposed substitution will perform adequately in the intended application.

We waive the right to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

As part of this Substitution Request, we propose the following changes:

To the Contract Sum:         Add         Subtract    \$ \_\_\_\_\_

To the Contract Time:       Add         Subtract    \_\_\_\_\_ days

**Subcontractor/Supplier**

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Name	Phone	Fax
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Representative's Signature	Date
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**General Contractor's**

Acceptance     Rejection

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Representative's Signature	Date
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**Architect/Engineer's**

Acceptance     Rejection

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Representative's Signature	Date
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**Owner's**

Acceptance     Rejection

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Representative's Signature	Date
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## **SECTION 003113 - PRELIMINARY SCHEDULES**

### **1.1 PROJECT SCHEDULE**

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but do not affect Contract Time requirements. This Document and its attachments are not part of the Contract Documents.
- B. Available Project information includes the following:
1. Ann Arbor Fire Station 1 Renovations: Refer to tentative schedule below.
- C. Project schedule including design and construction milestones and Owner's occupancy requirements is available for viewing as appended to this Document.
- D. Tentative Schedule is as follows:

	<b>START</b>	<b>COMPLETION</b>	<b>DURATION</b>
1. Project Advertisement:	2/15/2022	3/22/2022	35 days
2. Release Bidding Documents:	2/15/2022	2/15/2022	1 day
3. Mandatory Pre-Bid Meeting:	2/25/2022	2/25/2022 - 9:00 AM	1 day
4. Bidders Questions Deadline:	3/4/2022	3/4/2022 - 12:00 PM	1 day
5. Final Addendum Issuance	3/7/2022	3/11/2022	5 days
6. Bid Due Date:	3/22/2022	3/22/2022 - 2:00 PM	1 day
7. Bidder Interviews:	4/5/2022	4/5/2022	1 day
8. Bid Award:	5/16/2022	5/16/2022	1 day
9. Notice to Proceed:	5/31/2022	5/31/2022	1 day
10. Construction	6/1/2022	10/31/2022	150 days
11. Substantial Completion:	11/1/2022	11/8/2022	1 week

- E. Related Requirements:
1. Section 011000 "Summary" for any applicable phased construction requirements.
  2. Section 013200 "Construction Progress Documentation" for Contractor's construction schedule requirements.

END OF DOCUMENT 003113

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## **DOCUMENT 004373 - PROPOSED SCHEDULE OF VALUES FORM**

### **1.1 BID FORM SUPPLEMENT**

- A. A completed Proposed Schedule of Values form is required to be attached to the Bid Form.

### **1.2 PROPOSED SCHEDULE OF VALUES FORM**

- A. Proposed Schedule of Values Form: Provide a breakdown of the bid amount, including alternates, in enough detail to facilitate continued evaluation of bid. Coordinate with the Project Manual table of contents. Provide multiple line items for principal material and subcontract amounts in excess of five percent of the Contract Sum.
- B. Arrange schedule of values consistent with format of AIA Document G703.
  - 1. Copies of AIA standard forms may be obtained from the American Institute of Architects; <http://www.aiacontract.org/purchase>; (800) 942-7732.

END OF DOCUMENT 004373

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**AIA**<sup>®</sup>

# Document G703<sup>®</sup>CW – 2021

## Continuation Sheet for Cost of the Work Projects

AIA Document G702<sup>®</sup>CW, Application and Certification for Payment without GMP, or G702<sup>®</sup>GMP, Application and Certificate for Payment with GMP, containing Contractor's signed certification is attached. Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:  
APPLICATION DATE:  
PERIOD TO:  
ARCHITECT'S PROJECT NO:

A ITEM NO.	B DESCRIPTION OF WORK	C SCHEDULED VALUE				D WORK COMPLETED		F MATERIALS PRESENTLY STORED <i>(Not in D or E)</i>	G		H BALANCE TO FINISH <i>(C4 - G)</i>	I RETAINAGE <i>(If variable rate)</i>
		C1 ORIGINAL	C2 CHANGE FROM PREVIOUS APPLICATIONS	C3 CHANGE THIS PERIOD	C4 CURRENT <i>(C1 + C2 + C3)</i>	D FROM PREVIOUS APPLICATION <i>(D + E)</i>	E THIS PERIOD		TOTAL COMPLETED AND STORED TO DATE <i>(D + E + F)</i>	% <i>(G ÷ C4)</i>		
	<b>GRAND TOTAL</b>											

## **SECTION 008000 - SUPPLEMENTARY CONDITIONS**

### **PART 1 - GENERAL**

END OF SECTION 008000

## **SECTION 011000 - SUMMARY**

### **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. Project information.
2. Permits
3. Work covered by Contract Documents.
4. Owner-furnished products.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and Drawing conventions.

- B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for schedules to be submitted by the Contractor.
2. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### **1.3 PERMITS**

- A. Contractor shall be responsible for securing all permits and required inspections by the City of Ann Arbor having jurisdiction over the project, however, permit and inspection fees required by the City will be paid for by the Fire Department. Contractor will be responsible to pay for any and all City re-inspection fees associated with rejected work. Contractor will be responsible for securing and fees for all permits and inspections outside of the City of Ann Arbor.

#### **1.4 PROJECT ONE INFORMATION**

- A. Project Identification: Ann Arbor Fire Station No. 1 Renovations – NSA Project No. 2210015.00
  1. Project Location: 111 North Fifth Avenue Ann Arbor MI 48104.
- B. Owner: City of Ann Arbor, Procurement Unit, 301 E. Huron St. Ann Arbor MI 48104
- C. Architect: NSA Architecture, 23761 Research Drive, Farmington Hills, Michigan 48335.

- D. Architect's Consultants: Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. Peter Basso Associates, Inc. (Mechanical, Plumbing, Electrical)  
5145 Livernois Suite 100, Troy, MI. 48098

### **1.5 WORK COVERED BY CONTRACT DOCUMENTS**

- A. The Work of Project is defined by the Contract Documents and consists of the following:
1. Interior Demolition of existing finishes
  2. Limited site work including removal and replacement of existing entry slab
  3. Millwork including cabinetry, countertops (solid surface & plastic laminate)
  4. Interior metal stud and gypsum partitions.
  5. Suspended acoustical and gypsum board ceilings.
  6. Interior finishes: painting, epoxy flooring, LVT, Ceramic Tiling
  7. Interior doors and finish hardware
  8. Toilet accessories.
  9. Miscellaneous specialties including interior signage, fire extinguishers, window treatment
  10. Mechanical HVAC Systems
  11. Mechanical Plumbing and Piping
  12. Fire Suppression System (limited)
  13. Electrical Power.
  14. Electrical Lighting.
  15. Auxiliary and Special Electrical Systems including Emergency Alert and Public Address systems.
- B. Type of Contract:
1. Project will be constructed under a single prime contract.

### **1.6 WORK BY OWNER**

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

### **1.7 OWNER-FURNISHED PRODUCTS**

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, coordinating with other Work and installing Owner-furnished products and making any related and required building services connections.
- B. Owner-Furnished Contractor Installed Products:
1. Wall mounted televisions and monitors
  2. Stand up Refrigerators with ice-maker unit.
- C. Owner-Furnished and Owner-Installed Products:
1. Office furniture.
  2. Dining furniture
  3. Bunk room beds and night stands



## **1.8 ACCESS TO SITE**

- A. General: Contractor shall coordinate with the Owner daily access procedures and routes.
- B. Use of Site: Contractor shall have limited use of the project site for construction operations as indicated on Drawings (designated work area).. Coordinate with Owner any staging areas and off site employee parking. "Driveways, Walkways and Entrances" Subparagraph below is an example of a special requirement appropriate to many projects. Revise to suit Project or delete.
  - 1. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
    - c. Do not store materials on roof; lift only those materials needed for that days' work.
- C. Condition of perimeter Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

## **1.9 WORK RESTRICTIONS**

- A. Work Restrictions, General: Comply with restrictions on construction operations.
  - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
  - 2. Contractor must include the cost of all labor to complete the project in the time indicated in the Contractor's submitted schedule. Owner will not pay for overtime or shift premiums
- B. On-Site Work Hours: Limit work at the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.
  - 1. Weekend Hours: Coordinate work on weekends with Owner.
  - 2. Early Morning Hours: No early morning work allowed.
  - 3. Hours for Utility Shutdowns: No utility shutdowns are allowed. Coordinate with Owner for Utility Interruptions as indicated below.
- C. Existing Utility Interruptions: Do not interrupt utilities serving surrounding neighborhood or others .
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to building occupants.
  - 1. Notify Owner not less than two days in advance of proposed disruptive operations.
  - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- F. Employee Identification: Owner will provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

- G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
- H. No fire arms are allowed on job site of project site premises.

**1.10 SPECIFICATION AND DRAWING CONVENTIONS**

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
  - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard.
  - 3. Conflicts between drawings and specifications: Contractor shall issue a Request for Information for all clarifications required for conflicts discovered between drawings and specification. The Architect shall provide a final interpretation. Greater quantity and quality shall be the basis of contact.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

END OF SECTION 011000

## **SECTION 012500 - SUBSTITUTION PROCEDURES**

### **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 administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

#### **1.3 DEFINITIONS**

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

#### **1.4 ACTION SUBMITTALS**

- A. Substitution Requests: Submit one electronic copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use facsimile of form provided in Project Manual.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
    - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect,

- sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
  - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

## **1.5 QUALITY ASSURANCE**

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## **1.6 PROCEDURES**

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

## **1.7 SUBSTITUTIONS**

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Substitution request is fully documented and properly submitted.
  - c. Requested substitution will not adversely affect Contractor's construction schedule.
  - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - e. Requested substitution is compatible with other portions of the Work.
  - f. Requested substitution has been coordinated with other portions of the Work.
  - g. Requested substitution provides specified warranty.
  - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
  
- B. Substitutions for Convenience: Not allowed.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

END OF SECTION 012500

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**PRIME CONTRACTOR'S SUBSTITUTION REQUEST SUBMITTAL**

(Use separate form for each request)

Refer to Specification Section 012500 Substitution Procedures.

Date when bids for this item is to be received: \_\_\_\_\_.

TO: NSA Architecture  
Attn: Construction Administration  
23761 Research Drive  
Farmington Hills, MI 48335  
Phone: (248) 477-2444  
[rfi@nsa-architecture.com](mailto:rfi@nsa-architecture.com)

We request acceptance of the proposed substitution that is generally described as follows:

If accepted, the proposed substitution would revise the following Specifications (All other requirements would remain unchanged): \_\_\_\_\_.

We are attaching to this request the following items:

- Copies of pertinent product data that are noted and highlighted to indicate the exact product(s) proposed in .pdf format.
- Copies of Contract Drawing details and Contract Specification pages, noted to indicate all revisions that are necessary in order to accommodate the proposed substitution in .pdf format.

The condition(s) that produce this request are as follows (refer to acceptable conditions described in 012500):

We certify that in every significant respect, the proposed substitution is equal to, or better than, that required by the Contract Documents, and that the proposed substitution will perform adequately in the intended application.

We waive the right to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

As part of this Substitution Request, we propose the following changes:

To the Contract Sum:         Add         Subtract    \$ \_\_\_\_\_

To the Contract Time:       Add         Subtract    \_\_\_\_\_ days

**Subcontractor/Supplier**

Name	Phone	Fax
------	-------	-----

Representative's Signature	Date
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**General Contractor's**

Acceptance     Rejection

Representative's Signature	Date
----------------------------	------

**Architect/Engineer's**

Acceptance     Rejection

Representative's Signature	Date
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**Owner's**

Acceptance     Rejection

Representative's Signature	Date
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## **SECTION 012600 - CONTRACT MODIFICATION PROCEDURES**

### **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 administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

#### **1.3 DEFINITIONS**

- A. Bulletin: A description indicating a proposed change in the work, and requesting a proposal for the cost and time requirements for implementing that proposed change.

#### **1.4 MINOR CHANGES IN THE WORK**

- A. Architect will issue through Construction Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Architect's Supplemental Instructions form.

#### **1.5 BULLETINS (PROPOSAL REQUESTS)**

- A. Owner-Initiated Bulletins: Architect, will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Bulletins issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Bulletin after receipt of Bulletin, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.

- d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  - e. Quotation Form: Use forms acceptable to Architect.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to the Architect.
- 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - 4. Include costs of labor and supervision directly attributable to the change.
  - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  - 6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
  - 7. Proposal Request Form: Use form acceptable to Architect.

## **1.6 CHANGE ORDER PROCEDURES**

- A. On Owner's approval of a Work Change Bulletin, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

## **1.7 CONSTRUCTION CHANGE DIRECTIVE**

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION (Not Used)**

END OF SECTION 012600

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## **SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION**

### **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 administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. RFIs.
  - 4. Digital project management procedures.
  - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

#### **1.3 DEFINITIONS**

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, General Contractor, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.

- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
  - 1. Post copies of list in project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in built facility. Keep list current at all times.

## **1.5 GENERAL COORDINATION PROCEDURES**

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
  - 4. Provide on-site supervision of all sub trade activities. Note: Do not permit any unsupervised activities by any sub trade during construction.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractor's construction schedule.
  - 2. Preparation of the schedule of values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Pre-installation conferences.
  - 7. Project closeout activities.
  - 8. Startup and adjustment of systems.

## **1.6 COORDINATION DRAWINGS**

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    - f. Indicate required installation sequences.
    - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
  2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
  3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
  4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
  6. Mechanical and Plumbing Work: Show the following:
    - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    - c. Fire-rated enclosures around ductwork.
  7. Electrical Work: Show the following:
    - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.

- c. Panel board, switch board, switchgear, transformer, busway, generator, and motor-control center locations.
    - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
  8. Fire-Protection System: Show the following:
    - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
  9. Review: Architect will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
  10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
  1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
  2. File Preparation Format: DWG, Version 15 (or later), operating in Microsoft Windows operating system.
  3. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.

#### **1.7 REQUEST FOR INFORMATION (RFI)**

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified and attached to this specification.
  1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. RFI Delivery to Architect: RFI's shall be transmitted to the Architect ONLY via e-mail to: [RFI@nsa-architecture.com](mailto:RFI@nsa-architecture.com).
- C. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. Name of Architect and General Contractor.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Drawing number and detail references, as appropriate.
  10. Field dimensions and conditions, as appropriate.
  11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
  - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
  
- D. RFI Forms: To be provided by the Contractor.
  1. Attachments shall be electronic files in PDF format.
  
- E. Architect's and General Contractor's Action: Architect and General Contractor will review each RFI, determine action required, and respond. Allow three working days after Architect's receipt of RFI for Architect's response for each RFI. RFIs received by Architect or General Contractor after 1:00 p.m. will be considered as received the following working day.
  1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of Submittals.
    - b. Requests for approval of Substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Architect's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect or General Contractor of additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and General Contractor] in writing within 3 days of receipt of the RFI response.
  
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
  1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect and General Contractor.
  4. RFI number including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's and General Contractor's response was received.
  8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
  
- G. On receipt of Architect's and General Contractor's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and General Contractor within three days if Contractor disagrees with response.



## **1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES**

- A. Architect's Data Files Not Available: Architect will not provide Architect's BIM model digital data files for Contractor's use during construction.
- B. Web-Based Project Software: Use General Contractor's web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.
  - 1. Web-based Project software site includes, at a minimum, the following features:
    - a. Compilation of Project data, including Contractor, subcontractors, Architect, architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    - c. Document workflow planning, allowing customization of workflow between project entities.
    - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    - e. Track status of each Project communication in real time, and log time and date when responses are provided.
    - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    - g. Processing and tracking of payment applications.
    - h. Processing and tracking of contract modifications.
    - i. Creating and distributing meeting minutes.
    - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
    - k. Management of construction progress photographs.
    - l. Mobile device compatibility, including smartphones and tablets.
- C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
  - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2. Name file with submittal number or other unique identifier, including revision identifier.
  - 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

## **1.9 PROJECT MEETINGS**

- A. General: General Contractor will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
  - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, General Contractor, and Architect, within three days of the meeting.

- B. Preconstruction Conference: General Contractor will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority,, General Contractor, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Responsibilities and personnel assignments.
    - b. Tentative construction schedule.
    - c. Phasing.
    - d. Critical work sequencing and long lead items.
    - e. Designation of key personnel and their duties.
    - f. Lines of communications.
    - g. Use of web-based Project software.
    - h. Procedures for processing field decisions and Change Orders.
    - i. Procedures for RFIs.
    - j. Procedures for testing and inspecting.
    - k. Procedures for processing Applications for Payment.
    - l. Distribution of the Contract Documents.
    - m. Submittal procedures.
    - n. Sustainable design requirements.
    - o. Preparation of Record Documents.
    - p. Use of the premises.
    - q. Work restrictions.
    - r. Working hours.
    - s. Owner's occupancy requirements.
    - t. Responsibility for temporary facilities and controls.
    - u. Procedures for moisture and mold control.
    - v. Procedures for disruptions and shutdowns.
    - w. Construction waste management and recycling.
    - x. Parking availability.
    - y. Office, work, and storage areas.
    - z. Equipment deliveries and priorities.
    - aa. First aid.
    - bb. Security.
    - cc. Progress cleaning.
  3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.

D. Project Progress Meetings:

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, General Contractor, and Owner's Commissioning Authority of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
  - a. Contract Documents.
  - b. Options.
  - c. Related RFIs.
  - d. Related Change Orders.
  - e. Purchases.
  - f. Deliveries.
  - g. Submittals.
  - h. Sustainable design requirements.
  - i. Review of mockups.
  - j. Possible conflicts.
  - k. Compatibility requirements.
  - l. Time schedules.
  - m. Weather limitations.
  - n. Manufacturer's written instructions.
  - o. Warranty requirements.
  - p. Compatibility of materials.
  - q. Acceptability of substrates.
  - r. Temporary facilities and controls.
  - s. Space and access limitations.
  - t. Regulations of authorities having jurisdiction.
  - u. Testing and inspecting requirements.
  - v. Installation procedures.
  - w. Coordination with other work.
  - x. Required performance results.
  - y. Protection of adjacent work.
  - z. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

E. Project Closeout Conference: General Contractor will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, General Contractor, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

- a. Preparation of Record Documents.
  - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
  - c. Procedures for completing and archiving web-based Project software site data files.
  - d. Submittal of written warranties.
  - e. Requirements for completing sustainable design documentation.
  - f. Requirements for preparing operations and maintenance data.
  - g. Requirements for delivery of material samples, attic stock, and spare parts.
  - h. Requirements for demonstration and training.
  - i. Preparation of Contractor's punch list.
  - j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
  - k. Submittal procedures.
  - l. Coordination of separate contracts.
  - m. Owner's partial occupancy requirements.
  - n. Installation of Owner's furniture, fixtures, and equipment.
  - o. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- F. Progress Meetings: General Contractor will conduct progress meetings at regular intervals.
1. Coordinate dates of meetings with preparation of payment requests.
  2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, General Contractor, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Resolution of BIM component conflicts.
      - 4) Status of submittals.
      - 5) Status of sustainable design documentation.
      - 6) Deliveries.
      - 7) Off-site fabrication.
      - 8) Access.
      - 9) Site use.
      - 10) Temporary facilities and controls.
      - 11) Progress cleaning.
      - 12) Quality and work standards.
      - 13) Status of correction of deficient items.
      - 14) Field observations.
      - 15) Status of RFIs.

- 16) Status of Proposal Requests.
  - 17) Pending changes.
  - 18) Status of Change Orders.
  - 19) Pending claims and disputes.
  - 20) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- G. Coordination Meetings: General Contractor will conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.
1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, General Contractor, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    - c. Review present and future needs of each contractor present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Resolution of BIM component conflicts.
      - 4) Status of submittals.
      - 5) Deliveries.
      - 6) Off-site fabrication.
      - 7) Access.
      - 8) Site use.
      - 9) Temporary facilities and controls.
      - 10) Work hours.
      - 11) Hazards and risks.
      - 12) Progress cleaning.
      - 13) Quality and work standards.
      - 14) Status of RFIs.
      - 15) Proposal Requests.
      - 16) Change Orders.
      - 17) Pending changes.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

END OF SECTION 013100

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## **SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION**

### **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 administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Startup construction schedule.
  - 2. Contractor's Construction Schedule.
  - 3. Construction schedule updating reports.
  - 4. Daily construction reports.
  - 5. Material location reports.
  - 6. Site condition reports.
  - 7. Unusual event reports.

#### **1.3 DEFINITIONS**

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.



2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Format for Submittals: Submit required submittals in the following format:
1. PDF file.
  2. Two paper copies, of sufficient size to display entire period or schedule, as required.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- C. Construction Schedule Updating Reports: Submit with Applications for Payment.
- D. Daily Construction Reports: Submit at weekly intervals.
- E. Material Location Reports: Submit at weekly intervals.
- F. Site Condition Reports: Submit at time of discovery of differing conditions.
- G. Unusual Event Reports: Submit at time of unusual event.
- H. Qualification Data: For scheduling consultant.

#### **1.5 QUALITY ASSURANCE**

#### **1.6 COORDINATION**

- A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from entities involved.
  2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

#### **1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL**

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- B. Time Frame: Extend schedule from date established for the Notice of Award to date of final completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

- C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
  2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
  4. Startup and Testing Time: Include no fewer than 5 days for startup and testing.
  5. Commissioning Time: Include no fewer than 5 days for commissioning.
  6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
  7. Punch List and Final Completion: Include not more than 15 days for completion of punch list items and final completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  4. Products Ordered in Advance: Include a separate activity for each product.
  5. Owner-Furnished Products: Include a separate activity for each product.
  6. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use-of-premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
  7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.
    - f. Sample testing.
    - g. Deliveries.
    - h. Installation.
    - i. Tests and inspections.
    - j. Adjusting.
    - k. Curing.
    - l. Building flush-out.
    - m. Startup and placement into final use and operation.
    - n. Commissioning.

8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
  - a. Structural completion.
  - b. Temporary enclosure and space conditioning.
  - c. Permanent space enclosure.
  - d. Completion of mechanical installation.
  - e. Completion of electrical installation.
  - f. Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
  1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
  1. Unresolved issues.
  2. Unanswered Requests for Information.
  3. Rejected or unreturned submittals.
  4. Notations on returned submittals.
  5. Pending modifications affecting the Work and the Contract Time.
- H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
  1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate final completion percentage for each activity.
- I. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- J. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  1. Post copies in Project meeting rooms and temporary field offices.
  2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

## **1.8 REPORTS**

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. Equipment at Project site.
  5. Material deliveries.
  6. High and low temperatures and general weather conditions, including presence of rain or snow.
  7. Testing and inspection.
  8. Accidents.
  9. Meetings and significant decisions.
  10. Unusual events.
  11. Stoppages, delays, shortages, and losses.
  12. Meter readings and similar recordings.
  13. Emergency procedures.
  14. Orders and requests of authorities having jurisdiction.
  15. Change Orders received and implemented.
  16. Construction Change Directives received and implemented.
  17. Services connected and disconnected.
  18. Equipment or system tests and startups.
  19. Partial completions and occupancies.
  20. Substantial Completions authorized.
- B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
  2. Material stored prior to previous report and since removed from storage and installed.
  3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
- D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, and responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
1. Submit unusual event reports directly to Construction Manager within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION (Not Used)**

END OF SECTION 013200

## **SECTION 013300 - SUBMITTAL PROCEDURES**

### **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. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.
3. See also related Submittal Form that must be used and filled out completely for all submittals.

- B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 013301 "Submittal Routing Transmittals" for transmittal to accompany all submittals.
5. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections to 3<sup>rd</sup> Party Testing Agency.
6. Section 014100 "Special Inspections and Tests" for submitting tests and inspection reports, and schedules of tests and inspections to 3<sup>rd</sup> Party Testing Agency.
7. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
8. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
9. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
10. Section 017900 "Demonstration and Training" for submitting related photo documentation or video recordings of demonstration of equipment and training of Owner's personnel.

#### **1.3 DEFINITIONS**

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

#### **1.4 SUBMITTAL SCHEDULE**

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
  4. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal Category: Action; informational.
    - d. Name of subcontractor.
    - e. Description of the Work covered.
    - f. Scheduled date for Architect's final release or approval.

#### **1.5 SUBMITTAL FORMATS**

- A. Submittal Information: Utilize the NSA Submittal Routing Transmittal (Section 013301) and include the following information in each submittal:
1. Project name.
  2. Date.
  3. Name of Architect.
  4. Name of Contractor.
  5. Name of firm or entity that prepared submittal.
  6. Names of subcontractor, manufacturer, and supplier.
  7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
  8. Category and type of submittal.
  9. Submittal purpose and description.
  10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
  11. Drawing number and detail references, as appropriate.
  12. Indication of full or partial submittal.
  13. Location(s) where product is to be installed, as appropriate.
  14. Other necessary identification.
  15. Remarks.
  16. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.

- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
  
- D. PDF Submittals: Unless noted otherwise all submittals shall be in Electronic PDF files issued through Web-Based Project Software. Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number using NSA Routing Transmittal. Exceptions for required Material Samples.
  
- E. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or other format indicated by Project software website.
  
- F. Optional Paper Submittals if requested by Architect:
  - 1. Paper Submittals are required for submittals over 25 sheets, or sheet sizes over 11x17.
  - 2. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
  - 3. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
  - 4. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
  - 5. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
  - 6. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
  
- G. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using NSA Routing Transmittal form included in Project Manual (Section 013301)
  
- H. Prepare and submit submittals (and also RFI inquiries) required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  
- I. Electronic Delivery and Return:
  - 1. Deliver Submittals electronically to this NSA e-mail address: RFI@nsa-architecture.com.
  - 2. Web-Based Project Software: Any project or contractor required website for coordination of the project to be handled totally by the Contractor.
  - 3. Architect will return annotated file via NSA e-mail system.
  - 4. Material Samples will obviously require mailing.
  - 5. Architect will track internal submittals and RFI's for the purpose of creating tracking\ exception reports.
  
- J. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.



3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
  4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- K. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 10 working days for submittals of 25 sheets or less, and 15 working days for submittals of 25 sheets or more, as well as steel and sequential submittals for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow the same number of working days for each resubmittal as is required for review of the initial submittal.
- L. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- M. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- N. Use for Construction: Retain complete and record copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action noted on the transmittal form.

## **1.6 SUBMITTAL REQUIREMENTS**

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams that show factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit electronic Shop Drawings on actual sheet size.
  3. BIM Incorporation: Develop and incorporate Shop Drawing files into BIM established for Project.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    - a. Project name and submittal number.
    - b. Generic description of Sample.
    - c. Product name and name of manufacturer.
    - d. Sample source.
    - e. Number and title of applicable Specification Section.
    - f. Specification paragraph number and generic name of each item.
  3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

- a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return one sample of the selected product submittal sample with options selected.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  2. Manufacturer and product name, and model number if applicable.
  3. Number and name of room or space.
  4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
  2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
  3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
  4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
  5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
  6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
  2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
  3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - a. Name of evaluation organization.
  - b. Date of evaluation.
  - c. Time period when report is in effect.
  - d. Product and manufacturers' names.
  - e. Description of product.
  - f. Test procedures and results.
  - g. Limitations of use.

#### **1.7 DELEGATED-DESIGN SERVICES**

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies of certificate, signed and sealed by the responsible design professional, registered in the State of Michigan, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM Incorporation: Incorporate delegated-design drawing and data files into BIM established for Project.
  1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as original Drawings.

#### **1.8 CONTRACTOR'S REVIEW**

- A. Action Submittals and Informational Submittals: Contractor to review each submittal and check for coordination, proper fit and finish with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents. Approval also indicates materials; field measurements; and quantities have been verified.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.
2. Architect's review is for design intent only. Architect will not review detailed dimensions, quantities, completeness of submittal as related to other submittals, or coordination of the submittal with other adjacent or related work.

#### **1.9 ARCHITECT'S REVIEW**

- A. Action Submittals: Architect will review each submittal for general compliance with the Contract Documents, indicate observed corrections or revisions required, and return it.
  1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action on the Transmittal Form.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will discard submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

#### **PART 2 - PRODUCTS (Not Used)**

#### **PART 3 - EXECUTION (Not Used)**

END OF SECTION 013300  
(Submittal Transmittal Follows)

## **SECTION 014200 - REFERENCES**

### **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 DEFINITIONS**

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

#### **1.3 INDUSTRY STANDARDS**

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

#### 1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
  - 1. AABC - Associated Air Balance Council; [www.aabc.com](http://www.aabc.com).
  - 2. AAMA - American Architectural Manufacturers Association; [www.aamanet.org](http://www.aamanet.org).
  - 3. AAPFCO - Association of American Plant Food Control Officials; [www.aapfco.org](http://www.aapfco.org).
  - 4. AASHTO - American Association of State Highway and Transportation Officials; [www.transportation.org](http://www.transportation.org).
  - 5. AATCC - American Association of Textile Chemists and Colorists; [www.aatcc.org](http://www.aatcc.org).
  - 6. ABMA - American Bearing Manufacturers Association; [www.americanbearings.org](http://www.americanbearings.org).
  - 7. ABMA - American Boiler Manufacturers Association; [www.abma.com](http://www.abma.com).
  - 8. ACI - American Concrete Institute; (Formerly: ACI International); [www.concrete.org](http://www.concrete.org)
  - 9. ACPA - American Concrete Pipe Association; [www.concrete-pipe.org](http://www.concrete-pipe.org).
  - 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); [www.aeic.org](http://www.aeic.org).
  - 11. AF&PA - American Forest & Paper Association; [www.afandpa.org](http://www.afandpa.org).
  - 12. AGA - American Gas Association; [www.aga.org](http://www.aga.org).
  - 13. AHAM - Association of Home Appliance Manufacturers; [www.aham.org](http://www.aham.org).
  - 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); [www.ahrinet.org](http://www.ahrinet.org).
  - 15. AI - Asphalt Institute; [www.asphaltinstitute.org](http://www.asphaltinstitute.org).
  - 16. AIA - American Institute of Architects (The); [www.aia.org](http://www.aia.org).
  - 17. AISC - American Institute of Steel Construction; [www.aisc.org](http://www.aisc.org).
  - 18. AISI - American Iron and Steel Institute; [www.steel.org](http://www.steel.org).
  - 19. AITC - American Institute of Timber Construction; [www.aitc-glulam.org](http://www.aitc-glulam.org).
  - 20. AMCA - Air Movement and Control Association International, Inc.; [www.amca.org](http://www.amca.org).
  - 21. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  - 22. AOSA - Association of Official Seed Analysts, Inc.; [www.aosaseed.com](http://www.aosaseed.com).
  - 23. APA - APA - The Engineered Wood Association; [www.apawood.org](http://www.apawood.org).
  - 24. APA - Architectural Precast Association; [www.archprecast.org](http://www.archprecast.org).
  - 25. API - American Petroleum Institute; [www.api.org](http://www.api.org).
  - 26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
  - 27. ARI - American Refrigeration Institute; (See AHRI).
  - 28. ARMA - Asphalt Roofing Manufacturers Association; [www.asphaltroofing.org](http://www.asphaltroofing.org).
  - 29. ASCE - American Society of Civil Engineers; [www.asce.org](http://www.asce.org).
  - 30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
  - 31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; [www.ashrae.org](http://www.ashrae.org).
  - 32. ASME - ASME International; (American Society of Mechanical Engineers); [www.asme.org](http://www.asme.org).
  - 33. ASSE - American Society of Safety Engineers (The); [www.asse.org](http://www.asse.org).
  - 34. ASSE - American Society of Sanitary Engineering; [www.asse-plumbing.org](http://www.asse-plumbing.org).
  - 35. ASTM - ASTM International; [www.astm.org](http://www.astm.org).

36. ATIS - Alliance for Telecommunications Industry Solutions; [www.atis.org](http://www.atis.org).
37. AWEA - American Wind Energy Association; [www.awea.org](http://www.awea.org).
38. AWI - Architectural Woodwork Institute; [www.awinet.org](http://www.awinet.org).
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; [www.awmac.com](http://www.awmac.com).
40. AWPA - American Wood Protection Association; [www.awpa.com](http://www.awpa.com).
41. AWS - American Welding Society; [www.aws.org](http://www.aws.org).
42. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).
43. BHMA - Builders Hardware Manufacturers Association; [www.buildershardware.com](http://www.buildershardware.com).
44. BIA - Brick Industry Association (The); [www.gobrick.com](http://www.gobrick.com).
45. BICSI - BICSI, Inc.; [www.bicsi.org](http://www.bicsi.org).
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); [www.bifma.org](http://www.bifma.org).
47. BISSC - Baking Industry Sanitation Standards Committee; [www.bissc.org](http://www.bissc.org).
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); [www.bissc.org](http://www.bissc.org).
49. CDA - Copper Development Association; [www.copper.org](http://www.copper.org).
50. CE - Conformite Europeenne; <http://ec.europa.eu/growth/single-market/ce-marking/>
51. CEA - Canadian Electricity Association; [www.electricity.ca](http://www.electricity.ca).
52. CEA - Consumer Electronics Association; [www.ce.org](http://www.ce.org).
53. CFFA - Chemical Fabrics and Film Association, Inc.; [www.chemicalfabricsandfilm.com](http://www.chemicalfabricsandfilm.com).
54. CFSEI - Cold-Formed Steel Engineers Institute; [www.cfsei.org](http://www.cfsei.org).
55. CGA - Compressed Gas Association; [www.cganet.com](http://www.cganet.com).
56. CIMA - Cellulose Insulation Manufacturers Association; [www.cellulose.org](http://www.cellulose.org).
57. CISCA - Ceilings & Interior Systems Construction Association; [www.cisca.org](http://www.cisca.org).
58. CISPI - Cast Iron Soil Pipe Institute; [www.cispi.org](http://www.cispi.org).
59. CLFMI - Chain Link Fence Manufacturers Institute; [www.chainlinkinfo.org](http://www.chainlinkinfo.org).
60. CPA - Composite Panel Association; [www.pbmdf.com](http://www.pbmdf.com).
61. CRI - Carpet and Rug Institute (The); [www.carpet-rug.org](http://www.carpet-rug.org).
62. CRRC - Cool Roof Rating Council; [www.coolroofs.org](http://www.coolroofs.org).
63. CRSI - Concrete Reinforcing Steel Institute; [www.crsi.org](http://www.crsi.org).
64. CSA - CSA Group; [www.csa.ca](http://www.csa.ca).
65. CSA - CSA International; (Formerly: IAS - International Approval Services); [www.csa-international.org](http://www.csa-international.org).
66. CSI - Construction Specifications Institute (The); [www.csinet.org](http://www.csinet.org).
67. CSSB - Cedar Shake & Shingle Bureau; [www.cedarbureau.org](http://www.cedarbureau.org).
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.cti.org](http://www.cti.org).
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; [www.dasma.com](http://www.dasma.com).
71. DHI - Door and Hardware Institute; [www.dhi.org](http://www.dhi.org).
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; [www.eciaonline.org](http://www.eciaonline.org).
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; [www.eima.com](http://www.eima.com).
77. EJMA - Expansion Joint Manufacturers Association, Inc.; [www.ejma.org](http://www.ejma.org).
78. ESD - ESD Association; (Electrostatic Discharge Association); [www.esda.org](http://www.esda.org).
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); [www.intertek.com](http://www.intertek.com).
81. EVO - Efficiency Valuation Organization; [www.evo-world.org](http://www.evo-world.org).
82. FCI - Fluid Controls Institute; [www.fluidcontrolsintstitute.org](http://www.fluidcontrolsintstitute.org).
83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); [www.fiba.com](http://www.fiba.com).
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); [www.fivb.org](http://www.fivb.org).
85. FM Approvals - FM Approvals LLC; [www.fmglobal.com](http://www.fmglobal.com).
86. FM Global - FM Global; (Formerly: FMG - FM Global); [www.fmglobal.com](http://www.fmglobal.com).



87. FSA - Fluid Sealing Association; [www.fluidsealing.com](http://www.fluidsealing.com).
88. FSC - Forest Stewardship Council U.S.; [www.fscus.org](http://www.fscus.org).
89. GA - Gypsum Association; [www.gypsum.org](http://www.gypsum.org).
90. GANA - Glass Association of North America; [www.glasswebsite.com](http://www.glasswebsite.com).
91. GS - Green Seal; [www.greenseal.org](http://www.greenseal.org).
92. HI - Hydraulic Institute; [www.pumps.org](http://www.pumps.org).
93. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
94. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
95. HPVA - Hardwood Plywood & Veneer Association; [www.hpva.org](http://www.hpva.org).
96. HPW - H. P. White Laboratory, Inc.; [www.hpwhite.com](http://www.hpwhite.com).
97. IAPSC - International Association of Professional Security Consultants; [www.iapsc.org](http://www.iapsc.org).
98. IAS - International Accreditation Service; [www.iasonline.org](http://www.iasonline.org).
99. IAS - International Approval Services; (See CSA).
100. ICBO - International Conference of Building Officials; (See ICC).
101. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
102. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
103. ICPA - International Cast Polymer Alliance; [www.icpa-hq.org](http://www.icpa-hq.org).
104. ICRI - International Concrete Repair Institute, Inc.; [www.icri.org](http://www.icri.org).
105. IEC - International Electrotechnical Commission; [www.iec.ch](http://www.iec.ch).
106. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
107. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); [www.ies.org](http://www.ies.org).
108. IESNA - Illuminating Engineering Society of North America; (See IES).
109. IEST - Institute of Environmental Sciences and Technology; [www.iest.org](http://www.iest.org).
110. IGMA - Insulating Glass Manufacturers Alliance; [www.igmaonline.org](http://www.igmaonline.org).
111. IGSHPA - International Ground Source Heat Pump Association; [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu).
112. ILI - Indiana Limestone Institute of America, Inc.; [www.iliai.com](http://www.iliai.com).
113. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); [www.intertek.com](http://www.intertek.com).
114. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); [www.isa.org](http://www.isa.org).
115. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
116. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); [www.isfanow.org](http://www.isfanow.org).
117. ISO - International Organization for Standardization; [www.iso.org](http://www.iso.org).
118. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
119. ITU - International Telecommunication Union; [www.itu.int/home](http://www.itu.int/home).
120. KCMA - Kitchen Cabinet Manufacturers Association; [www.kcma.org](http://www.kcma.org).
121. LMA - Laminating Materials Association; (See CPA).
122. LPI - Lightning Protection Institute; [www.lightning.org](http://www.lightning.org).
123. MBMA - Metal Building Manufacturers Association; [www.mbma.com](http://www.mbma.com).
124. MCA - Metal Construction Association; [www.metalconstruction.org](http://www.metalconstruction.org).
125. MFMA - Maple Flooring Manufacturers Association, Inc.; [www.maplefloor.org](http://www.maplefloor.org).
126. MFMA - Metal Framing Manufacturers Association, Inc.; [www.metalframingmfg.org](http://www.metalframingmfg.org).
127. MHIA - Material Handling Industry of America; [www.mhia.org](http://www.mhia.org).
128. MIA - Marble Institute of America; [www.marble-institute.com](http://www.marble-institute.com).
129. MMPA - Moulding & Millwork Producers Association; [www.wmmpa.com](http://www.wmmpa.com).
130. MPI - Master Painters Institute; [www.paintinfo.com](http://www.paintinfo.com).
131. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; [www.mss-hq.org](http://www.mss-hq.org).
132. NAAMM - National Association of Architectural Metal Manufacturers; [www.naamm.org](http://www.naamm.org).
133. NACE - NACE International; (National Association of Corrosion Engineers International); [www.nace.org](http://www.nace.org).
134. NADCA - National Air Duct Cleaners Association; [www.nadca.com](http://www.nadca.com).
135. NAIMA - North American Insulation Manufacturers Association; [www.naima.org](http://www.naima.org).
136. NBGQA - National Building Granite Quarries Association, Inc.; [www.nbgqa.com](http://www.nbgqa.com).

137. NBI - New Buildings Institute; [www.newbuildings.org](http://www.newbuildings.org).
138. NCAA - National Collegiate Athletic Association (The); [www.ncaa.org](http://www.ncaa.org).
139. NCMA - National Concrete Masonry Association; [www.ncma.org](http://www.ncma.org).
140. NEBB - National Environmental Balancing Bureau; [www.nebb.org](http://www.nebb.org).
141. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
142. NeLMA - Northeastern Lumber Manufacturers Association; [www.nelma.org](http://www.nelma.org).
143. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
144. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
145. NFHS - National Federation of State High School Associations; [www.nfhs.org](http://www.nfhs.org).
146. NFPA - National Fire Protection Association; [www.nfpa.org](http://www.nfpa.org).
147. NFPA - NFPA International; (See NFPA).
148. NFRC - National Fenestration Rating Council; [www.nfrc.org](http://www.nfrc.org).
149. NHLA - National Hardwood Lumber Association; [www.nhla.com](http://www.nhla.com).
150. NLGA - National Lumber Grades Authority; [www.nlga.org](http://www.nlga.org).
151. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
152. NOMMA - National Ornamental & Miscellaneous Metals Association; [www.nomma.org](http://www.nomma.org).
153. NRCA - National Roofing Contractors Association; [www.nrca.net](http://www.nrca.net).
154. NRMCA - National Ready Mixed Concrete Association; [www.nrmca.org](http://www.nrmca.org).
155. NSF - NSF International; [www.nsf.org](http://www.nsf.org).
156. NSPE - National Society of Professional Engineers; [www.nspe.org](http://www.nspe.org).
157. NSSGA - National Stone, Sand & Gravel Association; [www.nssga.org](http://www.nssga.org).
158. NTMA - National Terrazzo & Mosaic Association, Inc. (The); [www.ntma.com](http://www.ntma.com).
159. NWFA - National Wood Flooring Association; [www.nwfa.org](http://www.nwfa.org).
160. PCI - Precast/Prestressed Concrete Institute; [www.pci.org](http://www.pci.org).
161. PDI - Plumbing & Drainage Institute; [www.pdionline.org](http://www.pdionline.org).
162. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); <http://www.plasa.org>.
163. RCSC - Research Council on Structural Connections; [www.boltcouncil.org](http://www.boltcouncil.org).
164. RFCI - Resilient Floor Covering Institute; [www.rfci.com](http://www.rfci.com).
165. RIS - Redwood Inspection Service; [www.redwoodinspection.com](http://www.redwoodinspection.com).
166. SAE - SAE International; [www.sae.org](http://www.sae.org).
167. SCTE - Society of Cable Telecommunications Engineers; [www.scte.org](http://www.scte.org).
168. SDI - Steel Deck Institute; [www.sdi.org](http://www.sdi.org).
169. SDI - Steel Door Institute; [www.steeldoor.org](http://www.steeldoor.org).
170. SEFA - Scientific Equipment and Furniture Association (The); [www.sefalabs.com](http://www.sefalabs.com).
171. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
172. SIA - Security Industry Association; [www.siaonline.org](http://www.siaonline.org).
173. SJI - Steel Joist Institute; [www.steeljoist.org](http://www.steeljoist.org).
174. SMA - Screen Manufacturers Association; [www.smainfo.org](http://www.smainfo.org).
175. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; [www.smacna.org](http://www.smacna.org).
176. SMPTE - Society of Motion Picture and Television Engineers; [www.smpite.org](http://www.smpite.org).
177. SPFA - Spray Polyurethane Foam Alliance; [www.sprayfoam.org](http://www.sprayfoam.org).
178. SPIB - Southern Pine Inspection Bureau; [www.spib.org](http://www.spib.org).
179. SPRI - Single Ply Roofing Industry; [www.spri.org](http://www.spri.org).
180. SRCC - Solar Rating & Certification Corporation; [www.solar-rating.org](http://www.solar-rating.org).
181. SSINA - Specialty Steel Industry of North America; [www.ssina.com](http://www.ssina.com).
182. SSPC - SSPC: The Society for Protective Coatings; [www.sspc.org](http://www.sspc.org).
183. STI - Steel Tank Institute; [www.steeltank.com](http://www.steeltank.com).
184. SWI - Steel Window Institute; [www.steelwindows.com](http://www.steelwindows.com).
185. SWPA - Submersible Wastewater Pump Association; [www.swpa.org](http://www.swpa.org).
186. TCNA - Tile Council of North America, Inc.; [www.tileusa.com](http://www.tileusa.com).
187. TEMA - Tubular Exchanger Manufacturers Association, Inc.; [www.tema.org](http://www.tema.org).
188. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); [www.tiaonline.org](http://www.tiaonline.org).
189. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).

190. TMS - The Masonry Society; [www.masonrysociety.org](http://www.masonrysociety.org).
191. TPI - Truss Plate Institute; [www.tpinst.org](http://www.tpinst.org).
192. TPI - Turfgrass Producers International; [www.turfgrassod.org](http://www.turfgrassod.org).
193. TRI - Tile Roofing Institute; [www.tilerroofing.org](http://www.tilerroofing.org).
194. UL - Underwriters Laboratories Inc.; <http://www.ul.com>.
195. UNI - Uni-Bell PVC Pipe Association; [www.uni-bell.org](http://www.uni-bell.org).
196. USGBC - U.S. Green Building Council; [www.usgbc.org](http://www.usgbc.org).
197. USITT - United States Institute for Theatre Technology, Inc.; [www.usitt.org](http://www.usitt.org).
198. WA - Wallcoverings Association; [www.wallcoverings.org](http://www.wallcoverings.org)
199. WASTEC - Waste Equipment Technology Association; [www.wastec.org](http://www.wastec.org).
200. WCLIB - West Coast Lumber Inspection Bureau; [www.wclib.org](http://www.wclib.org).
201. WCMA - Window Covering Manufacturers Association; [www.wcmanet.org](http://www.wcmanet.org).
202. WDMA - Window & Door Manufacturers Association; [www.wdma.com](http://www.wdma.com).
203. WI - Woodwork Institute; [www.wicnet.org](http://www.wicnet.org).
204. WSRCA - Western States Roofing Contractors Association; [www.wsrca.com](http://www.wsrca.com).
205. WWPA - Western Wood Products Association; [www.wwpa.org](http://www.wwpa.org).

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut für Normung e.V.; [www.din.de](http://www.din.de).
2. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
3. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
4. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).
5. State of Michigan - The 2015 Michigan Building Code.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; [www.usace.army.mil](http://www.usace.army.mil).
2. CPSC - Consumer Product Safety Commission; [www.cpsc.gov](http://www.cpsc.gov).
3. DOC - Department of Commerce; National Institute of Standards and Technology; [www.nist.gov](http://www.nist.gov).
4. DOD - Department of Defense; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
5. DOE - Department of Energy; [www.energy.gov](http://www.energy.gov).
6. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
7. FAA - Federal Aviation Administration; [www.faa.gov](http://www.faa.gov).
8. FG - Federal Government Publications; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
9. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
10. HUD - Department of Housing and Urban Development; [www.hud.gov](http://www.hud.gov).
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; [www.eetd.lbl.gov](http://www.eetd.lbl.gov).
12. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
13. SD - Department of State; [www.state.gov](http://www.state.gov).
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; [www.trb.org](http://www.trb.org).
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
16. USDA - Department of Agriculture; Rural Utilities Service; [www.usda.gov](http://www.usda.gov).
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; [www.ojp.usdoj.gov](http://www.ojp.usdoj.gov).
18. USP - U.S. Pharmacopeial Convention; [www.usp.org](http://www.usp.org).
19. USPS - United States Postal Service; [www.usps.com](http://www.usps.com).

- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
  2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
  3. DSCC - Defense Supply Center Columbus; (See FS).
  4. FED-STD - Federal Standard; (See FS).
  5. FS - Federal Specification; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
    - a. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
    - b. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
    - c. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org/ccb](http://www.wbdg.org/ccb).
  6. MILSPEC - Military Specification and Standards; (See DOD).
  7. OSHA – Occupational Safety and Health Administration.
  8. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
  9. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. State of Michigan: MIOSHA
  2. SCAQMD; South Coast Air Quality Management District; [www.aqmd.gov](http://www.aqmd.gov).

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION (Not Used)**

END OF SECTION 014200

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## **SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

##### **A. General**

1. Furnish all labor, materials, tools, equipment, and services for all temporary facilities and their subsequent removal as indicated, in accord with provisions of Contract Documents.
2. Completely coordinate with work specifically indicated.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

#### **1.2 COLD WEATHER PROTECTION**

A. Temporary Heat will be provided by the existing Heating/Cooling Units currently serving the target space, provide distribution ducting and replace filters monthly. Contractor will be responsible for protecting the units from dust damage during construction including provision to filter return air system at each register.

1. Operate system, furnishing necessary labor and supervision.
2. Maintain temperature of spaces where concrete is being placed or cured at not less than 50 deg. F (10 deg. C).
3. Maintain interior temperature of not less than 70 deg. F (21 deg. C) for at least 7 days prior to, during placement of interior finishes, and after finishing until substantial completion.

B. Owner will pay for utility costs from use of the existing equipment.

C. Extend warranty or guarantee period on permanent systems used during construction period to commence on date of substantial completion.

D. Use heat devices complying with codes and ordinances (note contractor is not permitted to use permanent heating system for temporary heating unless approved by the architect)

#### **1.3 TEMPORARY ELECTRICITY**

A. Make arrangements for and install equipment, wiring, switches, outlets, etc., to provide power for all lighting and power requirements for construction as required from existing building electrical service.

1. Permanent building power distribution system may be used once it is installed.
2. Remove all temporary electrical equipment, poles, meter, wiring, switches, outlets, etc., when no longer needed.
3. At completion of work, remove and replace all parts of permanent systems damaged.

B. Temporary electrical power used will be paid for by the Owner if existing service is used.

C. Each Contractor provide his own extension cord.

- D. Each Contractor provide heavy duty electrical power, exceeding available power, required for his operation.

#### **1.4 TEMPORARY WATER**

- A. Contractor shall be required to make all necessary arrangements to provide temporary water for construction.
- B. The cost of the temporary water will be paid for by the Owner.

#### **1.5 TEMPORARY TOILETS**

- A. Contractor will be permitted to use the existing toilet rooms located within the target work area during the construction duration.
  - 1. Maintain in clean, sanitary condition.
  - 3. Provide adequate supplies of toilet paper.

#### **1.6 CONTRACTORS FIELD OFFICE**

- A. Contractor to provide a temporary field office for his use and use of Architect within the target area of the renovation work.
  - 1. Field Office shall be of sufficient size (as determined by Architect) to allow comfortable seating at a table with chairs for 8.

#### **1.7 TEMPORARY ENCLOSURES**

- A. Furnish and install temporary enclosures, doors, and transparent plastic windows required to protect target work area from damage due to vandalism, or the elements, or to maintain suitable temperature during installation or finishing work. Temporary enclosures shall be provided at Owner's direction.
- B. Provide all items required in connection with safety program and secure work area from public/staff traffic.

#### **1.8 TEMPORARY STORAGE AND WORKING AREAS**

- A. Prior to start of work, General Contractor shall meet with all contractors to arrange and prepare a plan defining working, storing and traffic areas.
  - 1. Except as specifically provided, working and storing outside these areas will not be permitted.
  - 2. Arrange and locate temporary structures and sheds to avoid interfering with construction.
- B. Within area designated for his use, each Contractor provide suitable and sufficient enclosed and covered spaces, with raised flooring, to protect materials and equipment from damage by weather or construction work.
  - 1. Maintain storage and working areas in clean and orderly condition. Each trade responsible for cleaning as a result of their work.
  - 2. Upon completion of work, or sooner if directed by Architect, remove temporary structures and leave in clean and orderly condition.

**1.9 TEMPORARY FENCES AND BARRICADES**

- A. Furnish, install and maintain all necessary sound temporary fences, barricades, trench and hole covers, warning lights and all other safety devices necessary to prevent injury to persons and damages to property.

**1.10 PROJECT SIGNS**

- A. No signage will be permitted on site.

**1.11 TRAFFIC CONTROL**

- A. Provide any traffic control deemed necessary to effect smooth Owner operations.

**END OF SECTION 015213**



## **SECTION 017300 - EXECUTION**

### **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 general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.
- B. Related Requirements:
  - 1. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
  - 2. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

#### **1.3 DEFINITIONS**

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

#### **1.4 PREINSTALLATION MEETINGS**

- A. Cutting and Patching Conference: Conduct conference at Project site.
  - 1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
    - a. Contractor's superintendent.

- b. Trade supervisor responsible for cutting operations.
  - c. Trade supervisor(s) responsible for patching of each type of substrate.
  - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affecting by cutting and patching operations.
2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.
- B. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
  2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
  3. Products: List products to be used for patching and firms or entities that will perform patching work.
  4. Dates: Indicate when cutting and patching will be performed.
  5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

## **1.6 QUALITY ASSURANCE**

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
  2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    - a. Primary operational systems and equipment.
    - b. Fire separation assemblies.
    - c. Air or smoke barriers.
    - d. Fire-suppression systems.
    - e. Plumbing piping systems.
    - f. Mechanical systems piping and ducts.
    - g. Control systems.
    - h. Communication systems.
    - i. Fire-detection and -alarm systems.

- j. Electrical wiring systems.
  - k. Operating systems of special construction.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
- a. Water, moisture, or vapor barriers.
  - b. Membranes and flashings.
  - c. Exterior curtain-wall construction.
  - d. Equipment supports.
  - e. Piping, ductwork, vessels, and equipment.
  - f. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. General: Comply with requirements specified in other Sections.
- 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
- 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
- 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services; and other utilities.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
  2. List of detrimental conditions, including substrates.
  3. List of unacceptable installation tolerances.
  4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Existing Utility Information: Furnish information to local utility] and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

### **3.3 CONSTRUCTION LAYOUT**

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work.

Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

- C. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

### **3.4 INSTALLATION**

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
  - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

- J. Repair or remove and replace damaged, defective, or nonconforming Work.
  - 1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

### **3.5 CUTTING AND PATCHING**

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.
- G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### **3.6 OWNER-INSTALLED PRODUCTS**

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
  1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### **3.7 PROGRESS CLEANING**

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls" and Section 017419 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### **3.8 STARTING AND ADJUSTING**

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."



**3.9 PROTECTION OF INSTALLED CONSTRUCTION**

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

## **SECTION 017329 - CUTTING AND PATCHING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes procedural requirements for cutting and patching.
  - 1. Requirements of this Section also apply to cutting and patching for mechanical and electrical installations.
  - 2. Approval to proceed with cutting and patching does not waive the Owner's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

#### **1.2 DEFINITIONS**

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work; for access or inspection, for obtaining test samples, for damage repair, or for similar purpose.
  - 1. Drilling of holes for fasteners and similar operations are not cutting and patching.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

#### **1.3 QUALITY ASSURANCE**

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
  - 1. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
  - 2. Obtain approval of the cutting and patching proposal before cutting and patching structural elements.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
  - 1. Obtain approval of the cutting and patching proposal before cutting and patching operating elements or safety related systems.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect/Engineer's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.
- D. New In-place Construction: Employ original installer for cutting and patching exposed Work.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Provide materials whose installed performance will equal or surpass that of existing materials.

## **PART 3 - EXECUTION**

### **3.1 PERFORMANCE**

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction using methods least likely to damage elements to be retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
    - a. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
  - 1. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  - 2. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  - 3. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  - 4. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

- D. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- E. Repair And Protection
  - 1. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching".
  - 2. Protect construction exposed by or for quality control service activities, and protect repaired construction.
  - 3. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.
- F. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

## **SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

### **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 administrative and procedural requirements for the following:
  - 1. Disposing of nonhazardous construction waste.

#### **1.3 DEFINITIONS**

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

#### **1.4 MATERIALS OWNERSHIP**

- A. Unless otherwise indicated, demolition and construction waste become property of Contractor.

#### **1.5 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

**PART 2 - PRODUCTS – NOT USED**

**PART 3 - EXECUTION**

**3.1 DISPOSAL OF WASTE**

- A. General: Except for items or materials to be salvaged or recycled, dispose of waste materials in dumpsters provided by the General Contractor, coordinate location of dumpsters with Owner.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
- B. Burning: Do not burn waste materials.

END OF SECTION 017419

## **SECTION 017700 - CLOSEOUT PROCEDURES**

### **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 administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.
- B. Related Requirements:
  - 1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
  - 2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 3. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at final completion.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

## **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

## **1.6 SUBSTANTIAL COMPLETION PROCEDURES**

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
  - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.
  - 5. Submit testing, adjusting, and balancing records.
  - 6. Submit sustainable design submittals not previously submitted.
  - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Advise Owner of pending insurance changeover requirements.
  - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  - 3. Complete startup and testing of systems and equipment.
  - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
  - 6. Advise Owner of changeover in utility services.
  - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  - 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  - 9. Complete final cleaning requirements.



10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.

### **1.7 FINAL COMPLETION PROCEDURES**

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
  2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report.
  5. Submit final completion photographic documentation.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

### **1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)**

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect and Construction Manager.
    - d. Name of Contractor.

- e. Page number.
- 4. Submit list of incomplete items in the following format:
  - a. MS Excel electronic file. Architect, through Construction Manager, will return annotated file.

## **1.9 SUBMITTAL OF PROJECT WARRANTIES**

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  - 1. Submit on digital media acceptable to Architect.
- E. Warranties in Paper Form:
  - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## **PART 3 - EXECUTION**

### **3.1 FINAL CLEANING**

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.
    - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - k. Remove labels that are not permanent.
    - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
      - 1) Clean HVAC system in compliance with Section 230130.52 "Existing HVAC Air-Distribution System Cleaning." Provide written report on completion of cleaning.
    - p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
    - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls." and Section 017419 "Construction Waste Management and Disposal."

### **3.2 REPAIR OF THE WORK**

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
  
- B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
  - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

## **SECTION 017823 - OPERATION AND MAINTENANCE DATA**

### **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 administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory manuals.
  - 2. Systems and equipment operation manuals.
  - 3. Systems and equipment maintenance manuals.
  - 4. Product maintenance manuals.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

#### **1.3 DEFINITIONS**

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
  - 1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.
  - 2. Submit three paper copies. Architect, through Construction Manager, will return two copies.

- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

### **1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS**

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
  - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
  - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  - 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
  - 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
  - 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

- a. If oversized drawings are necessary, fold drawings to same size as text pages and use as foldouts.
- b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## **1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS**

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Include the following information:
  1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for Construction Manager.
  7. Name and contact information for Architect.
  8. Name and contact information for Commissioning Authority.
  9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

## **1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL**

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
  1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

## **1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS**

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
  1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  2. Performance and design criteria if Contractor has delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
  1. Product name and model number. Use designations for products indicated on Contract Documents.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.
  8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
  1. Startup procedures.
  2. Equipment or system break-in procedures.
  3. Routine and normal operating instructions.
  4. Regulation and control procedures.
  5. Instructions on stopping.
  6. Normal shutdown instructions.
  7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.



- 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

## **1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS**

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, includes source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
    - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.

#### **1.10 PRODUCT MAINTENANCE MANUALS**

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION (Not Used)**

END OF SECTION 017823

## **SECTION 017839 - PROJECT RECORD DOCUMENTS**

### **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 administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section 017300 "Execution" for final property survey.
  - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
  - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set of marked-up record prints.
- B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.
  - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

## **1.4 RECORD DRAWINGS**

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding photographic documentation.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Construction Change Directive.
    - k. Changes made following Architect's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect and Construction Manager.
    - e. Name of Contractor.

## **1.5 RECORD SPECIFICATIONS**

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  - 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
  - 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as marked-up paper copy of Specifications.

## **1.6 RECORD PRODUCT DATA**

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- C. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
  - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

## **1.7 MISCELLANEOUS RECORD SUBMITTALS**

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
  - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

**1.8 MAINTENANCE OF RECORD DOCUMENTS**

- A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

**PART 2 - PRODUCTS**

**PART 3 - EXECUTION**

END OF SECTION 017839

## **SECTION 017900 - DEMONSTRATION AND TRAINING**

### **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 administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
  - 2. Demonstration and training video recordings.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. Identification: On each copy, provide an applied label with the following information:
    - a. Name of Project.
    - b. Name and address of videographer.
    - c. Name of Architect.
    - d. Name of Construction Manager.
    - e. Name of Contractor.
    - f. Date of video recording.



2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
4. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

## **1.5 QUALITY ASSURANCE**

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
  1. Inspect and discuss locations and other facilities required for instruction.
  2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  3. Review required content of instruction.
  4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

## **1.6 COORDINATION**

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

## **1.7 INSTRUCTION PROGRAM**

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Systems and equipment operation manuals.
    - c. Systems and equipment maintenance manuals.
    - d. Product maintenance manuals.
    - e. Project Record Documents.
    - f. Identification systems.
    - g. Warranties and bonds.
    - h. Maintenance service agreements and similar continuing commitments.
  3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.
  4. Operations: Include the following, as applicable:
    - a. Startup procedures.
    - b. Equipment or system break-in procedures.
    - c. Routine and normal operating instructions.
    - d. Regulation and control procedures.
    - e. Control sequences.
    - f. Safety procedures.
    - g. Instructions on stopping.
    - h. Normal shutdown instructions.
    - i. Operating procedures for emergencies.
    - j. Operating procedures for system, subsystem, or equipment failure.
    - k. Seasonal and weekend operating instructions.
    - l. Required sequences for electric or electronic systems.
    - m. Special operating instructions and procedures.
  5. Adjustments: Include the following:
    - a. Alignments.
    - b. Checking adjustments.

- c. Noise and vibration adjustments.
- d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning.
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## **1.8 PREPARATION**

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

## **1.9 INSTRUCTION**

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
  - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
  - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.
- F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

#### **1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS**

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode.
  - 1. Submit video recordings on CD-ROM or thumb drive.
  - 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
  - 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
  - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
    - a. Name of Contractor/Installer.
    - b. Business address.
    - c. Business phone number.
    - d. Point of contact.
    - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
  - 1. Film training session(s) in segments not to exceed 15 minutes.
    - a. Produce segments to present a single significant piece of equipment per segment.
    - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
  - 1. Furnish additional portable lighting as required.

- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Pre-produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

## **PART 2 - PRODUCTS**

## **PART 3 - EXECUTION**

END OF SECTION 017900

## **SECTION 024119 - SELECTIVE DEMOLITION**

### **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. Demolition and removal of selected portions of building or structure.
  - 2. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
  - 1. Section 017300 - "Execution" for cutting and patching procedures.
  - 2. Section 200500 - General Mechanical Requirements
  - 3. Section 260100 - General Electrical Requirements

#### **1.3 DEFINITIONS**

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

#### **1.4 MATERIALS OWNERSHIP**

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

#### **1.5 PREINSTALLATION MEETINGS**

- A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

#### **1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.
- D. Schedule of Selective Demolition Activities: Indicate the following:
  1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  2. Interruption of utility services. Indicate how long utility services will be interrupted.
  3. Coordination for shutoff, capping, and continuation of utility services.
  4. Use of elevator and stairs.
  5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, which might be misconstrued as damage caused by demolition operations. Submit before Work begins.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

#### **1.7 CLOSEOUT SUBMITTALS**

- A. Inventory: Submit a list of items that have been removed and salvaged.

#### **1.8 FIELD CONDITIONS**

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
  1. Before selective demolition, Owner may remove various items.

- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: Hazardous materials are not known or anticipated to be encountered within the targeted work area. If hazardous materials are suspected the Contractor should not proceed and should notify the Architect and Owner immediately.
  - 1. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
  - 2. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## **1.9 COORDINATION**

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video before commencing with demolition activities.



1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

### **3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS**

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
  1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  2. Arrange to shut off utilities with utility companies.
  3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

### **3.3 PROTECTION**

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

### **3.4 SELECTIVE DEMOLITION, GENERAL**

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 5. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
  - 6. Maintain adequate ventilation when using cutting torches.
  - 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  - 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to Owner.
  - 4. Transport items to Owner's storage area on-site.
  - 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
  - 1. Clean and repair items to functional condition adequate for intended reuse.
  - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.

3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### **3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS**

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

### **3.6 DISPOSAL OF DEMOLISHED MATERIALS**

- A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."
  1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

### **3.7 CLEANING**

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119



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## SECTION 035350 – CEMENTITIOUS STAMPABLE OVERLAY

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to Work of this Section.
- B. Section Includes:
  - 1. Integrally colored concrete entry exterior slab.
  - 2. Stamping.
  - 3. Curing of integrally colored and imprinted concrete.
- C. Related Sections:
  - 1. Division 3 Section "Cast-in-Place Concrete" for general applications of concrete and coordination of sample submittal [and color selection].
  - 2. Division 7 Section "Joint Sealants" for colored sealants for joints.

#### 1.2 REFERENCES

- A. American Concrete Institute (ACI):
  - 1. ACI 301 "Specification for Structural Concrete for Buildings."
  - 2. ACI 302 IR "Recommended Practice for Concrete Floor and Slab Construction."
  - 3. ACI 303.1 "Standard Specification for Cast-In-Place Architectural Concrete."
  - 4. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing of Concrete."
  - 5. ACI 305R "Recommended Practice for Hot Weather Concreting."
  - 6. ACI 306R "Recommended Practice for Cold Weather Concreting."
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM C309 "Liquid Membrane-Forming Compounds for Curing Concrete."
  - 2. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
  - 3. ASTM C979 "Standard Specification for Pigments for Integrally Colored Concrete."
- C. American Association of State Highway and Transportation Officials (AASHTO):
  - 1. AASHTO M194 "Chemical Admixtures."

#### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's complete technical data sheets for the following:
  - 1. Colored admixture.
  - 2. Color hardener
  - 3. Clear liquid release agent.
  - 4. Imprinting/Texturing tools.
  - 5. Curing compound.
- B. Design Mixes: For each type of integrally colored concrete.

- C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available.
- D. Qualification Data: For firms indicated in "Quality Assurance" Article, including list of completed projects.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Manufacturer with 10-years' experience in production of specified products.
- B. Installer Qualifications: An installer with 5 years' experience with work of similar scope and quality.
- C. Comply with the requirements of ACI 301.
- D. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.
- E. Notification of manufacturer's authorized representative shall be given at least 1-week before start of Work.
- F. Integrally Colored Concrete Field Samples:
  - 1. Provide under provisions of Division 1 Section "Quality Control.
  - 2. At location on Project selected by Architect, place and finish 3 ft. x 3 ft. area.
  - 3. For accurate color, the quantity of concrete mixed to produce the sample should not be less than 3 cubic yards (or not less than 1/3 the capacity of the mixing drum on the ready-mix truck) and should always be in full cubic yard increments. Excess material shall be discarded according to local regulations.
  - 4. Construct sample panel using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in sample panels. Field sample shall be produced by the individual workers who will perform the work for the Project.
  - 5. Retain samples of cements, sands, aggregates, and color additives used in mockup for comparison with materials used in remaining work.
  - 6. Accepted field sample provides visual standard for work of Section.
  - 7. Field sample shall remain through completion of the work for use as a quality standard for finished work.
  - 8. Remove field sample when directed.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- A. Colored Admixture: Comply with manufacturer's instructions. Deliver colored admixtures in original, unopened packaging. Store in dry conditions.

#### **1.6 PROJECT CONDITIONS**

- A. Integrally Colored Concrete Environmental Requirements:
  - 1. Schedule placement to minimize exposure to wind and hot sun before curing materials are applied.
  - 2. Avoid placing concrete if rain, snow, or frost is forecast within 24-hours. Protect fresh concrete from moisture and freezing.
  - 3. Comply with professional practices described in ACI 305R and ACI 306R.
- B. Schedule delivery of concrete to provide consistent mix times from batching until discharge. Mix times shall meet manufacturer's written recommendations.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURER**

- A. SikaColor

### **2.2 MATERIALS**

- A. Colored Admixture for Integrally Colored Concrete: SikaColor- G as manufactured by SikaColor.
  - 1. Admixture shall be a colored, water-reducing, admixture containing no calcium chloride with coloring agents that are lime proof and UV resistant. Color to be determined by Architect.
  - 2. Colored admixture shall conform to the requirements of **ACI 303.1, ASTM C979, ASTM C494, and AASHTO M194.**
- B. Stamping/Imprinting Tools and Materials:
- C. Clear Liquid Release Agent: "Liquid Release BG" by SikaColor
  - 1. Liquid release agent shall be recommended by pattern tool manufacturer and compatible with integral color additives.
- D. Curing Compound for Integrally Colored Concrete: "Clearguard" by SikaColor .Curing compound shall comply with ASTM C309 and be of same manufacturer as colored admixture, for use with integrally colored concrete.
- E. **SUBSTITUTIONS:** The use of products other than those specified will be considered providing that the Contractor requests its use in writing within 14-days prior to bid date. This request shall be accompanied by the following:
  - 1. A certificate of compliance from the material manufacturer stating that proposed products meet or exceed requirements of this Section, including standards ACI 303.1, ASTM C979, ASTM C494 and AASHTO M194.
  - 2. Documented proof that proposed materials have a 10-year proven record of performance for staining concrete substrates, confirmed by at least 5 local projects that [Architect] [Landscape Architect] [Engineer] can examine.

### **2.3 COLORS [AND PATTERNS]**

- A. Concrete Color[s]:
  - 1. Cement: Color shall be gray.
  - 2. Sand: Color shall be locally available natural sand.
  - 3. Aggregate: Concrete producer's standard aggregate complying with specifications.
  - 4. Colored Admixture Add integral color name here
  - 5. Stamp/Imprinting Pattern: S 4399 12"X12" Slate pattern." As selected by Architect. from SikaStamp Lifestyle Brochure
  - 6. Clear Liquid Release Agent: Liquid Release BG"
  - 7. Curing Compound: SikaColor ClearGuard



## **2.4 CONCRETE MIX DESIGN**

- A. Minimum Cement Content: 6 sacks per cubic yard of concrete.
- B. Slump of concrete shall be consistent throughout Project at 4-inches or less. At no time shall slump exceed 5-inches. [If super plasticizers are allowed, slump shall not exceed 8-inches.]
- C. Do not add calcium chloride to mix as it causes mottling and surface discoloration.
- D. Supplemental admixtures shall not be used unless approved by manufacturer.
- E. Do not add water to the mix in the field.
- F. Add colored admixture to the mix according to manufacturer's written instructions in premeasured bags, not by weight of cement content.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install concrete according to requirements of Division 3 Section "Cast-In-Place Concrete."
- B. Do not add water to the mix in the field.
  - 1. Stamped/Imprinted: Apply pattern according to tool manufacturer's instructions. Touch-up pattern and finish edges with hand tools as necessary.

### **3.2 CURING**

- A. Integrally Colored Concrete: Apply curing and sealing compound for integrally colored concrete according to manufacturer's instructions using manufacturer's recommended application techniques. Apply curing and sealing compound at consistent time for each pour to maintain close color consistency.
- B. Precautions shall be taken in hot weather to prevent plastic cracking resulting from excessively rapid drying at surface as described in CIP 5 *Plastic Shrinkage Cracking* published by the National Ready Mixed Concrete Association.
- C. Do not cover concrete with plastic sheeting.

### **3.3 TOLERANCES**

- A. Minor variations in appearance of colored concrete, which are similar to natural variations in color and appearance of uncolored concrete, are acceptable. Examination of field sample should be representative of tolerances allowed on project.

### **3.4 APPLICATORS**

- A. For a list of qualified contractors, contact your local SikaColor representative Scott Reyes @ 586-292-1492

END OF SECTION 035350

## **SECTION 055000 - METAL FABRICATIONS**

### **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. Steel framing and supports for countertops.
  - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- B. Products furnished, but not installed, under this Section include the following:
  - 1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
  - 2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

#### **1.3 COORDINATION**

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For the following:
  - 1. Fasteners.
  - 2. Shop primers.
  - 3. Shrinkage-resisting grout.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
  - 1. Steel framing and supports for countertops.
  - 2. Steel framing and supports for mechanical and electrical equipment.

3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Metal bollards.

### **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Research Reports: For post-installed anchors.

### **1.6 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
  1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

### **1.7 FIELD CONDITIONS**

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
  1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

### **2.2 METALS**

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

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**METAL FABRICATIONS**

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- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- F. Aluminum Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.
- G. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.
- H. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

### **2.3 FASTENERS**

- A. General: Unless otherwise indicated, provide stainless steel fasteners for fastening aluminum.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, (ASTM A563M, Class 10S3) heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593 (ASTM F738M); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1).
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

### **2.4 MISCELLANEOUS MATERIALS**

- A. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting."

- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete: Normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

## **2.5 FABRICATION, GENERAL**

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

## **2.6 MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated or as recommended by partition manufacturer with attached bearing plates, anchors, and braces as indicated or as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer.

## **2.7 MISCELLANEOUS STEEL TRIM**

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
  - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize bearing and leveling plates.
- D. Prime plates with zinc-rich primer.

## **2.8 STEEL WELD PLATES AND ANGLES**

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

## **2.9 GENERAL FINISH REQUIREMENTS**

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## **2.10 STEEL AND IRON FINISHES**

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer or as specified in Section 099123 "Interior Painting".
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
  - 1. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 3. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
  - 4. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## **2.11 ALUMINUM FINISHES**

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION, GENERAL**

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

### **3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for ceiling hung toilet partitions securely to, and rigidly brace from, building structure.

### **3.3 INSTALLATION OF BEARING AND LEVELING PLATES**

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### **3.4 INSTALLING METAL BOLLARDS**

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards to existing construction where detailed with adhesive anchor bolts. Provide four 3/4-inch (19-mm) bolts at each bollard unless otherwise indicated.
  - 1. Embed anchor bolts at least 4 inches (100 mm) in concrete.



- C. In new construction anchor bollards in concrete with pipe sleeves preset and anchored into concrete or in formed or core-drilled holes not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard]. Fill annular space around bollard solidly with non-shrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.
- D. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- E. Fill bollards solidly with concrete, mounding top surface to shed water.
- F. Install plastic covers over steel pipe for finish installation.

### **3.5 REPAIRS**

- A. Touchup Painting:
  - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
    - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
  - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

## **SECTION 055213 - PIPE AND TUBE RAILINGS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Steel pipe and tube handrails and railing systems.
- B. Related Sections: Requirements relating to this Section are contained in the following Sections:

Division 5 Section "Metal Fabrications" for miscellaneous steel requirements.

#### **1.3 DEFINITIONS**

- A. Definitions in ASTM E 985 for railing-related terms apply to this Section.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:
  - 1. Aluminum: AA "Specifications for Aluminum Structures."
  - 2. Cold-Formed Structural Steel: AISI "Specification for the Design of Cold-Formed Steel Structural Members."
- B. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.
  - 1. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as indicated:
    - a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
    - b. Uniform load of 50 lbf per linear foot (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf per linear foot (1460 N/m) applied vertically downward.
    - c. Concentrated and uniform loads above need not be assumed to act concurrently.
  - 2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
    - a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
    - b. Uniform load of 50 lbf per linear foot (730 N/m) applied in any direction.

- c. Concentrated and uniform loads above need not be assumed to act concurrently.
3. Infill Area of Guardrail Systems: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in the system including panels, intermediate rails, balusters, or other elements composing the infill area.
  - a. Above load need not be assumed to act concurrently with loads on top rails of railing systems in determining stress on guard.
- C. Thermal Movements: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating, and installing handrails and railing systems to prevent buckling, opening of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
  1. Temperature Change (Range): 120 deg F (67 deg C) ambient 180 deg F (100 deg C) material surfaces.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

## **1.5 SUBMITTALS**

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for mechanically connected handrails and railing systems, each kind of fitting, grout, anchoring cement, and paint products.
- C. Shop drawings showing fabrication and installation of handrails and railing systems including plans, elevations, sections, details of components, and attachments to other units of Work.
  1. For installed handrails and railing systems indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation.
    - a. Samples for initial selection in the form of short sections of railing or flat sheet metal samples showing available mechanical finishes.
- D. Samples for verification of each type of exposed finish required, prepared on components indicated below that are of the same thickness and metal indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
  1. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project names, addresses, names of architects and owners, and other information specified.
- E. Product test reports from a qualified independent testing agency evidencing compliance of handrails and railing systems with requirements based on comprehensive testing of current products.

## **1.6 QUALITY ASSURANCE**

- A. Single-Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.
- B. Engineer Qualifications: Professional engineer legally authorized to practice in the authority where Project is located and experienced in providing engineering services of the kind indicated for handrails and railing systems similar to this Project in material, design, and extent, and that have a record of successful in-service performance.

## **1.7 STORAGE**

- A. Store handrails and railing systems inside a well-ventilated area, away from uncured concrete and masonry and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

## **1.8 PROJECT CONDITIONS**

- A. Field Measurements: Where handrails and railing systems are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

## **1.9 SEQUENCING AND SCHEDULING**

- A. Sequence and coordinate installation of wall handrails as follows:
  - 1. Mount handrails only on completed walls. Do not support handrails temporarily by any means not satisfying structural performance requirements.
  - 2. Mount handrails on plaster or gypsum board assemblies only where reinforced to receive anchors and where the location of concealed reinforcements has been clearly marked for benefit of Installer.

# **PART 2 - PRODUCTS**

## **2.1 MANUFACTURERS**

- A. Manufacturer: Subject to compliance with requirements, provide handrails and railing systems by one of the following:
  - 1. Steel Pipe and Tube Railings:
    - a. Humane Equipment Co.
    - b. Wagner: R & B Wagner, Inc.
    - c. Metro Fabricators, Inc.
    - d. Rohmann Iron Works, Inc.
    - e. Bristol Steel & Conveyor Corp.

## **2.2 METALS**

- A. General: Provide metals free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- B. Steel and Iron: Provide steel and iron in the form indicated, complying with the following requirements:
  - 1. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:
    - a. Black finish, unless otherwise indicated.
    - b. Galvanized finish for exterior installations and where indicated.
    - c. Type F, or Type S, Grade A, standard weight (schedule 40), unless otherwise indicated, or another weight, type, and grade required by structural loads.
  - 2. Steel Tubing: Product type (manufacturing method) and other requirements as follows:
    - a. Cold-Formed Steel Tubing: ASTM A 500, grade as indicated below:
      - i. Grade A, unless otherwise indicated or required by structural loads.
    - b. Hot-Formed Steel Tubing: ASTM A 501.
    - c. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.
  - 3. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).
- B. Brackets, Flanges, and Anchors: Cast or formed metal of the same material and finish as supported rails, unless otherwise indicated.

## **2.3 WELDING MATERIALS, FASTENERS, AND ANCHORS**

- A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railings to other types of construction indicated and capable of withstanding design loadings.
  - 1. For steel railings and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- B. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
  - 1. Provide concealed fasteners for interconnecting railing components and their attachment to other work, except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated.
  - 2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- C. Cast-in-Place and Post installed Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials, capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete,

as determined by testing per ASTM E 488, conducted by a qualified, independent testing agency.

1. Cast-in-place anchors.
2. Chemical anchors.
3. Expansion anchors.
4. Undercut anchors.

## **2.4 PAINT**

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure, complying with performance requirements of FS TT-P-664.
- B. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and compatibility with finish paint systems indicated, complying with SSPC-Paint 5.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, complying with DOD-P-21035 or SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

## **2.5 GROUT AND ANCHORING CEMENT**

- A. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- B. Interior Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.
- C. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.
- D. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
  1. Non-shrink, Nonmetallic Grouts:
    - a. B-6 Construction Grout; W.R. Bonsal Co.
    - b. Diamond-Crete Grout; Concrete Service Materials Co.
    - c. Supreme; Cormix Construction Chemicals.
    - d. Sure-grip High Performance Grout; Dayton Superior Corp.
    - e. Euco N-S Grout; Euclid Chemical Co.
    - f. Five Star Grout; Five Star Products.
    - g. Vibropruf #11; Lambert Corp.
    - h. Crystex; L & M Construction Chemicals, Inc.
    - i. Masterflow 928 and 713; Master Builders Technologies, Inc.

- j. Sealtight 588 Grout; W.R. Meadows, Inc.
  - k. SonogROUT 14; Sonneborn Building Products--ChemRex, Inc.
  - l. Kemset; The Spray-Cure Company.
2. Interior Anchoring Cement:
- a. Ankertite Cement; Dayton Superior Corp.
  - b. Por-Rok; Minwax Construction Products Division.
3. Erosion-Resistant Anchoring Cement:
- a. Bonsal Anchor Cement; W.R. Bonsal Co.
  - b. Super Por-Rok; Minwax Construction Products Division.
  - c. Thorogrip; Thoro Systems Products.

## **2.6 FABRICATION**

- A. General: Fabricate handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of hollow members, post spacings, and anchorage, but not less than those required to support structural loads.
- B. Assemble handrails and railing systems in the shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- C. Form changes in direction of members as follows:
  - 1. As detailed.
- D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
- E. Welded Connections: Fabricate handrails and railing systems for connection of members by welding. For connections made during fabrication, weld corners and seams continuously to comply 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. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe or tube to which end is joined, and weld all around.
  - 5. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- F. Nonwelded Connections: Fabricate handrails and railing systems by connecting members with railing manufacturer's standard concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  - 1. Fabricate splice joints for field connection using epoxy structural adhesive where this represents manufacturer's standard splicing method.

- G. Welded Connections for Aluminum Pipe: Fabricate pipe handrails and railing systems by connecting members with concealed internal welds, which eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- H. Brackets, Flanges, Fittings, and Anchors: Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing system members to other construction.
- I. Provide inserts and other anchorage devices to connect handrails and railing systems to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.
- J. For railing posts set in concrete, provide preset sleeves of steel, not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (12 mm) greater than outside dimensions of post, and steel plate forming bottom closure.
- K. For removable railing posts, fabricate slip-fit sockets from steel pipe whose inside diameter is sized for a close fit with posts and to limit deflection of post without lateral load, measured at top, to not more than 1/12 of post height. Provide socket covers designed and fabricated to resist accidental dislodgement.
  - 1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- L. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.
- M. Ease exposed edges to a radius of approximately 1/32-inch (1 mm), unless otherwise indicated. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.
- N. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.
- O. Provide weepholes, or another means to evacuate entrapped water, in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.
- P. Fabricate joints that will be exposed to weather in a manner to exclude water.
- Q. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
- R. Fillers: Provide steel sheet or plate fillers, of thickness and size indicated or required to support structural loads of handrails, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses to produce adequate bearing to prevent bracket rotation and overstressing substrate.

## **2.7 FINISHES, GENERAL**

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering prior to shipment.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of



approved samples and they are assembled or installed to minimize contrast.

- D. Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railing systems.

## **2.8 STEEL FINISHES**

- A. Galvanized Finish: Hot-dip galvanize items indicated to be galvanized to comply with applicable standard listed below:
  - 1. ASTM A 153 for galvanizing iron and steel hardware.
  - 2. ASTM A 123 for galvanizing iron and steel products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips.
- B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized handrails and railing systems, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For nongalvanized steel handrails and railing systems, provide nongalvanized ferrous metal fittings, brackets, fasteners, and sleeves, except provide galvanized anchors where embedded in exterior masonry and concrete construction.
- E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- F. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed railings:
  - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6 "Commercial Blast Cleaning."
  - 2. Interiors (SSPC Zone 1A): SSPC-SP 7 "Brush-Off Blast Cleaning."
- G. Apply shop primer to prepared surfaces of handrails and railing components, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
- H. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to Project site.

### **3.2 INSTALLATION, GENERAL**

- A. Fit exposed connections accurately together to form tight, hairline joints.

- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing handrails and railing systems. Set handrails and railing systems accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
  - 1. Do not weld, cut, or abrade surfaces of handrails and railing components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/4 inch in 12 feet (2 mm in 1 m).
  - 3. Align rails so that variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (2 mm in 1 m).
- C. Field Welding: Comply with the following requirements:
  - 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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and welded surface matches contours of adjoining surfaces.
- D. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- E. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.
- F. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing handrails and railing systems and for properly transferring loads to in-place construction.

### **3.3 RAILING CONNECTIONS**

- A. Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Locate exposed fasteners in least conspicuous locations. Seal recessed holes of exposed locking screws with plastic filler, cement colored to match finish of handrails and railing systems.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact, or use fittings designed for this purpose.

### **3.4 ANCHORING POSTS**

- A. Anchor posts in concrete with pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, solidly fill annular space between post and sleeve with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's directions.
  - 1. Non-shrink, nonmetallic grout.
- B. Cover anchorage joint with a round steel flange attached to post as follows:
  - 1. By set screws.
- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts as indicated using fittings designed and engineered for this purpose.
  2. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- D. Install removable railing sections where indicated in slip-fit metal sockets cast into concrete. Accurately locate sockets to match post spacing.

### **3.5 ANCHORING RAIL ENDS**

- A. Anchor rail ends into concrete and masonry with round flanges connected to rail ends and anchored into wall construction with post-installed anchors and bolts.
- B. Anchor rail ends to metal surfaces with oval or round flanges.
1. Weld flanges to rail ends.
  2. Connect flanges to rail ends using non-welded connections.
  3. Bolt flanges to metal surfaces.

### **3.6 ATTACHING HANDRAILS TO WALLS**

- A. Attach handrails to wall with wall brackets and end fittings. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets and wall return fittings to building construction as follows:
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
  2. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.
  3. For hollow masonry anchorage, use toggle bolts with square heads.
  4. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed anchors using self-tapping screws of size and type required to support structural loads.

### **3.7 ADJUSTING AND CLEANING**

- A. Clean the following metals by washing thoroughly with clean water and soap, followed by rinsing with clean water.
1. Aluminum.
  2. Stainless steel.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

### **3.8 PROTECTION**

- A. Protect finishes of handrails and railing systems from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

- B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 055213

## **SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY**

### **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. Wood blocking and nailers.
  - 2. Wood furring and grounds.
  - 3. Plywood backing panels.

#### **1.3 DEFINITIONS**

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  - 2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
  - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

#### **1.5 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## **PART 2 - PRODUCTS**

### **2.1 WOOD PRODUCTS, GENERAL**

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

### **2.2 WOOD-PRESERVATIVE-TREATED LUMBER**

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
  - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
  - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat all exterior blocking rough carpentry unless otherwise indicated, and other items indicated on Drawings, and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  - 4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
  - 5. Wood floor plates that are installed over concrete slabs-on-grade.

### **2.3 FIRE-RETARDANT-TREATED MATERIALS**

- A. General: Where fire-retardant-treated wood is indicated, comply with applicable requirements of AWWPA C20 (lumber) and AWWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL; U.S. Testing; Timber Products Inspection, Inc.; or another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Research or Evaluation Reports: Provide fire-retardant-treated wood acceptable to authorities having jurisdiction and for which a current model code research or evaluation report exists that evidences compliance of fire-retardant-treated wood for application indicated.
- B. Interior Type A: For interior locations, use chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:
  - 1. Bending strength, stiffness, and fastener-holding capacities are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions simulating installed conditions when tested by a qualified independent testing agency.
  - 2. No form of degradation occurs due to acid hydrolysis or other causes related to treatment.
  - 3. Contact with treated wood does not promote corrosion of metal fasteners.
- C. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

### **2.4 MISCELLANEOUS LUMBER**

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Rooftop equipment bases and support curbs.
  - 4. Cants.
  - 5. Furring.
  - 6. Grounds.
  - 7. Utility shelving.
- B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any of the following species:
  - 1. Hem-fir (north); NLGA.
  - 2. Mixed southern pine or southern pine; SPIB.
  - 3. Spruce-pine-fir; NLGA.
  - 4. Hem-fir; WCLIB or WWPA.
  - 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
  - 6. Western woods; WCLIB or WWPA.
  - 7. Northern species; NLGA.
  - 8. Eastern softwoods; NeLMA.
- C. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:
  - 1. Mixed southern pine or southern pine, [No. 2] [No. 3] grade; SPIB.

2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
  3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
  4. Eastern softwoods, No. 2 Common grade; NELMA.
  5. Northern species, No. 2 Common grade; NLGA.
  6. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## **2.5 PLYWOOD MOUNTING PANELS**

- A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness. All exposed surfaces should be A Grade and paintable.

## **2.6 PLYWOOD BACKING PANELS**

- A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

## **2.7 FASTENERS**

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, as appropriate for the substrate.
1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.



## **2.8 METAL FRAMING ANCHORS**

- A. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
  - 1. Use for interior locations unless otherwise indicated.
- B. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
  - 1. Use for wood-preservative-treated lumber and where indicated.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304.
  - 1. Use for exterior locations and where indicated.

## **2.9 MISCELLANEOUS MATERIALS**

- A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION, GENERAL**

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
  2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
  3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
  4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
  2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
  3. ICC-ES evaluation report for fastener.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

### **3.2 WOOD BLOCKING AND NAILER INSTALLATION**

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### **3.3 WOOD FURRING INSTALLATION**

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally or vertically at 24 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

### **3.4 PROTECTION**

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

## **SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS**

### **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. Plastic-laminate-faced architectural cabinets.
- 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

#### **1.3 PREINSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct conference at Project site.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product, including, panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, and cabinet hardware and accessories.

- 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

- 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
- 2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
- 3. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Initial Selection:

1. Plastic laminates.
2. Thermoset decorative panels.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
2. Exposed cabinet hardware and accessories, one unit for each type and finish.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- B. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

## **1.6 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

## **1.8 FIELD CONDITIONS**

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

- D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## **1.9 COORDINATION**

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087111 "Door Hardware (Descriptive Specification)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

## **PART 2 - PRODUCTS**

### **2.1 ARCHITECTURAL CABINET FABRICATORS**

- A. Fabricators: Subject to compliance with requirements, provide products by one of the following:
  - 1. Sterling Millwork, Farmington Hills, MI.
  - 2. CKI, Warren, MI.
  - 3. LaFata Cabinets, Shelby Twp., MI.
  - 4. Merillat, Cabinetry, Adrian, MI.
  - 5. Quality Cabinetry, Adrian, MI.
  - 6. Masco Cabinetry, LLC, Ann Arbor, MI.

### **2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS**

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
  - 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
- F. Design Basis:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Abet Laminati Inc.
  - b. Formica Corporation.
  - c. Bella Laminati.
  - d. Pionite; a Panolam Industries International, Inc. brand.
  - e. Wilsonart LLC. (Basis-of-Design)
  
- G. Laminate Cladding for Exposed Surfaces:
  1. Horizontal Surfaces: Grade HGS.
  2. Post-formed Surfaces: Grade HGP.
  3. Vertical Surfaces: Grade HGS.
  4. Edges: Grade HGS.
  5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
  
- H. Materials for Semi-exposed Surfaces:
  1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
    - a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
  2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
  3. Drawer Bottoms: Thermoset decorative panels.
  
- I. Dust Panels: 1/4-inchplywood or tempered hardboard above compartments and drawers unless located directly under tops.
  
- J. Drawer Construction: Fabricate with exposed fronts fastened to sub-front with mounting screws from interior of body.
  1. Join sub-fronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
  
- K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  1. As selected by Architect from laminate manufacturer's full range in the following categories:
    - a. Solid colors, matte finish.
    - b. Solid colors with core same color as surface, matte finish.
    - c. Wood grains, matte finish.
    - d. Patterns, matte finish.
  
  2. Refer to Material Finish Schedule on drawings for P Lam finishes.

## **2.3 WOOD MATERIALS**

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  1. Wood Moisture Content: 5 to 10 percent.

- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

## **2.4 CABINET HARDWARE AND ACCESSORIES**

- A. General: Provide heavy-duty "School Grade" cabinet hardware and accessory materials associated with architectural cabinets.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening.
- C. Pull Doug Mocket/DP129-SS, Length 6-11/16" Flat Top Pull, Projection: 1-3/8", Center: 6-5/16", Satin Stainless-Steel Finish.
- D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- E. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- F. Drawer Slides: BHMA A156.9.
  - 1. Provide soft close drawer slides with full extensions.
  - 2. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 2.
  - 3. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
  - 4. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
- G. Door Locks: BHMA A156.11, E07121.
- H. Drawer Locks: BHMA A156.11, E07041.
- I. Door and Drawer Silencers: BHMA A156.16, L03011.
- J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
  - 1. Satin Stainless Steel: BHMA 630.
- K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

## **2.5 MISCELLANEOUS MATERIALS**

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.



## **2.6 FABRICATION**

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate cabinets to dimensions, profiles, and details indicated.
- C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

### **3.2 INSTALLATION**

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
  - 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inchsag, bow, or other variation from a straight line.
  - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with toggle bolts through metal backing or metal framing behind wall finish.

**3.3 ADJUSTING AND CLEANING**

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semi-exposed surfaces.

END OF SECTION 064116

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## **SECTION 066400 - PLASTIC PANELING**

### **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. Plastic sheet paneling for use as a wainscot.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

#### **1.4 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight 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 MANUFACTURERS**

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

#### **2.2 PLASTIC SHEET PANELING**

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.
  - 1. Design Basis: Marlite, A Versatec Company "Standard FRP Panels" P-199 Brite White – pebbled texture or a comparable product by the following:
    - a. Crane Composites, "Kemlite."
    - b. Nudor Products, Inc., "FiberLight FRP Panels."
    - c. USFRP Company, "Standard FRP Panels."

2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
  - a. Flame-Spread Index: 25 or less.
  - b. Smoke-Developed Index: 450 or less.
3. Nominal Thickness: Not less than 0.09 inch.
4. Surface Finish: Pebble.
5. Color: P 470N Dark Grey.

### **2.3 ACCESSORIES**

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
  1. Color: Match panels.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Adhesive: As recommended by plastic paneling manufacturer.
- E. Sealant: Mildew-resistant, single-component, neutral-curing silicone, mildew-resistant, single-component, neutral-curing or acid-curing silicone], or latex sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

- E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
  - 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
  - 2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

### **3.3 INSTALLATION**

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
  - 1. Drill oversized fastener holes in panels and center fasteners in holes.
  - 2. Apply sealant to fastener holes before installing fasteners.
- D. Install factory-laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with adhesive and nails.
- F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

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## **SECTION 072100 - THERMAL 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. Glass-fiber blanket – Ceiling & Cavity Wall Sound Insulation.
- B. Related Requirements:
  - 1. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.
  - 2. Section 133419 "Metal Building Systems" for pre-engineered building insulation.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

### **PART 2 - PRODUCTS**

#### **2.1 GLASS-FIBER BLANKET INSULATION**

- 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. CertainTeed Corporation.
  - 2. Guardian Building Products, Inc.
  - 3. Johns Manville.
  - 4. Knauf Insulation.



5. Owens Corning.
  - B. Unfaced, Glass-Fiber Blanket Cavity Sound Attenuation Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Blanket thickness as indicated on drawings. Completely fill cavity space, no voids.
  - C. Unfaced, Glass-Fiber Ceiling Batts: Basis of Design Owens Corning "Sonobatts: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

## **2.2 ACCESSORIES**

- A. Insulation for Miscellaneous Voids:
  1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

### **3.2 INSTALLATION, GENERAL**

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

### **3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION**

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
  5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
  6. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
    - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
  7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
    - a. Exterior Walls: Set units with facing placed toward exterior of construction or as indicated on Drawings.
    - b. Interior Walls: Set units with facing placed as indicated on Drawings.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
  2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

### **3.6 CLEANING**

- C. Remove and legally dispose of waste materials and construction debris.
- D. Clean EPS insulation may be recycled through a national program; <http://www.epsrecycling.org/>.

### **3.4 PROTECTION**

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

## **SECTION 078413 - PENETRATION FIRESTOPPING**

### **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. Penetrations in fire-resistance-rated walls.
  - 2. Penetrations in horizontal assemblies.
- B. Related Sections:
  - 1. Division 07 Section "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
  - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

#### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
  - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
  - b. Classification markings on penetration firestopping correspond to designations listed by the following:
    - 1) UL in its "Fire Resistance Directory."

## **1.5 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

## **1.6 COORDINATION**

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. A/D Fire Protection Systems Inc.
  2. Grace Construction Products.
  3. Hilti, Inc.
  4. Johns Manville.
  5. Nelson Firestop Products.
  6. RectorSeal Corporation.
  7. Specified Technologies Inc.
  8. 3M Fire Protection Products.
  9. Tremco, Inc.; Tremco Fire Protection Systems Group.
  10. USG Corporation.

### **2.2 PENETRATION FIRESTOPPING**

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating

of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  - 1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
  - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  - 1. Horizontal assemblies include ceiling membranes of roof/ceiling assemblies.
  - 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
- D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
  - 1. Permanent forming/damming/backing materials, including the following:
    - a. Slag-wool-fiber or rock-wool-fiber insulation.
    - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    - c. Fire-rated form board.
    - d. Fillers for sealants.
  - 2. Temporary forming materials.
  - 3. Substrate primers.
  - 4. Collars.
  - 5. Steel sleeves.

### **2.3 FILL MATERIALS**

- A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- D. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

- F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- G. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

## **2.4 MIXING**

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 REPARATION**

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
  - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
  - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

### **3.3 INSTALLATION**

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### **3.4 IDENTIFICATION**

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Designation of applicable testing and inspecting agency.
  - 4. Date of installation.
  - 5. Manufacturer's name.
  - 6. Installer's name.

### **3.5 CLEANING AND PROTECTION**

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

### **3.6 PENETRATION FIRESTOPPING SCHEDULE**

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Firestopping with No Penetrating Items:
  - 1. UL-Classified Systems: W-L- 0001-0999.
  - 2. Type of Fill Materials: As required to achieve rating.

- C. Firestopping for Metallic Pipes, Conduit, or Tubing:
  - 1. UL-Classified Systems: W-L- 1001-1999.
  - 2. Type of Fill Materials: As required to achieve rating.
  
- D. Firestopping for Nonmetallic Pipe, Conduit, or Tubing:
  - 1. UL-Classified Systems: W-L- 2001-2999.
  - 2. Type of Fill Materials: As required to achieve rating.



- E. Firestopping for Electrical Cables:
  - 1. UL-Classified Systems: W-L- 3001-3999.
  - 2. Type of Fill Materials: As required to achieve rating.
  
- F. Firestopping for Miscellaneous Electrical Penetrants:
  - 1. UL-Classified Systems: W-L- 6001-6999.
  - 2. Type of Fill Materials: As required to achieve rating.
  
- G. Firestopping for Miscellaneous Mechanical Penetrants:
  - 1. UL-Classified Systems: C- 7001-7999 or W-L- 7001-7999.
  - 2. Type of Fill Materials: As required to achieve rating.
  
- H. Firestopping for Groupings of Penetrants:
  - 1. UL-Classified Systems: C- 8001-8999 or W-L- 8001-8999.
  - 2. Type of Fill Materials: As required to achieve rating.

END OF SECTION 078413

## **SECTION 079200 - JOINT SEALANTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

**A. Section Includes:**

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Acoustical joint sealants.

**B. Joint sealants will be required for the following locations:**

1. Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:
  - a. Control and expansion joints in unit masonry.
  - b. Joints between different materials listed above.
  - c. Perimeter joints between materials listed above and frames of doors and windows.
  - d. Control and expansion joints in ceiling and overhead surfaces.
  - e. Other joints as indicated.
2. Interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:
  - a. Control and expansion joints on exposed interior surfaces of exterior walls.
  - b. Perimeter joints of exterior openings where indicated.
  - c. Tile control and expansion joints.
  - d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
  - e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
  - f. Perimeter joints of toilet fixtures.
  - g. Other joints as indicated.
3. Interior joints in horizontal traffic surfaces as indicated below:
  - a. Control and expansion joints in tile flooring.
  - b. Other joints as indicated.

**C. Related Sections:**

1. Division 07 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
2. Division 08 Section "Glazing" for glazing sealants.
3. Division 09 Section "Gypsum Board" for sealing perimeter joints.
4. Division 09 Section "Tiling" for sealing tile joints.
5. Division 09 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.

#### **1.2 PRECONSTRUCTION TESTING**

- A. Preconstruction Compatibility and Adhesion Testing:** Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

### **1.3 SUBMITTALS**

- A. Product Data: For each joint-sealant product indicated.
- B. Joint-Sealant Schedule: Include the following information:
  1. Joint-sealant application, joint location, and designation.
  2. Joint-sealant manufacturer and product name.
  3. Joint-sealant formulation.
  4. Joint-sealant color.
- C. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- D. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
  1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Warranties: Sample of special warranties.

### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

### **1.5 PROJECT CONDITIONS**

- A. Do not proceed with installation of joint sealants under the following conditions:
  1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
  2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## **1.6 WARRANTY**

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: Two years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  2. Disintegration of joint substrates from natural causes exceeding design specifications.
  3. Mechanical damage caused by individuals, tools, or other outside agents.
  4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS, GENERAL**

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
  1. Architectural Sealants: 250 g/L.
  2. Sealant Primers for Nonporous Substrates: 250 g/L.
  3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

## **2.2 SILICONE JOINT SEALANTS**

- A. Silicone, S, NS, 100/50, NT: Single-component, non-sag, plus 100 percent and minus 50 percent movement capability, non-traffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
- B. Manufactures: Subject to compliance with requirements, provide products from one of the following manufacturers:
  - 1. Dow Chemical Company
  - 2. GE Construction Sealants
  - 3. Sika Corporation

## **2.3 POLYSULFIDE JOINT SEALANTS**

- A. Multicomponent, Nosag, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class25, for Use NT.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. BASF Building Systems; MasterSeal Polysulfide Sealant..
    - b. Pacific Polymers International, Inc.; Elasto Seal 227 Type II.
    - c. Pecora Corporation; Synthaealk GC 2+.
    - d. W.R. Meadows, Inc.; Deck O Seal Gun Grade.
- B. Multicomponent, Pourable, Traffic Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade P, Class25, for Use T.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Pacific Polymers International, Inc.; Elasto Seal 227 Type I.
    - b. W.R. Meadows, Inc.; Deck O Seal 125.

## **2.4 URETHANE JOINT SEALANTS**

- A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and non-traffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
  - 1. Manufacturers: Subject to compliance with requirements provide products from one of the following manufacturers:
    - a. Sika Corporation.
    - b. Other Approved.

## **2.5 LATEX JOINT SEALANTS**

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. BASF Building Systems; Sonolac.
    - b. Pecora Corporation; AC-20+.
    - c. Tremco Incorporated; Tremflex 834.

## **2.6 ACOUSTICAL JOINT SEALANTS**

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Pecora Corporation; AC-20 FTR.
    - b. USG Corporation; SHEETROCK Acoustical Sealant.

## **2.7 JOINT SEALANT BACKING**

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## **2.8 MISCELLANEOUS MATERIALS**

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### **3.3 INSTALLATION OF JOINT SEALANTS**

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

### **3.4 CLEANING**

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### **3.5 PROTECTION**

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### **3.6 JOINT-SEALANT SCHEDULE**

- A. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Control and expansion joints in tile flooring.
    - c. Other joints as indicated.
  2. Polysulfide Joint Sealant: Multicomponent, pourable, traffic grade.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.



- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints of exterior openings where indicated.
    - c. Tile control and expansion joints.
    - d. Vertical joints on exposed surfaces of interior unit masonry, concrete walls, and partitions.
    - e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    - f. Other joints as indicated.
  2. Joint Sealant: Latex Acrylic based.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Location:
    - a. Acoustical joints where indicated.
    - b. Other joints as indicated.
  2. Joint Sealant: Acoustical.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

## **SECTION 081100 - STEEL DOORS AND FRAMES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes steel doors and frames, including door louvers, transom panels and sidelights.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 7 Section "Joint Sealer".
  - 2. Division 8 Section "Glass and Glazing".
  - 3. Division 8 Section "Finish Hardware".
  - 5. Division 9 Section "Painting".

#### **1.3 REFERENCES**

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently reference herein are referred to by issuing authority abbreviation and standard designation.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM A 366 Standard Specification for Commercial Steel (CS) Sheet, Carbon (0.15 Maximum Percent) Cold-Rolled.
  - 2. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 3. ASTM A 924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  - 4. ASTM D610 Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces.
  - 5. ASTM D714 Standard Test Method for Evaluating Degree of Blistering of Paints.
  - 6. ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
  - 7. ASTM D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
  - 8. ASTM D1623 Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
  - 9. ASTM D1654 Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
  - 10. ASTM D2126 Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
  - 11. ASTM D2863 Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index).
- C. American National Standards Institute (ANSI):

1. ANSI/DHI A115.IG Installation Guide for Doors and Hardware.
  2. ANSI/SDI Standard A224.1 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors & Frames.
  3. ANSI A250.8 Standard Steel Door Frames.
- D. Federal Specification (Fed Spec):
1. Fed Spec C578Bead Fusion Test.
- E. National Fire Protection Association (NFPA):
1. NFPA 80 Fire Doors and Windows.
  2. NFPA 252 Fire Tests of Door Assemblies.
- F. Underwriters Laboratories, Inc. (UL):
1. UL 10(b) and UL 10 (c) Fire Tests of Door Assemblies
  2. UL Building Materials Director.
- G. Warnock Hersey, Inc. (WHI):
1. WHI Directory of Listed Products.
  2. WHI Directory of Positive Pressure Rated Door assemblies and components.

#### **1.4 SYSTEM DESCRIPTION**

- A. Performance Requirements: Provide metal doors and frames which have been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

#### **1.5 SUBMITTALS**

- A. General: Submit listed submittals in accordance with the Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product Data: Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products.
- C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories and finish colors.
1. Indicate door type, frame, steel, core, material thickness, reinforcements, anchorages, exposed fasteners locations, openings (glazed, paneled or louvered) and hardware arrangement.
  2. Include schedule identifying each unit, with door marks or numbers referencing numbering in schedules or drawings.
- D. Samples: Submit selection and verification samples for finishes, colors and textures. Coordinate with Division 9 Painting Section for paint finishes.
- E. Quality Assurance Submittals: Submit the following:
1. Certificates: Product certificates signed by manufacturer certifying that materials comply with specified performance characteristics and criteria and physical requirements.
  2. Manufacturer's Instructions: Manufacturer's installation instructions.

3 Manufacturer's Field Reports: Manufacturer's field reports specified herein.

F. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein.

## **1.6 QUALITY ASSURANCE**

A. Installer Qualifications: Installer should be experienced in performing work of this section and should have specialized in the installation of work similar to that required for this project.

1. Certificate: When requested, submit certificate indicating qualifications.

B. Regulatory Requirements:

1. Labeled Door and Frame Construction: Where noted or required, provide Underwriters Laboratories, Inc., (UL) or Warnock Hersey Inc. (WHI) labels with appropriate fire resistance and temperature rise ratings for class of opening indicated. Construction details and hardware applications authorized by testing or certification laboratories shall take precedence over project details or specifications.

C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

A. General: Comply with Division 1 Product Requirements Sections, and with ANSI A250.8.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

1. Handle and store products according to Amweld recommendations published in technical materials. Leave product wrapped or otherwise protected and under clean, dry storage conditions until required.

D. Storage and Protection: Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

1. Door Storage: Doors shall be protected at corners to prevent damage or marring of finish. Doors shall be stored in an upright position under cover on building site on wood sills or on floors in a manner that will prevent rust and damage. Avoid creating a humidity chamber by using a plastic or canvas shelter and not venting the area covered.
2. Frame Storage: Frames shall be stored in an upright position under cover on building site on wood sills or on floors in a manner that will prevent rust and damage. Avoid creating a humidity chamber by using a plastic or canvas shelter and not venting the area covered.

## **1.8 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

## **1.9 WARRANTY**

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
  - 1. Warranty Period: 1 year commencing on Date of Substantial Completion for manufacture workmanship and defect. Lifetime warranty on the continuous welded edges of the door.

## **PART 2 - PRODUCTS**

### **2.1 STEEL DOORS AND FRAMES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amweld Building Products
  - 2. Ceco Door Products
  - 3. Curries Company
  - 4. Steelcraft
  - 5. Republic
- B. Sizes:
  - 1. Standard Door Sizes: As indicated on drawings.
- C. Fire Rating:
  - 1. Provide doors and frames with UL or WHI listing (classification marks) where specified.
- D. Sound Rating:
  - 1. Provide sound transmission class of standard units tested as follows:
    - a. 1 3/4" 18 Gauge Door: 31 STC.
    - b. 1 3/4" 16 Gauge Door: 35 STC.
- E. Finishes:
  - 1. Exposed surfaces on doors and frames shall be cleaned, treated with a 3 stage iron phosphate and given 1 shop coat of synthetic resin, rust-inhibitive alkyd enamel primer. Prime paint shall be tested at a recognized independent testing laboratory in accordance with ANSI/SDI Standard A250.10 and meet the acceptance criteria outlined in that document (120 salt spray hours, 240

- humidity hours, etc.).
- 2. Colors: Finish doors with gray primer paint, ready for field painting.

## **2.2 PRODUCT SUBSTITUTIONS**

- A. Substitutions: as permitted in Section 1.

## **2.3 MATERIALS**

- A. Steel Materials:
  - 1. Cold-Rolled Steel: Comply with ASTM A 366 cold-rolled carbon steel sheet.
  - 2. Galvanized Steel: Comply with ASTM A 924 general requirements for steel sheet metallic coated by hot dip process (formerly ASTM A525).
- B. Primer Materials: Comply with ANSI A250.10 test procedures and acceptance criteria for prime painted steel surfaces for steel doors and frames.
- C. Painted Finish Material: Comply with ANSI A250.3 test procedures and acceptance criteria for factory applied finish for steel doors and frames.
- D. Door Color Paint Material: Provide manufacturer's standard finish and color.

## **2.4 MANUFACTURED FRAME UNITS**

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Frames of 0.042-inch thick (16 gauge) steel sheet for:
  - 1. Level I steel doors.
  - 2. Wood doors.
- D. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.
- F. Plaster Guards: Provide 0.016-inch-thick steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.
- G. Supports and Anchors: Fabricated from not less than 0.045-inch-thick, electrolytic zinc-coated or metallic-coated steel sheet.
  - 1. Wall Anchors in Masonry Construction: 0.177-inch diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.
- H. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, complying with ASTM A 152/A 153M, Class C or D as applicable.
- I. Frame minimum steel thickness: Interior - 16 ga.

- J. Rain caps/drip edge of all exterior door frames.
- K. Provide ½" thick by 1-3/4" wide full height filler strip of styrofoam behind hinge jamb to allow for drilling and topping for continuous hinge in field.
- L. Metal Door Frames: Fabricate from 16 or 14 gauge steel (ASTM A366) for 1 3/4" (45 mm) doors and 16 gauge for 1 3/8" (35 mm) doors. Frames shall be designed with integral stop and trim. Mitered corners shall be reinforced with 18 gauge channel shaped Inter-Lok reinforcements. Knocked-down frames shall have self-aligning tabs and slots for securely locked corners. Welded frame corners shall be mitered, arc welded and ground smooth per ANSI A250.8.
- M. Masonry: Equip frames with 1 welded in floor anchor in each jamb. Provide 3 field inserted steel lock-in or welded-in anchors (maximum of 24" (610 mm) oc) for each jamb. Anchors shall be type for particular construction involved (i.e., wood stud, masonry or steel stud).
- N. Drywall Frames: Design frames for installation after wall is erected. Provide hinge and strike jambs with welded-in compression anchors which are to be screw adjusted after frame is installed to maintain a tight grip on wall and shall be equipped with welded-in sill anchors. Provide 16 gauge frames.
- O. Hardware Preparation: Frames shall be mortised, reinforced, drilled and tapped to receive specified mortise hardware and reinforced only for specified surface hardware. Drilling and tapping for surface hardware shall be done in the field. Plaster guards shall be installed on applicable hardware cutouts in 400 Series frames. Strike jambs shall be prepared for 3 rubber silencers.
- P. Labeled Frames: When noted or required, provide for frame, windows and/or transoms and sidelights Underwriters Laboratories, Inc. (UL) or Warnock Hersey Inc. (WHI) labels for class of opening indicated. Construction details and hardware applications authorized by labeling authorities shall take precedence over project details or specifications.
- Q. Galvanized Option: Provide frame members of ASTM A40 hot dipped 16 or 14 gauge galvanized materials in 0.4 oz class conforming to ASTM A924 and A653. Treat materials in mill to ensure superior prime paint adhesion.
- R. Prime Painted Frames: Exposed surfaces shall be cleaned, treated with Bonderite chemical and given 1 baked-on shop coat of EPA compliant gray synthetic primer.
- S. Prepainted Frames: Frames shall be chemically cleaned and treated with a Bonderite chemical, plus a heavy coat of electrostatically applied baked on finish paint. Finish paint shall be a durable formulation, made specifically for Amweld. Hard film shall provide good resistance to both mar and abrasion tests. Weather and chemical resistance shall be a property of finish.

## **2.6 RELATED MATERIALS**

- A. Related Materials: Refer to other sections listed under Related Sections for related materials.

## **2.7 SOURCE QUALITY**

- A. Source Quality: Obtain metal door and frame products from a single manufacturer.

## **PART 3 - EXECUTION**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

### **3.2 EXAMINATION**

- A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
  - 1. Verify that door frame openings are installed plumb, true and level before beginning installation process. Select fasteners of adequate type, number and quality to perform the intended functions.

### **3.3 PREPARATION**

- A. Surface Preparation:
  - 1. Preparation for Field Painting: Before application of finish coat of paint, surfaces must be dry and free to dirt, oil and dust. Finish coat shall be applied over a film which is intact. Scratches or bare edges shall be field primed with a rust inhibiting paint before top coating. Comply with instructions on finish coat application provided by paint manufacturer.

### **3.4 INSTALLATION**

- A. General:
  - 1. Set frame product plumb, square, aligned and without twist at correct elevation.
  - 2. Frame Installation: Install pressed steel frames. Installation shall be plumb, straight and true, rigidly secured in place, and properly braced. Comply with ANSI/DHI A115-IG installation guide.
- B. Frame Installation Tolerances: Plumbness tolerance (measured through a line from intersecting corner of vertical members and the head to the floor) + 0.063" (1.6 mm).
  - 1. Squareness tolerance (measured through a line 90 degrees from one jamb at upper corner of product, to opposite jamb): + 0.063" (1.6 mm).
  - 2. Alignment tolerance (measured on jambs, through a horizontal line parallel to plane of wall): + 0.063" (1.6 mm).
  - 3. Twist tolerance (measured at face corners of jambs, on parallel lines perpendicular to plane of wall) + 0.063" (1.6 mm).
- C. Installation:
  - 1. Secure anchorages and connections to adjacent construction.
  - 2. Install hardware in accordance with manufacturer's templates and instructions.
  - 3. Finish exposed field welds to present a smooth uniform surface. Touch up with a rust inhibitive primer.
  - 4. Touch up exposed surfaces scratched or marred during shipment, installation or handling with a rust inhibitive primer.
  - 5. Install glazing materials and door silencers.



- D. Installation Reference Standard(s): Install metal doors and frames in accordance with requirements of applicable reference standards.
  - 1. Comply with Door and Hardware Institute (DHI) installation standards.
  - 2. Comply with Steel Door Institute (SDI) installation and maintenance standards.
  - 3. Comply with NFPA80 installation standards.
- E. Fire Rated Construction:
  - 1. Regulatory Requirements: Install fire labeled steel door and frame product in accordance with NFPA80, current edition, unless specified otherwise.
- F. Related Products Installation: Refer to other sections listed under Related Sections for related products installation.

### **3.5 FIELD QUALITY REQUIREMENTS**

- A. Door Supplier's Field Services: Upon Owner's request, provide Door Supplier's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.6 ADJUSTING**

- A. Adjusting: Adjust hinge sets, locksets and other hardware. Lubricate using a suitable lubricant compatible with door and frame coatings.

### **3.7 CLEANING**

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace products that have been installed and are damaged. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

### **3.8 PROTECTION**

- A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION 081100

## **SECTION 081416 - FLUSH WOOD DOORS**

### **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. Swinging solid-core doors with wood-veneer hardboard or MDF faces.
  - 2. Factory fitting flush wood doors to frames and factory machining for hardware.
  - 3. Louvered wood doors.
- B. Related Requirements:
  - 1. Section 087100 "Door Hardware" for coordination with door hardware.
  - 2. Section 088000 "Glazing" for any glass view panels or frosted glass in flush wood doors.
- C. Application: as indicated on Drawings, provide three panel wood doors and glass panel infill doors with frosted glass where indicated.

#### **1.3 REFERENCES**

- A. ANSI A117.1 "Accessible and Usable Buildings and Facilities."
- B. ANSI A208.1 "Wood Particleboard."
- C. Forestry Stewardship Council (FSC) "Guidelines for Environmentally Certified Wood Doors."
- D. Intertek Testing Service (ITS Warnock Hersey) "Certifications Listing for Fire Doors."
- E. NFPA 80, National Fire Protection Association "Standard for Fire Doors and Fire Windows."
- F. NFPA 252, National Fire Protection Association "Standard Methods of Fire Tests for Door Assemblies."
- G. WDMA I.S.1-A, Window and Door Manufacturers Association "Architectural Wood Flush Doors."
- H. WDMA I.S.10, Window and Door Manufacturers Association "Industry Standard for Testing Cellulostic Composite Materials for Use in Fenestration Products."

#### **1.4 PREINSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct conference at Project site.

### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
  - 1. Dimensions and locations of blocking.
  - 2. Dimensions and locations of mortises and holes for hardware.
  - 3. Dimensions and locations of cutouts.
  - 4. Undercuts.
  - 5. Requirements for veneer matching.
  - 6. Doors to be factory finished and finish requirements.
  - 7. Fire-protection ratings for any required fire-rated doors.
- C. Samples for Verification:
  - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish
  - 2. Frames for light openings, 6 inches long, for each material, type, and finish required.

### **1.6 INFORMATIONAL SUBMITTALS**

- A. Sample Warranty: For special warranty.

### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

### **1.8 FIELD CONDITIONS**

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels (60-90 deg F) during remainder of construction period.

### **1.9 WARRANTY**

- A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain flush wood doors from single manufacturer.
- B. Design Basis: VT Industries Architectural Wood Doors
  - 1. Species: Select White Birch
  - 2. Color: Ravine RA18
  - 3. Cut Style: Rift Cut
- C. Other Manufacturers: Subject to compliance with requirements, provide wood doors from one of the following other acceptable manufacturers:
  - 1. Allegheny Wood Works, Inc.
  - 2. Eggers Industries.
  - 3. Five Lakes Manufacturing.
  - 4. Kelleher Corporation.
  - 5. Lambton Doors.
  - 6. Oshkosh Door Company
  - 7. Algoma Wood Doors.

### **2.2 FLUSH WOOD DOORS, GENERAL**

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
  - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
  - 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. WDMA I.S.1-A Performance Grade: Heavy Duty.
- C. Structural-Composite-Lumber-Core Doors:
  - 1. Structural Composite Lumber: WDMA I.S.10.
    - a. Screw Withdrawal, Face: 700 lbf.
    - b. Screw Withdrawal, Edge: 400 lbf.

### **2.3 WOOD DOORS**

- A. Solid-Core 5 Ply-Doors:
  - 1. Grade: Premium.
  - 2. Colors, Patterns, and Finishes: As indicated on the Drawing Material Finish Schedule.
  - 3. Core: Either glued wood stave or structural composite lumber.
  - 4. Veneer: Plain sliced.

## **2.4 LIGHT FRAMES AND LOUVERS**

- A. Wood Frames for Light Openings: Manufacturer's standard wood molding glass frame to match door and finish. Provide rated frame and glass in fire-rated doors.
- B. Glazing: Utilize ¼" safety glazing (uninsulated) in interior glass lites.
- C. Louvers: Manufacturer solid wood (louver) slats to match door and finish.

## **2.5 FABRICATION**

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
  - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  - 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
  - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
  - 1. Install any required fire-rated doors according to NFPA 80.

- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
    - a. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
  - 2. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### **3.3 ADJUSTING**

- A. Operation: Rehang or replace doors that do not swing, slide or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

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## SECTION 08 33 00 – ROLLING COUNTER SHUTTERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes: manual rolling counter doors
- B. Related Sections:
  - 1. 05 50 00 Metal Fabrications. Door opening jamb and head members
  - 2. 06 10 00 Rough Carpentry. Door opening jamb and head members
  - 3. 08 31 00 Access Doors and Panels. Access doors
  - 4. 08 70 00 Hardware. Padlocks. Masterkeyed cylinder
  - 5. 09 91 00 Painting. Field painting
  - 6. Division 26. Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, and installation of control station and wiring
- C. Products That May Be Supplied, But Are Not Installed Under This Section:
  - 1. Control Station

#### 1.2 DESIGN REQUIREMENTS

- A. Wind Loading:
  - 1. Supply doors to withstand up to 5 psf design wind load
- B. Custom Layout
  - 1. Product has been reconfigured for a custom layout, refer to drawings by CornellCookson.
- C. Customized Product
  - 1. This product has custom modifications designed by CornellCookson. Contact Manufacturer for details.

#### 1.3 SUBMITTALS

- A. Reference Section 01 33 00 Submittal Procedures; submit the following items:
  - 1. Product Data
  - 2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
  - 3. Quality Assurance/Control Submittals:
    - a. Provide manufacturer ISO 9001:2015 registration
    - b. Provide manufacturer and installer qualifications - see below
    - c. Provide manufacturer's installation instructions
  - 4. Closeout Submittals:
    - a. Operation and Maintenance Manual
    - b. Certificate stating that installed materials comply with this specification

#### 1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Manufacturer Qualifications: ISO 9001:2015 registered and a minimum of five years' experience in producing counter doors of the type specified
  - 2. Installer Qualifications: Manufacturer's approval



## **1.5 DELIVERY STORAGE AND HANDLING**

- A. Reference Section 01 66 00 Product Storage and Handling Requirements.
- B. Follow manufacturer's instructions.

## **1.6 WARRANTY**

- A. Standard Warranty: Two years from date of shipment against defects in material and workmanship
- B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURER**

- A. Manufacturer:
  - 1. Cornell: 24 Elmwood Avenue, Mountain Top, PA 18707. Telephone: (800) 233-8366.
  - 2. Cookson
  - 3. Clopay Building Products

**Substitutions:** Not permitted

### **2.2 PRODUCT INFORMATION**

- A. Model: ESC10

### **2.3 MATERIALS**

- A. Curtain:
  - 1. Slat Configuration:
    - a. Galvanized Steel with Finish as Described Below: No. 1F, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, minimum 22-gauge ASTM A 653, Commercial Quality, galvanized steel with extruded tubular aluminum bottom bar with continuous lift handle and vinyl astragal
  - 2. Finish:
    - a. GalvaNex™ Coating System (Stock Colors):
      - 1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding baked-on base coat and gray baked-on polyester enamel finish coat
- B. Endlocks: Fabricate interlocking slat sections with high strength molded nylon endlocks riveted to ends of alternate slats
- C. Guides:
  - 1. Fabrication:
    - a. Aluminum: Heavy duty extruded aluminum sections with snap-on cover to conceal fasteners. Provide polypropylene pile runners on both sides of curtain to eliminate metal to metal contact between guides and curtain.

2. Finish:
  - a. Aluminum: Powder coat – color selected by architect
- D. Shaft Assembly:
  1. Counterbalance Shaft Assembly:
    - a. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width
    - b. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.
- E. Brackets: Fabricate from reinforced steel plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures
  1. Finish:
    - a. Standard (Stock Colors): Zirconium treatment followed by a gray baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness
- F. Hood: Minimum 24-gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4-inch (6.35 mm) steel intermediate support brackets.
  1. Finish:
    - a. GalvaNex™ Coating System (Stock Colors):
      - 1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding baked-on base coat and gray baked-on polyester enamel finish coat

## **2.4 OPERATION**

- A. Manual Operation:
  1. Push-Up: Manual lift or pole with hook

## **2.5 ACCESSORIES**

- A. Locking:
  1. Padlockable slide bolt: Padlockable slide bolt on coil side of bottom bar at each jamb extending into slots in guides. Provide interlock switches on motor operated units.
- B. Countertop: provided by General Contractor.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates
- C. Commencement of work by installer is acceptance of substrate

**3.2 INSTALLATION**

- A. Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports
- B. Follow manufacturer's installation instructions

**3.3 ADJUSTING**

- A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion

**3.4 CLEANING**

- A. Clean surfaces soiled by work as recommended by manufacturer
- B. Remove surplus materials and debris from the site

**3.5 DEMONSTRATION**

- A. Demonstrate proper operation to Owner's Representative
- B. Instruct Owner's Representative in maintenance procedures

END OF SECTION 083300

## **SECTION 087100 - DOOR HARDWARE**

### **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. Mechanical door hardware for the following:
    - a. Swinging doors.
    - b. Sliding doors
  - 2. Cylinders for door hardware specified in other Sections.
  - 3. Electrified door hardware.
- B. Related Requirements:
  - 1. Section 064116 "Plastic-Laminate-Clad Architectural Cabinets" for cabinet door hardware provided with cabinets.
  - 2. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
  - 3. Section 083113 "Access Doors and Frames" for access door hardware, including cylinders.
  - 4. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, including cylinders.
  - 5. Section 281500 "Access Control Hardware Devices" for access control devices installed at door openings and provided as part of a security system.
  - 6. Section 284600 "Fire Detection and Alarm" for connections to building fire-alarm system.

#### **1.3 COORDINATION**

- A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

#### **1.4 PREINSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct conference at Project site.
  - 1. Conference participants shall include Installer's Architectural Hardware Consultant.
  
- B. Keying Conference: Conduct conference at Project site.
  - 1. Conference participants shall include Installer's Architectural Hardware Consultant.
  - 2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:
    - a. Flow of traffic and degree of security required.
    - b. Preliminary key system schematic diagram.
    - c. Requirements for key control system.
    - d. Requirements for access control.
    - e. Address for delivery of keys.

#### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  
- B. Shop Drawings: For electrified door hardware.
  - 1. Include diagrams for power, signal, and control wiring.
  - 2. Include details of interface of electrified door hardware and building safety and security systems.
  
- C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.
  - 1. Tag Samples with full product description to coordinate Samples with door hardware schedule.
  
- D. Samples for Initial Selection: For each type of exposed finish.
  - 1. Tag Samples with full product description to coordinate Samples with door hardware schedule.
  
- E. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
  - 2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
  - 3. Content: Include the following information:
    - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    - d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    - e. Fastenings and other installation information.
    - f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
    - g. Mounting locations for door hardware.
    - h. List of related door devices specified in other Sections for each door and frame.

- F. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

#### **1.6 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- B. Field quality-control reports.
- C. Sample Warranty: For special warranty.

#### **1.7 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
- B. Schedules: Final door hardware and keying schedule.

#### **1.8 QUALITY ASSURANCE**

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
  - 1. Warehousing Facilities: In Project's vicinity.
  - 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
  - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Openings Consultant (AOC).

#### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

## **1.10 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including excessive deflection, cracking, or breakage.
    - b. Faulty operation of doors and door hardware.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  - 2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
    - a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
    - b. Exit Devices: Two years from date of Substantial Completion.
    - c. Manual Closers: 10 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.
  - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1 and Michigan Barrier Free Design.
  - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
  - 2. Comply with the following maximum opening-force requirements:
    - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
  - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
  - 4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
  - 5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

### **2.3 SCHEDULED DOOR HARDWARE**

- A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.
  - 1. Door hardware is scheduled in Part 3.

### **2.4 HINGES**

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies
    - b. Allegion PLC.
    - c. Stanley

### **2.5 MECHANICAL LOCKS AND LATCHES**

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
  - 1. Bored Locks: Minimum 1/2-inch latchbolt throw.
  - 2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
  - 3. Deadbolts: Minimum 1.25-inch bolt throw.
- C. Lock Backset: 2-3/4 inches unless otherwise indicated.
- D. Lock Trim:
  - 1. Description: Per Hardware Schedule.
  - 2. Levers: Per Hardware Schedule.
  - 3. Escutcheons (Roses): Per Hardware Schedule.
  - 4. Dummy Trim: Match lever lock trim and escutcheons.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
  - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  - 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
  - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Cylindrical Locks: BHMA A156.2; Operational Grade 1, Security Grade 1; stamped steel case with steel or brass parts; Series 4000.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies
    - b. Allegion plc.
    - c. DORMA USA, Inc.
    - d. SARGENT Manufacturing Company; ASSA ABLOY.



- G. Push-Pull Latches: Mortise, BHMA A156.13; with paddle handles that retract latchbolt; capable of being mounted vertically or horizontally.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies
    - b. Allegion PLC.
    - c. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
    - d. SARGENT Manufacturing Company; ASSA ABLOY.
  - 2. Grade: 1.

## **2.6 ELECTRIC STRIKES**

- A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager
    - b. RCI.
    - c. Securitron Magnalock Corporation; an ASSA ABLOY Group company.

## **2.7 EXIT LOCKS AND EXIT ALARMS**

- A. Exit Locks and Alarms: BHMA A156.29, Grade 1.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies
    - b. Allegion plc.
    - c. SARGENT Manufacturing Company; ASSA ABLOY.

## **2.8 MANUAL FLUSH BOLTS**

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies
    - b. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
    - c. Allegion plc.
    - d. Trimco.

## **2.9 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS**

- A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge. Include wear plates.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies
    - b. Allegion plc.
    - c. Door Controls International, Inc.
    - d. Trimco.

## **2.10 EXIT DEVICES AND AUXILIARY ITEMS**

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies – 4500 / 4700 Series
    - b. Allegion plc. – 33/35 or 98/99 Series
    - c. DORMA USA, Inc. 9300 / 9700 Series
    - d. SARGENT Manufacturing Company; ASSA ABLOY. 8500 & 8800 Series

## **2.11 LOCK CYLINDERS**

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allegion plc.
    - b. Best Access Systems; Stanley Security Solutions, Inc.
    - c. SARGENT Manufacturing Company; ASSA ABLOY.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.
  - 1. Core Type: Interchangeable.
- C. High-Security Lock Cylinders: BHMA A156.30; Grade 1 permanent cores that are removable; face finished to match lockset.
  - 1. Type: M, mechanical, E, electrical.
- D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
- E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

## **2.12 KEYING**

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.
  - 1. Master Key System: Change keys and a master key operate cylinders.
    - a. Provide three cylinder change keys and five master keys.
- B. Keys: Nickel silver.
  - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
    - a. Notation: "DO NOT DUPLICATE."

## **2.13 KEY CONTROL SYSTEM**

- A. Key Control Cabinet: BHMA A156.28; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Key Boxes and Cabinets.
    - b. GE Security, Inc.
    - c. Lund Equipment Co., Inc.
  2. Wall-Mounted Cabinet: Grade 1 cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
- B. Key Lock Boxes: Designed for storage of two keys.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. GE Security, Inc.
    - b. HPC, Inc.
    - c. Knox Company.
- C. Key Control System Software: Multiple-index system for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allegion PLC.
    - b. Best Access Systems; Stanley Security Solutions, Inc.
    - c. GE Security, Inc.

#### **2.14 OPERATING TRIM**

- A. Operating Trim: BHMA A156.6; brass stainless steel unless otherwise indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies
    - b. Allegion PLC.
    - c. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

#### **2.15 ACCESSORIES FOR PAIRS OF DOORS**

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

#### **2.16 SURFACE CLOSERS**

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written

instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force. Any drop plates, or accessories needed to complete the installation is the responsibility of the hardware supplier.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hager Companies 5100 Series
  - b. Allegion plc. 4040XP
  - c. DORMA USA, Inc. TS93 Series
  - d. SARGENT Manufacturing Company; ASSA ABLOY. 281 Series

## **2.17 MECHANICAL STOPS AND HOLDERS**

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies
    - b. Allegion PLC.
    - c. Rockwood Manufacturing Company; an ASSA ABLOY Group company
- B. Overhead Stops and Holders: BHMA A156.8.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies
    - b. Allegion PLC.
    - c. DORMA USA, Inc.
    - d. Rixson Specialty Door Controls; an ASSA ABLOY Group company.

## **2.18 DOOR GASKETING**

- A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies
    - b. National Guard Products, Inc.
    - c. Reese Enterprises, Inc.
    - d. Zero
- B. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg, as follows:
  1. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
  2. Gasketing on Double Doors: 0.50 cfm per foot of door opening.

## **2.19 THRESHOLDS**

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Hager Companies
- b. National Guard Products, Inc.
- c. Reese Enterprises, Inc.
- d. Zero

## **2.20 METAL PROTECTIVE TRIM UNITS**

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick; with manufacturer's standard machine or self-tapping screw fasteners.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Companies
    - b. Allegion PLC.
    - c. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

## **2.21 AUXILIARY DOOR HARDWARE**

- A. Auxiliary Hardware: BHMA A156.16.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Company
    - b. Allegion PLC.
    - c. Hager Companies.
    - d. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

## **2.22 AUXILIARY ELECTRIFIED DOOR HARDWARE**

- A. Auxiliary Electrified Door Hardware:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hager Company
    - b. Allegion PLC.
    - c. DORMA USA, Inc.
    - d. Securitron Magnalock Corporation; an ASSA ABLOY Group company.

## **2.23 FABRICATION**

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.
  1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized

industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

## **2.24 FINISHES**

- A. General: Satin Chrome BHMA 626 US26D: Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

### **3.3 INSTALLATION**

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
  1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  2. Custom Steel Doors and Frames: HMMA 831.

3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
  1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
  1. Replace construction cores with permanent cores as directed by Owner.
  2. Furnish permanent cores to Owner for installation.
- E. Key Control System:
  1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
  2. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
  3. Key Control System Software: Set up multiple-index system based on final keying schedule.
- F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.
  1. Configuration: Provide one power supply for each door opening with electrified door hardware.
- G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
  1. Do not notch perimeter gasketing to install other surface-applied hardware.
- J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

### **3.4 FIELD QUALITY CONTROL**

- A. Independent Architectural Hardware Consultant: Engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
  1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### **3.5 ADJUSTING**

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
  - 2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
  - 3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

### **3.6 CLEANING AND PROTECTION**

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

### **3.7 MAINTENANCE SERVICE**

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

### **3.8 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.



### 3.9 DOOR HARDWARE SCHEDULE

#### 3.10 HARDWARE SET NO. 01 101A

CARD ACCESS / CYLINDER ENTRY NIGHT LATCH FUNCTION / AIPHONE DOOR RELEASE

EXISTING DOOR & HARDWARE TO REMAIN

EACH TO HAVE:

1	EA	DEADLATCH	4900 SERIES	DBZ	AR
1	EA	DEADLATCH PADDLE	4590 SERIES	DBZ	AR
1	EA	ELECTRIC STRIKE	7100 SERIES	DBZ	AR
1	EA	POWER SUPPLY	PS-1	-	AR
1	EA	CARD READER	-	-	BO
1	EA	AIPHONE SYSTEM	JF	-	AIP
1	EA	THRESHOLD	412S	MIL	HAG

NORMAL OPERATION: ENTRY BY PULL AFTER PRESENTING APPROVED CREDENTIAL AT CARD READER. FREE EGRESS BY PRESSING DOOR MOUNTED DEADLATCH PADDLE. GUESTS REQUEST ENTRY BY DEPRESSING AIPHONE CALL SWITCH. OWNER CONFIRMS THROUGH AUDIO VISUAL, DEPRESSING DOOR RELEASE SWITCH GRANTING GUEST ACCESS.

#### HARDWARE SET NO. 02 203A, 207B

PASSAGE FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1168 4.5X4.5	626	HAG
1	EA	EXIT DEVICE	4501 RIM FR 2-649-0217	626	HAG
1	EA	EXIT DEVICE TRIM	45BE-ARC	626	HAG
1	EA	SURFACE CLOSER	5100 MLT (PULL SIDE MOUNT)	ALM	HAG
1	EA	KICK PLATE	194S 10" X 2" LDW	630	HAG
1	SET	SMOKE SEAL	726S	CH	HAG
1	EA	WALL STOP	260W	626	HAG

FREE ENTRY FROM STAIRWELL AT ALL TIMES.

**HARDWARE SET NO. 03 204A, 215A, 227A, 228A**  
PRIVACY FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1199 4.5X4.5	626	HAG
1	EA	CYLINDRICAL LOCK	3440 ARC PRIVACY FUNCTION	626	HAG
1	EA	KICKPLATE	194S 10"X2" LDW	630	HAG
1	EA	WALL STOP	260W	626	HAG

PRIVACY FUNCTION LOCK WITH EMERGENCY KEY. FREE EGRESS AT ALL TIMES

**HARDWARE SET NO. 04 205A**  
CLASSROOM FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1199 4.5X4.5	626	HAG
1	EA	CYLINDRICAL LOCK	3470 ARC CLASSROOM FUNCTION	626	HAG
1	EA	SURFACE CLOSER	5100 (PULL SIDE MOUNT)	ALM	HAG
1	EA	KICK PLATE	194S 10" X 2" LDW	630	HAG
1	EA	WALL STOP	260W	626	HAG

CLASSROOM FUNCTION, LOCK AND UNLOCK BY KEY. FREE EGRESS AT ALL TIMES

**HARDWARE SET NO. 04A**

(NOT USED)

**HARDWARE SET NO. 05**

(NOT USED)

**HARDWARE SET NO. 06 207A**

CARD ACCESS / CYLINDER ENTRY NIGHT LATCH FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1168 4.5X4.5	626	HAG
1	EA	EXIT DEVICE	4501 RIM FR 2-649-0217	626	HAG
1	EA	RIM CYLINDER	3901	626	HAG
1	EA	EXIT DEVICE TRIM	45NL-ARC	626	HAG
1	EA	ELECTRIC STRIKE	0162 RIM 12/24 VDC	630	RCI
1	EA	CARD READER	-	-	BO
1	EA	SURFACE CLOSER	5100 – HD ARM (PUSH SIDE MOUNT)	ALM	HAG
1	EA	KICK PLATE	194S 10" X 2" LDW	630	HAG
1	SET	SMOKE SEAL	726S	CH	HAG
1	SET	WALL STOP	260W	626	HAG

ENTRY APPROVED CREDENTIAL TO UNLATCH ELECTRIC STRIKE OR BY KEY. FREE EGRESS ALWAYS BY EXIT DEVICE. POWER SUPPLY AND BATTERY BACK UP – UTILIZE MISC #17

**HARDWARE SET NO. 07 206A, 213B**

CARD ACCESS / CYLINDER ENTRY, NIGHT LATCH FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1199 4.5X4.5	626	HAG
1	EA	CYLINDRICAL LOCK	3480 ARC	626	HAG
1	EA	ELECTRIC STRIKE	2925 12/24 VDC FAIL SECURE	US32D	HAG
1	EA	CARD READER	-	-	BO
1	EA	DOOR CLOSER	5100 MLT (PULL SIDE MOUNT)	ALM	HAG
1	EA	KICK PLATE	194S 10" X 2" LDW	630	HAG
1	EA	WALL STOP	260W	US26D	HAG

ENTRY BY APPROVED CREDENTIAL TO UNLATCH ELECTRIC STRIKE OR BY KEY. FREE EGRESS AT ALL TIMES. POWER SUPPLY AND BATTERY BACK UP – UTILIZE MISC HARDWARE SET #17

**HARDWARE SET NO. 08 210A**

CARD ACCESS / CYLINDER ENTRY, NIGHT LATCH FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1199 4.5X4.5	626	HAG
1	EA	CYLINDRICAL LOCK	3480 ARC	626	HAG
1	EA	ELECTRIC STRIKE	2925 12/24 VDC FAIL SECURE	US32D	HAG
1	EA	CARD READER	-	-	BO
1	EA	DOOR CLOSER	5100 HD (PUSH SIDE MOUNT)	ALM	HAG
1	EA	KICK PLATE	194S 10" X 2" LDW	630	HAG
1	EA	WALL STOP	260W	626	HAG

ENTRY BY APPROVED CREDENTIAL TO UNLATCH ELECTRIC STRIKE OR BY KEY. FREE EGRESS AT ALL TIMES. POWER SUPPLY AND BATTERY BACK UP – UTILIZE MISC HARDWARE SET #17

**HARDWARE SET NO. 09 211A, 212A, 212B, 216A, 232A, 233A, 234A, 235A, 236A, 237A, 239A, 240A**  
PASSAGE FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1199 4.5 X 4.5	626	HAG
1	EA	CYLINDRICAL LOCK	3410 ARC	626	HAG
1	EA	KICK PLATE	194S 10"X2" LDW	630	HAG
1	EA	WALL STOP	260W	626	HAG

FREE ENTRY AND FREE EGRESS AT ALL TIMES

**HARDWARE SET NO. 10**

(NOT USED)

**HARDWARE SET NO. 10A 229A**

CARD ACCESS / CYLINDER ENTRY, NIGHT LATCH FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1168 4.5X4.5	626	HAG
1	EA	CYLINDRICAL LOCK	3480 ARC	626	HAG
1	EA	ELECTRIC STRIKE	EXISTING	-	EXIST
1	EA	POWER SUPPLY	EXISTING	-	EXIST
1	EA	BATTERY BACK UP	EXISTING	-	EXIST
1	EA	CARD READER	EXISTING	-	EXIST
1	EA	DOOR CLOSER	5100 MLT (PULL SIDE MOUNT)	ALM	HAG
1	EA	KICK PLATE	194S 10" X 2" LDW	630	HAG
1	SET	SMOKE SEAL	726S	CH	HAG
1	EA	WALL STOP	260W	US26D	HAG

ENTRY BY APPROVED CREDENTIAL TO UNLATCH ELECTRIC STRIKE OR BY KEY. FREE EGRESS AT ALL TIMES.

**HARDWARE SET NO. 11 213C**

CARD ACCESS / CYLINDER ENTRY, NIGHT LATCH FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1199 4.5X4.5	626	HAG
1	EA	CYLINDRICAL LOCK	3480 ARC	626	HAG
1	EA	ELECTRIC STRIKE	2925 12/24 VDC FAIL SECURE	US32D	HAG
1	EA	CARD READER	-	-	BO
1	EA	DOOR CLOSER	5100 MLT (PULL SIDE MOUNT)	ALM	HAG
1	EA	KICK PLATE	194S 10" X 2" LDW	630	HAG

ENTRY BY APPROVED CREDENTIAL TO UNLATCH ELECTRIC STRIKE OR BY KEY. FREE EGRESS AT ALL TIMES. POWER SUPPLY AND BATTERY BACK UP – UTILIZE MISC HARDWARE SET #17

**HARDWARE SET NO. 11A 213A**

CARD ACCESS / CYLINDER ENTRY, NIGHT LATCH FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1199 4.5X4.5	626	HAG
1	EA	CYLINDRICAL LOCK	3480 ARC	626	HAG
1	EA	ELECTRIC STRIKE	2925 12/24 VDC FAIL SECURE	US32D	HAG
1	EA	CARD READER	-	-	BO
1	EA	DOOR CLOSER	5100 HD (PUSH SIDE MOUNT)	ALM	HAG
1	EA	KICK PLATE	194S 10" X 2" LDW	630	HAG
1	EA	WALL STOP	260W	US26D	HAG

ENTRY BY APPROVED CREDENTIAL TO UNLATCH ELECTRIC STRIKE OR BY KEY. FREE EGRESS AT ALL TIMES. POWER SUPPLY AND BATTERY BACK UP – UTILIZE MISC HARDWARE SET #17

**HARDWARE SET NO. 12 219A, 231A, 238A**

EXIT TO FIRE POLE, PASSAGE FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1168 4.5X4.5	626	HAG
1	EA	EXIT DEVICE	4501 RIM FR 2-649-0217	626	HAG
1	EA	EXIT DEVICE TRIM	45BE-ARC	626	HAG
1	EA	DOOR CLOSER	5100 MLT (PULL SIDE MOUNT, ADJUST FOR DELAYED ACTION)	ALM	HAG
1	EA	WALL STOP	260W	626	HAG

1	EA	KICKPLATE	194S 10"X2" LDW	630	HAG
1	SET	SMOKE SEAL	726S	CH	HAG
1	EA	AUTO DOOR BOTTOM	743S	MIL	HAG

FREE EGRESS TO FIRE POLE. PASSAGE FUNCTION ALLOWS FREE ENTRY FROM FIRE POLE ROOM

**HARDWARE SET NO. 13 222A, 223A, 224A, 225A, 226A**  
OFFICE FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1199 4.5X4.5	626	HAG
1	EA	CYLINDRICAL LOCK	3453 ARC	626	HAG
1	EA	KICK PLATE	194S 10"X2" LDW	630	HAG
1	EA	WALL STOP	260W	626	HAG

ENTRY BY KEY UNLESS UNLOCKED. PUSH BUTTON LOCKING FROM INSIDE. CLOSING DOOR DOES NOT RELEASE PUSH BUTTON. FREE EGRESS AT ALL TIMES.

**HARDWARE SET NO. 14 231B, 231C**  
PASSAGE FUNCTION

EACH TO HAVE:

3	EA	HINGE	BB1168 4.5X4.5	626	HAG
1	EA	CYLINDRICAL LOCK	3410 ARC	626	HAG
1	EA	DOOR CLOSER	5100 MLT (PULL SIDE MOUNT)	ALM	HAG
1	EA	KICKPLATE	194S 10"X2" LDW	630	HAG
1	SET	SMOKE SEAL	726S	CH	HAG
1	EA	WALL STOP	260W	626	HAG

FREE ENTRY AND EGRESS AT ALL TIMES

**HARDWARE SET NO. 15 231D, 231E**  
STOREROOM FUNCTION / PAIRED ENTRY

EACH TO HAVE:

6	EA	HINGE	BB1168 4.5X4.5	626	HAG
1	EA	CYLINDRICAL LOCK	3480 ARC	626	HAG
2	EA	DOOR CLOSER	5300-HD ARM (PUSH SIDE MOUNT)	ALM	HAG
1	SET	AUTO FLUSH BOLTS	283D	US32D	HAG

1	SET	SMOKE SEAL	726S	CH	HAG
1	EA	DUST PROOF STRIKE	280X	US26D	HAG

CLOSET ALWAYS LOCKED, ACCESS BY KEY. INACTIVE LEAF ACCESSED BY AUTO FLUSH BOLTS AFTER ACTIVE LEAF IS OPEN

**HARDWARE SET NO. 16**

(NOT USED)

**HARDWARE SET NO. 17 (ONLY ONE REQUIRED)**

MISC. ELECTRIFIED HARDWARE

3	EA	POWER SUPPLY	2909 2 AMP MODULAR	-	HAG
3	EA	ACCESS CONTROL MODULE	2-679-0704	-	HAG

One hardware set #17 required to accommodate all of the following openings combined: **206A, 207A, 210A, 213A, 213B, 213C**

END OF SECTION 087100



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## **SECTION 088000 - GLAZING**

### **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. Glass for windows doors interior and borrowed lites.
  - 2. Glazing sealants and accessories.

#### **1.3 DEFINITIONS**

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. MBC: 2015 Michigan Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

#### **1.4 COORDINATION**

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

#### **1.5 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review temporary protection requirements for glazing during and after installation.

#### **1.6 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### **1.7 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.
- B. Product Certificates: For glass.
- C. Product Test Reports: For insulating glass and glazing sealants, for tests performed by a qualified testing agency.
  - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

#### **1.8 QUALITY ASSURANCE**

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
  - 1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## **1.9 PRECONSTRUCTION TESTING**

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
  2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
  3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
  4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
  5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

## **1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

## **1.11 FIELD CONDITIONS**

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

## **1.12 WARRANTY**

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 10 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Design Basis: Guardian Glass, "clear glass"
- B. Other Manufacturers: Subject to compliance with requirements, provide products by one of the following other acceptable manufacturers:
  - 1. Oldcastle BuildingEnvelope™.
  - 2. Pilkington North America.
  - 3. Trulite Glass & Aluminum Solutions, LLC.
  - 4. Vetrotech Saint-Gobain.
  - 5. Vitro.
- C. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
  - 1. Obtain exterior glass from single source from single manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
  - 1. Design Wind Pressures: As indicated on Drawings.
  - 2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
    - a. Wind Design Data: As indicated on Drawings.
    - b. Basic Wind Speed: 115 mph.
    - c. Importance Factor: 1.0.
    - d. Exposure Category: B.
  - 3. Design Snow Loads: 25 psi.
  - 4. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
  - 5. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
  - 6. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.

7. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

### **2.3 GLASS PRODUCTS, GENERAL**

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  1. GANA Publications: "Glazing Manual."
  2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
  1. Minimum Glass Thickness for Exterior Lites: 6 mm.
  2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

### **2.4 GLASS PRODUCTS**

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
  1. Clear interior glass: ¼" minimum thickness, tempered where required by code.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (bronze tinted) as indicated, Quality-Q3.
  1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (bronze tinted) as indicated, Quality-Q3.
  1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

## **2.5 GLAZING SEALANTS**

- A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation.
    - b. GE Construction Sealants; Momentive Performance Materials Inc.
    - c. May National Associates, Inc.; a subsidiary of Sika Corporation.
    - d. Pecora Corporation.
    - e. Sika Corporation.
    - f. Tremco Incorporated.

## **2.6 GLAZING TAPES**

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## **2.7 MISCELLANEOUS GLAZING MATERIALS**

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Translucent Adhesive Glazing Film: See Finishes Schedule.

## **2.8 FABRICATION OF GLAZING UNITS**

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
  - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
    - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep systems.
  - 3. Minimum required face and edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.



### **3.3 GLAZING, GENERAL**

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### **3.4 TAPE GLAZING**

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### **3.5 GASKET GLAZING (DRY)**

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.
- F. Provide tempered/safety glazing in all hazardous locations in accordance with the Michigan Building Code.

### **3.6 SEALANT GLAZING (WET)**

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### **3.7 CLEANING AND PROTECTION**

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### **3.8 MONOLITHIC AND INSULATING GLASS SCHEDULE**

- A. Glass Type: Clear fully tempered float glass.
  - 1. Application: Doors (location as indicated on the Drawings).
  - 2. Minimum Thickness: 6 mm.
  - 3. Safety glazing required.
- B. Glass Type: Clear fully tempered float glass.
  - 1. Application: Borrowed lites and aluminum storefront system.
  - 2. Minimum Thickness: 1/2 inch.
  - 3. Safety glazing required.
- C. Glass Type: Annealed mirror with flat polished exposed edges.
  - 1. Application: Restroom mirrors.
  - 2. Minimum Thickness: 1/4 inch.
- D. Glass Type: Low-E-coated, ultra-clear, insulating laminated glass.
  - 1. Guardian "Sunguard SuperNeutral 68."
  - 2. Overall Unit Thickness: 1 inch (25 mm).
  - 3. Minimum Thickness of Outdoor Lite: 5 mm.
  - 4. Outdoor Lite: Clear heat-strengthened or fully tempered float glass.
  - 5. Color: Ultra Clear.
  - 6. Interspace Content: Argon.
  - 7. Indoor Lite: Clear laminated glass with two plies of annealed or heat-strengthened float glass.
    - a. Minimum Thickness of Each Glass Ply: 3 mm.
    - b. Interlayer Thickness: 0.060 inch (1.52 mm).
  - 8. Low-E Coating: Pyrolytic on second surface.
  - 9. Winter Nighttime U-Factor: 0.25 maximum.
  - 10. Summer Daytime U-Factor: 0.28 maximum.
  - 11. Visible Light Transmittance: 71 percent minimum.
  - 12. Solar Heat Gain Coefficient: 0.39 maximum.

13. Safety glazing where required by Code or as indicated on Drawings.

END OF SECTION 088000

## **SECTION 092216 - NON-STRUCTURAL METAL FRAMING**

### **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. Non-load-bearing steel framing systems for interior partitions.
  - 2. Non-load bearing steel shaft wall framing systems for interior partitions.
  - 3. Resilient channels for acoustic walls.
  - 4. Suspension systems for interior ceilings and soffits.
  - 5. Grid suspension systems for gypsum board ceilings.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.

#### **2.2 FRAMING SYSTEMS**

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
  2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C 645.
1. Steel Studs and Tracks:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) ClarkDietrich Building Systems.
      - 2) Jaimes Industries.
      - 3) MarinoWARE.
    - b. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection but not less than 0.0279 inch (22 gauge).
    - c. Depth: As indicated on Drawings.
    - d. Type C-H studs as shaft wall construction where indicated.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch minimum vertical movement.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) ClarkDietrich Building Systems.
      - 2) MarinoWARE.
  2. Single Long-Leg Track System: ASTM C 645 top track with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  3. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
  4. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) ClarkDietrich Building Systems.
      - 2) MarinoWARE.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich Building Systems.

- b. MarinoWARE.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: 0.0329 inch.
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
  - 1. Depth: 1-1/2 inches.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich Building Systems.
    - b. Jaimes Industries.
    - c. MarinoWARE.
  - 2. Minimum Base-Metal Thickness: 0.0179 inch.
  - 3. Depth: As indicated on Drawings.
- H. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
  - 1. Depth: As indicated on Drawings.
  - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
  - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- I. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical or hat shaped.

### **2.3 SUSPENSION SYSTEMS**

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
  - 1. Depth: 2-1/2 inches.
- E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
  2. Steel Studs and Tracks: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.0179 inch.
    - b. Depth: 1-5/8 inches.
  3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base-Metal Thickness: 0.0329 inch.
  4. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.
    - a. Configuration: Asymmetrical.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armstrong World Industries, Inc.
    - b. USG Corporation.

## **2.4 AUXILIARY MATERIALS**

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.



- B. Coordination with Sprayed Fire-Resistive Materials:
1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
  2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

### **3.3 INSTALLATION, GENERAL**

- A. Installation Standard: ASTM C 754.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### **3.4 INSTALLING FRAMED ASSEMBLIES**

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
  2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
  3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

- c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  5. Sound-Rated Partitions: Install framing including resilient channels and to comply with sound-rated assembly indicated.
  6. Curved Partitions:
    - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. Direct Furring:
  1. Screw to wood framing.
  2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

### **3.5 INSTALLING CEILING SUSPENSION SYSTEMS**

- A. Install suspension system components according to spacing indicated, but not greater than spacings required by referenced installation standards for assembly types.
  1. Hangers: 48 inches o.c.
  2. Carrying Channels (Main Runners): 48 inches o.c.
  3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
  2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  5. Do not attach hangers to steel roof deck.
  6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

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## **SECTION 092900 - GYPSUM BOARD**

### **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. Interior gypsum board.
  - 2. Tile backing panels.
  - 3. Fire-rated gypsum board.
  - 4. Shaft wall liner panels
- B. Related Requirements:
  - 1. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For the following products:
  - 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.
- C. Samples for Verification: For the following products:
  - 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Items not protected prior to installation will be rejected. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### **1.5 FIELD CONDITIONS**

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

- C. Do not install panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

### **2.2 GYPSUM BOARD, GENERAL**

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

### **2.3 INTERIOR GYPSUM BOARD**

- A. Gypsum Wallboard: ASTM C 1396/C 1396M.
  - 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. Georgia-Pacific Gypsum LLC.
    - b. National Gypsum Company.
    - c. USG Corporation.
  - 2. Thickness: 5/8 inch.
  - 3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
  - 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. Georgia-Pacific Gypsum LLC.
    - b. National Gypsum Company.
    - c. USG Corporation.
  - 2. Thickness: 5/8 inch.
  - 3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

- C. Gypsum Board, Type X Liner Panels: ASTM C 1396/C 1396M.
  - 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. Georgia-Pacific Gypsum LLC.
    - b. National Gypsum Company.
    - c. USG Corporation.
  - 2. Thickness: 1 inch.  
Edges: Finished on all edges
- D. Gypsum Board, Type X Impact Resistant Panels: ASTM C840; C1629
  - 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. Georgia-Pacific Gypsum LLC.
    - b. National Gypsum Company.
    - c. USG Corporation.
  - 2. Thickness: 5/8 inch.  
Edges: Tapered and featured (rounded or beveled) for prefilling
- E. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
  - 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. Georgia-Pacific Gypsum LLC.
    - b. National Gypsum Company.
    - c. USG Corporation.
  - 2. Thickness: 1/2 inch.
  - 3. Long Edges: Tapered.

## **2.4 TILE BACKING PANELS**

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
  - 1. Core: 5/8 inch, Type X.
  - 2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
  - 1. Thickness: 5/8 inch.
  - 2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- C. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.
  - 1. Core: 5/8 inch, Type X.

## **2.5 TRIM ACCESSORIES**

- A. Interior Trim: ASTM C 1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
  - 2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.
    - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
  - 1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
  - 2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

## **2.6 JOINT TREATMENT MATERIALS**

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
  - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
  - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
  - 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
  - 2. Cementitious Backer Units: As recommended by backer unit manufacturer.
  - 3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.



## **2.7 AUXILIARY MATERIALS**

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 APPLYING AND FINISHING PANELS, GENERAL**

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### **3.3 APPLYING INTERIOR GYPSUM BOARD**

- A. Install interior gypsum board in the following locations:
  - 1. Wallboard Type: As indicated on Drawings.
  - 2. Type X: As required for all fire-rated walls or as indicated on Drawings.
  - 3. Ceiling Type: As indicated on Drawings.
  - 4. Glass-Mat Interior Type: As indicated on Drawings.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
  2. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
  3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

### **3.4 APPLYING TILE BACKING PANELS**

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Water-Resistant Backing Board: Install where indicated with 1/4-inch gap where panels abut other construction or penetrations.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

### **3.5 APPLYING CURVED INSIDE CORNER PANELS**

- A. General: Follow manufacturer's specifications and recommendations for installing board.
- B. Cutting: Utilize table saw with fence and sharp blade or a sharp utility knife.
  1. Avoid denting edges.
  2. Avoid peeling skin from edges.
- C. Installation: Screw to stud backing and abut to gypsum board with matching tapered edge.
- D. Finish tapered edge with tape, joint compound in three layers, sanding each layer to a smooth finish.
  1. Fill screw holes to smooth surface.
  2. Level 4 finish minimum.

### **3.6 INSTALLING TRIM ACCESSORIES**

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.
  - 2. U-Bead: Use at exposed panel edges.
  
- D. Exterior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.
  - 2. LC-Bead: Use at exposed panel edges.

### **3.7 FINISHING GYPSUM BOARD**

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
  
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
  
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
  
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 3: Where indicated on Drawings.
  - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
  
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
  
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.
  
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### **3.8 PROTECTION**

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
  
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
  
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

## **SECTION 093013 – CERAMIC TILING**

### **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. Porcelain Ceramic Tile
  - 2. Metal edge strips.
- B. Related Sections:
  - 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
  - 2. Section 092900 "Gypsum Board" for cementitious backer units.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
  - 1. Level Surfaces: Minimum 0.7.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Verification:
  - 1. Full-size units of each type and composition of tile and for each color and finish required.
  - 2. Full-size units of each type of trim and accessory.
  - 3. Metal edge strips in 6-inch lengths.
- D. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- E. Product Certificates: For each type of product, signed by product manufacturer.

#### **1.5 QUALITY ASSURANCE**

- A. Source Limitations for Tile: Obtain tile from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
  1. Joint sealants.
  2. Metal edge strips.
- D. Preinstallation Conference: Conduct conference at Project site.
  1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

## **1.7 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

## **PART 2 - PRODUCTS**

### **2.1 PRODUCTS, GENERAL**

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
  - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

## **2.2 TILE PRODUCTS**

- A. Porcelain Ceramic Tile as indicated in the Drawing Material Finish Schedule.
  - 1. PCT-1 Design Basis: DalTile, "Linden Point." Floor Tile
    - a. Color: Grigio LP21.
    - b. Size: 12"x24"x5/16"
  - 2. PCTB-2 Design Basis: DalTile "Linden Point" Tile
    - a. Color: Grigio LP21.
    - b. Size: 3"x12" square
  - 3. Other Manufacturers: Subject to compliance with requirements, provide comparable product by one of the following other acceptable manufacturers:
    - a. American Olean; Division of Dal-Tile International Inc.
    - b. Crossville, Inc.
    - c. Daltile; Division of Dal-Tile International Inc.
    - d. Interceramic.
    - e. Portobello America, Inc.
    - f. Seneca Tiles, Inc.
  - 4. Surface: Slip-resistant, with abrasive admixture.
  - 5. Coefficient of Friction, Static: Dry – 0.08%; Wet – 0.62%.
  - 6. Coefficient of Friction, Dynamic: 0.47 per BOT 3000.
  - 7. MOHS: 7 average.
  - 8. Breaking Strength: 450 lbf per AST C 648.
  - 9. Visible Abrasion Resistance (PEI): 4 average result per ASTM C1027.
  - 10. Water Absorption: 0.08% per ASTM C 373.
  - 11. Chemical Resistance: Class A per ASTM 650.
  - 12. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
  - 13. Grout Color: As selected by Architect from manufacturer's full range.
  - 14. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

## **2.3 SETTING MATERIALS**

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
  - 1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
- B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.



1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

## **2.4 GROUT MATERIALS**

A. Standard Cement Grout: ANSI A118.6.

## **2.5 MISCELLANEOUS MATERIALS**

A. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; exposed-edge material.

B. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

## **2.6 MIXING MORTARS AND GROUT**

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

### **3.3 TILE INSTALLATION**

- A. Comply with TCNA's "Handbook for Ceramic Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
  2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
  3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch.
  2. Quarry Tile: 3/8 inch.
- F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
  2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- H. Metal Edge Strips: Install at locations indicated.
- I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

### **3.4 CLEANING AND PROTECTING**

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove grout residue from tile as soon as possible.
  2. Clean grouts smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
  3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

### **3.5 INTERIOR TILE INSTALLATION SCHEDULE**

- A. Interior Floor Installations, Concrete Slab on Grade:
- B. Interior Floor Installations, Concrete Substrate:
1. Tile Installation F113: Thin-set mortar on concrete slab; TCNA F113.
    - a. Tile Type: Per the Finish Schedule on the Drawings.
    - b. Thin-set mortar: ANSI A118.4 Latex-Portland Cement Mortar.
    - c. Grout: ANSI A118.6 Standard Cement Grouts for Tile Installation.

END OF SECTION 093000

## **SECTION 095113 - ACOUSTICAL PANEL CEILINGS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes acoustical panels for ceilings.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling 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. Ceiling suspension system members.
  - 2. Method of attaching hangers to building structure.
    - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
  - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 4. Minimum Drawing Scale: 1/4 inch = 1 foot.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- E. Maintenance Data: For finishes to include in maintenance manuals.

#### **1.3 QUALITY ASSURANCE**

- A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer or distributor.
- B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
  - 1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
    - a. Smoke-Developed Index: 450 or less.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

#### **1.5 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
  - 1. Any Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

#### **1.6 COORDINATION**

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

### **PART 2 - PRODUCTS**

#### **2.1 ACOUSTICAL PANEL CEILINGS**

- A. ACT-1 Design Basis: Armstrong Cirrus # 584 – White – 24"x24"x3/4" Angled Tegular profile with 15/16" White Grid.
- B. Substitutions: Provide alternative products\ manufactures only in accordance with Section 012500 "Substitution Procedures."
- C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
- D. Acoustical Panel Sizes, Colors and Patterns: See also Drawing Material Finish Schedule.
- E. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.
- F. Antimicrobial Fungicide Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

## **2.2 METAL SUSPENSION SYSTEMS**

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Design Basis: Armstrong Wall and Ceiling Systems or USG Corporation equivalent.
- C. Width, Finishes and Colors: 15/16-inch, white.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- E. Hold-Down Clips: Provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees. Provide at areas within 8 feet of exterior door conditions.

## **2.3 METAL EDGE MOLDINGS AND TRIM**

- A. Product: Same manufacturer as metal grid.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
  - 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
  - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
  - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

## **2.4 ACOUSTICAL SEALANT**

- A. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Acoustical Sealant for Exposed and Concealed Joints:
    - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
    - b. USG Corporation; SHEETROCK Acoustical Sealant.
  - 2. Acoustical Sealant for Concealed Joints:
    - a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
    - b. Pecora Corporation; BA-98.
    - c. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through

perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### **3.3 INSTALLATION**

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  - 6. When building framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  - 7. Do not attach hangers to deck sheathing.
  - 8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  - 9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent

metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
  - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
  - 1. Arrange directionally patterned acoustical panels as follows:
    - a. As indicated on reflected ceiling plans.
    - b. Install panels with pattern running in one direction parallel to short axis of space.
  - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  - 3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  - 4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
  - 5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
  - 6. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

### **3.4 CLEANING**

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113



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## **SECTION 096513 - RESILIENT BASE AND ACCESSORIES**

### **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. Thermoplastic-rubber base.
  - 2. Transition strips.
  - 3. Rubber molding accessories.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- E. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

#### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

## **1.6 FIELD CONDITIONS**

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

## **PART 2 - PRODUCTS**

### **2.1 THERMOPLASTIC-RUBBER BASE**

- A. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
  - 1. Group: I (solid, homogeneous).
  - 2. Style and Location:
    - a. Refer to Material Finish Schedule, included on Drawings, for rubber base selection.
- B. Design Basis:
  - 1. RB- 1: Roppe Corporation, USA "Model 193."
    - a. Color: Refer to Material Finish Schedule
- C. Other Manufacturers: Subject to compliance with requirements, provide products from one of the following other acceptable manufacturers:
  - 1. Burke Mercer Flooring Products
  - 2. Flexco
  - 3. Johnsonite, a Tarkett company
- D. Thickness: 0.125 inch.
- E. Height: 4" and ss indicated on Drawing Material Finish Schedule.
- F. Lengths: Coils in manufacturer's standard length.
- G. Outside Corners: Preformed.
- H. Inside Corners: Preformed.
- I. Colors: As indicated on Drawings.

## **2.2 TRANSITION STRIPS**

- A. Carpet to Resilient Transition Design Basis: Roppe #177 or other approved, color as selected by Architect
- B. Carpet to Carpet Transition Design Basis: Roppe #155 or other approved, color as selected by Architect
- C. Carpet to Concrete Design Basis: Roppe Edguard 193 Black Brown

## **2.3 RUBBER MOLDING ACCESSORY**

- A. Description: Rubber reducer strip for resilient floor covering, joiner for tile and carpet, and transition strips.
- B. Profile and Dimensions: As indicated.
- C. Locations: Provide rubber molding accessories in areas indicated.
- D. Colors and Patterns: As selected by Architect from manufacturer's full range.

## **2.4 INSTALLATION MATERIALS**

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Metal Edge Strips: Extruded aluminum with anodized finish, nominal 2 inches wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### **3.3 RESILIENT BASE INSTALLATION**

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.

### **3.4 RESILIENT ACCESSORY INSTALLATION**

- A. Comply with manufacturer's written instructions for installing resilient transitions and accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### **3.5 CLEANING AND PROTECTION**

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
  - 3. Damp-mop horizontal surfaces to remove marks and soil.

- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

## **SECTION 096519 - RESILIENT TILE FLOORING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Vinyl composition tile.
  - 2. Solid vinyl plank tile.
- B. Related Sections:
  - 1. Division 9 Section "Resilient Wall Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

#### **1.3 REFERENCES**

- A. Armstrong Flooring Technical Manuals
  - 1. Armstrong Flooring Guaranteed Installation Systems manual, F-5061
  - 2. Armstrong Flooring Maintenance Recommendations and Procedures, manual, F-8663
- B. ASTM International:
  - 1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
  - 2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
  - 3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
  - 4. ASTM F 1066 Standard Specification for Vinyl Composition Tile
  - 5. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
  - 6. ASTM F 1861 Standard Specification for Resilient Wall Base
  - 7. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
  - 8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

C. National Fire Protection Association (NFPA):

1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials

D. ANSI/ESD Standards

1. ANSI/ESD S7.1 :Floor Materials—Resistive Characterization of Materials
2. ANSI/ESD STM 97.1: Floor Materials and Footwear—Resistance in Combination with a Person
3. ANSI/ESD STM 97.2: Floor Materials and Footwear Voltage Measurement in Combination with a Person

## **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  1. Show details of special patterns.
- C. Samples for Initial Selection: For each type of floor tile indicated.
- D. Product Schedule: For floor tile. Use same designations indicated on Drawings.
- E. Qualification Data: For qualified Installer.
- F. Maintenance Data: For each type of floor tile to include in maintenance manuals.

## **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation indicated.
  1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.
- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.



## **1.7 PROJECT CONDITIONS**

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

## **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. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

## **PART 2 - PRODUCTS**

### **2.1 SOLID VINYL PLANK AND TILE**

- A. Manufacturers: Subject to compliance with requirements, other available manufacturers that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Armstrong World Industries, Inc.
  - 2. Interface.
  - 3. Mannington.
  - 4. Tarkett, Inc.
- B. VCT Design Basis: Armstrong "Premium Excelon Stonetex," vinyl tile as indicated in the Drawing Finish Schedule.
  - 1. VCT-1 "Premium Excelon Stonetex" in color as defined on the Drawing Finish Schedule.
    - a. Tile Standard: ASTM F 1066, Class 2 through pattern; ISO 10595, Type II.
    - b. Total Thickness: 1/8" (3.2 mm).
    - c. Wear Layer: Factory finish through pattern.
    - d. Edge Treatment: Square.
    - e. Size: 12" X 12" per Drawing Finish Schedule.
    - f. Squareness: 0.010 inch per ASTM F 2055.
    - g. Indentation – One Minute: 0.006" to 0.015" per ASTM F 1914.
    - h. Indentation @ 115 deg. F: Less than 0.032" per ASTM F 1914.

- i. Impact: No cracks beyond limit per ASTM F 1265.
- j. Deflection: 1.0 inch minimum per ASTM F 1304.
- k. Dimensional Stability: Less than 0.024 inch per linear foot per ASTM F 2199.
- l. Chemical Resistance: Slight change in surface dulling, attack or staining per ASTM F 925.
- m. Resistance to Heat: Delta E not greater than 8.0 per ASTM F 1514.
- n. Static Load Resistance: Less than 0.005 inch at 2000 psi per ASTM F 970.
- o. Indoor Air Quality: Meets CDPH Standard Method v1.1-2010; FloorScore Certification.
- p. Slip Resistance: Exceeds Federal Standards per ASTM D 2407 and ADA recommendations.
- q. Fire Resistance: Class 1, 0.45 W/sf Critical Radiant Flux per ASTM E 648 / NFPA 253.
- r. Smoke Resistance: 450 or less per ASTM E 662.
- s. Warranty: 20-Year Limited Commercial Wear Warranty.
- t. Adhesive: Armstrong Full Spread Adhesive S-515.

C. LVT Design Basis: Mowhawk.

1. LVT-1: Hot & Heavy Collection per Material Finish Schedule.

- a. Tile Standard: Bolder COO 10
- b. Color: 832 River Rock
- c. Total Thickness: 0.20" (5 mm).
- d. Wear Layer: 20 mil
- e. Finish: M-Force Enhanced Urethane
- f. Texture: Wood Emboss; Light Emboss
- g. Edge Treatment: Square.
- h. Size: 9" X 59" per Drawing Finish Schedule.
- i. Indoor Air Quality: Meets CDPH Standard Method v1.1-2010; FloorScore Certification.
- j. Slip Resistance: Exceeds Federal Standards per ASTM D 2407 and ADA recommendations.
- k. Fire Resistance: Class 1 Critical Radiant Flux per ASTM E 648 / NFPA 253.
- l. Warranty: 5-Year Limited Commercial Wear Warranty.
- m. Adhesive: Manufactures recommended

## 2.2 ACCESSORIES

- A. Transition Strip: LVT to Tile – Tandus Style MET02-metaledege deux trim, color: 00176 Brass

## 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Full spread adhesives S-288 premium, water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
- a. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - 1) Use only adhesives as recommended by the floor tile manufacturer.
    - 2) Rubber Floor Adhesives: Not more than 60 g/L. The adhesives shall be of type recommended by rubber flooring manufacturer.

- C. Provide all necessary accessories for a complete installation including all thresholds and transition strips to adjacent finishes as recommended by manufacturer.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
  - 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate acceptable to flooring manufacturer.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are same temperature as space where they are to be installed.
  - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

#### **3.3 VCT AND LVT FLOOR TILE INSTALLATION**

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, non-staining marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### **3.4 STATIC DISSIPATIVE FLOOR TILE INSTALLATION**

- A. Install flooring in strict accordance with the latest edition of Armstrong Flooring Guaranteed Installation Systems manual, F-5061. Failure to comply may result in voiding the manufacturer's warranty listed in Section 1.08.
- B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the Drawings.
- C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- D. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- E. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

### **3.4 CLEANING AND PROTECTION**

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

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## **SECTION 096800 – TILE CARPETING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes carpeting and entry walk off mats.
- B. Related Sections include the following:
  - 1. See Drawing "Material Finish Schedules" for specific product Finish Specifications.
  - 2. Section 096519 "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet.

#### **1.2 SUBMITTALS**

- A. Product Data: For the following, including installation recommendations for each type of substrate:
  - 1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- B. Shop Drawings: Show the following:
  - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
  - 2. Carpet type, color, and dye lot.
  - 3. Locations where dye lot changes occur.
  - 4. Seam locations, types, and methods.
  - 5. Type of subfloor.
  - 6. Type of installation.
  - 7. Pattern type, repeat size, location, direction, and starting point.
  - 8. Pile direction.
  - 9. Type, color, and location of insets and borders.
  - 10. Type, color, and location of edge, transition, and other accessory strips.
  - 11. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
  - 1. Carpet: 12-inch- square Sample.
  - 2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- long Samples.
  - 3. Carpet Seam: 6-inch Sample.
  - 4. Mitered Carpet Border Seam: 12-inch- square Sample. Show carpet pattern alignment.
- D. Product Schedule: For carpet. Use same designations indicated on Drawings.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.
- G. Maintenance Data: For carpet to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

H. Warranties: Special warranties specified in this Section.

### **1.3 QUALITY ASSURANCE**

- A. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to carpet installation including, but not limited to, the following:
  1. Review delivery, storage, and handling procedures.
  2. Review ambient conditions and ventilation procedures.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with CRI 104, Section 5, "Storage and Handling."

### **1.5 PROJECT CONDITIONS**

- A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
- B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer. See Division 03 Section "Concrete Resurfacing and Rehabilitation" for moisture reduction barrier.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

### **1.6 WARRANTY**

- A. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
  1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
  2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
  3. Warranty Period: 5 years from date of Substantial Completion.



## **PART 2 - PRODUCTS**

### **2.1 CARPET**

- A. Refer to Drawing “Material Finish Schedules”.
- B. Design Basis: Basis of design is Tarkett or comparable product, subject to requirements, by one of the following other acceptable manufacturers:
  - 1. Atlas Carpet Mills, Inc.
  - 2. Mannington Mills, Inc.
  - 3. Milliken & Company.
  - 4. Mohawk Group (The).
  - 5. Patcraft, a division of Shaw Industries, Inc.
  - 6. Shaw Contract Group, a Berkshire Hathaway company.
  - 7. Tandus
- C. All carpeting shall meet the requirements of HUD Use of Materials Bulletin UM44d.
- D. CPT-1
  - 1. Style: 11498 Fabricate
  - 2. Color: 36216 Night Time
  - 3. Size: 9 x 36
  - 4. Installation: Direct Glue Down
  - 5. Installation Method: Vertical Ashlar
- E. CPT-2
  - 1. Style: 11472 Sound Block
  - 2. Color: 68204 Cedar Deck
  - 3. Size: 24 x 24
  - 4. Installation: Direct Glue Down
  - 5. Installation Method: Vertical Ashlar
- F. Minimum Critical Radiant Flux limits for carpeting is 0.22 watts/cm<sup>2</sup>.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
  - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet or cushion manufacturer.
  - 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Install moisture reduction barrier. See Division 03 Section "Concrete Resurfacing and Rehabilitation" for moisture reduction barrier.
- D. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet or cushion manufacturer.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet.

### **3.3 INSTALLATION**

- A. Comply with CRI 104 and carpet manufacturer's written installation instructions for applicable installation method.
- B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet.
- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

### **3.4 CLEANING AND PROTECTING**

- A. Perform the following operations immediately after installing carpet:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
  - 2. Remove yarns that protrude from carpet surface.
  - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."

END OF SECTION 096800

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## **SECTION 099100 – PAINTING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes surface preparation and field painting of the following:
  - 1. Exposed exterior items and surfaces as specified.
  - 2. Exposed interior items and surfaces as specified.
  - 3. Existing painted surfaces damaged, abraded, or scuffed by construction.
  - 4. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Owner will select from standard colors and finishes available.
  - 1. Metal surfaces to be painted include the following principal items:
    - a. Shop primed steel fabrications.
    - b. Shop primed structural steel building columns.
    - c. Ferrous metal fabrications.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
  - 1. Prefinished items include the following factory-finished components:
    - a. Metal siding.
  - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
    - a. Furred areas.
    - b. Ceiling plenums.
  - 3. Finished metal surfaces include the following:
    - a. Anodized aluminum.
    - b. Stainless steel.
    - c. Chromium plate.
    - d. Copper.
    - e. Bronze and brass.
    - f. Galvanized steel.
  - 4. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections:
  - 1. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
  - 2. Division 9 Section "Structural Metal Primer/Finish" for shop finish on structural steel.
  - 3. Division 9 Section "Piping Identification" for piping systems identification and color coding.

#### **1.3 DEFINITIONS**

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
  - 1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

2. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

#### **1.4 SUBMITTALS**

- A. Product Data: For each paint system specified. Include block fillers and primers.
  1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
  3. Certification: From the manufacturer attesting that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
  4. Chrysler Vendor Code Numbers: Include Chrysler NPVP code number for all colors intended to be used.
- B. LEED Submittals (for interior items and surfaces):
  1. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content from product manufacturer.
- C. Samples for Selection: Unless colors are specified in this Section, submit manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
  1. After color selection, the Owner's Representative will furnish color chips for surfaces to be coated.
- D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
  1. Submit Samples on rigid backing, 8 inches square.
  2. Step coats on Samples to show each coat required for system.
  3. Label each coat of each Sample.
  4. Label each Sample for location and application area.
- E. Certification: Submit written certification that materials and equipment installed or consumed in construction, are free from traces of silicone.
- F. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

#### **1.5 QUALITY ASSURANCE**

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- C. Silicones: Materials and equipment furnished for this Project shall be silicone-free.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
  1. Product name or title of material.
  2. Product description (generic classification or binder type).

3. Manufacturer's stock number and date of manufacture.
  4. Contents by volume, for pigment and vehicle constituents.
  5. Thinning instructions.
  6. Application instructions.
  7. Color name and number.
  8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

## **1.7 PROJECT CONDITIONS**

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.
- D. Spray application to be used only with the approval of the Owner.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS' REPRESENTATIVES**

- A. PPG Industries, Inc. (PPG) and Glidden Professional (GP)
1. [Bob](#) Shrock, phone 513-543-2555 bob.schrock@ppg.com
  2. Wayde Hayley, phone 416-557-8386 wayde.hayley@ppg.com
- B. Sherwin-Williams Company (S-W)
1. Joe Ghattas, phone 734-395-2448
  2. Roger Hall, phone 216-224-7509
- C. Benjamin Moore (BM)
1. Mary Hoffman, phone 815-919-0209
- D. Belzona
1. Randy Van Voorhees, phone 517-580-5860

### **2.2 MANUFACTURERS AND PRODUCTS**

- A. Products: Provide the products named in the paint schedules.

### **2.3 PAINT MATERIALS**

- A. Owner Compliance: Paint materials shall comply with Owner Standards for quality of their respective kinds, and for painting and color requirements of surfaces of items specified in this Section.
- B. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat 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.
- C. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
- D. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24), Green Seal Standard GS-11, Paints, Green Seal Standard GS-03, Anti-Corrosive Paints, and SCAQMD Rule 1113 Architectural Coatings.
  - 1. Flat Paints and Coatings: 50 g/L.
  - 2. Nonflat Paints and Coatings: 150 g/L.
  - 3. Dry-Fog Coatings: 400 g/L.
  - 4. Primers, Sealers, and Undercoaters: 200 g/L.
  - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
  - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  - 7. Pretreatment Wash Primers: 420 g/L.
  - 8. Floor Coatings: 100 g/L.
  - 9. Shellacs, Clear: 730 g/L.
  - 10. Shellacs, Pigmented: 550 g/L.

## **2.4 COLORS**

- A. Provide colors complying with Chrysler Standards, as verified by the Owner's Representative
- B. Provide piping color coding specified in Division 9 Section "Piping Identification."

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with requirements for maximum moisture content and with paint application requirements.
  - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Masonry (Clay and CMU): 12 percent.
  - 3. Wood: 15 percent.
  - 4. Gypsum Board: 12 percent.
  - 5. Plaster: 12 percent.
  - 6. Portland Cement Plaster: 12 percent.

- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- F. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- G. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 1. Notify the Owner's Representative about anticipated problems using the materials specified over substrates primed by others.

### **3.2 PREPARATION**

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved. Remove surface-applied protection.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
  - 1. Provide barrier coats over incompatible primers or remove and reprime.
  - 2. Cementitious Materials: Prepare concrete masonry block surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
    - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
  - 3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
    - a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
  - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  - 3. Use only thinners approved by paint manufacturer and only within recommended limits.



- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### **3.3 APPLICATION**

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
  - 1. Paint colors, surface treatments, and finishes are indicated in the schedules.
  - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  - 3. Provide finish coats that are compatible with primers used.
  - 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
  - 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 6. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  - 7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
  - 8. Finish upper and lower edges of doors with at least two coats.
  - 9. Sand lightly between each succeeding enamel coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
  - 1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
    - a. Repaint existing painted surfaces damaged, abraded, or scuffed by construction, with one coat. Terminate paint with a neat line.
  - 2. Omit primer on metal surfaces that have been shop primed and touchup painted.
  - 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  - 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
  - 1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
  - 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
  - 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required. Spray application to be used only with the approval of the Owner.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

- E. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- F. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- G. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

### **3.4 CLEANING**

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
  - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### **3.5 PROTECTION**

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Owner's Representative.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
  - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### **3.6 EXTERIOR PAINT SCHEDULE**

- A. Concrete Masonry Units: Provide the following finish systems over exterior concrete masonry units:
  - 1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a block filler and a primer.
    - a. Block Filler: High-performance, latex block filler applied at spreading rate recommended by the manufacturer to achieve a total dry mill thickness of not less than 4.0 mils.
      - 1) GP: 3010 Ultra-Hide Block Filler Latex Interior-Exterior.
      - 2) PPG: 6-7 Speedhide Interior/Exterior Masonry Latex Block Filler.
      - 3) SW: Preprite Interior / Exterior Block Filler B25W25.
      - 4) BM: Super Spec 0206 Masonry Interior/Exterior Hi-Build Block Filler.
    - b. Primer: Alkali-resistant, exterior, acrylic-latex primer applied at spreading rate to achieve a total dry film thickness of not less than 1.4 mils.
      - 1) GP: Primer not required over block filler.
      - 2) PPG: Primer not required over block filler.
      - 3) SW: Primer not required over block filler.
      - 4) BM: Primer not required over block filler.
    - c. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate to achieve a total dry film thickness of not less than 2.4 mils.
      - 1) GP: Fortis 350 2406V Acrylic Latex Exterior Semi-Gloss Paint.
      - 2) PPG: 6-900 XI Speedhide Exterior Semi-Gloss Acrylic Latex.
      - 3) SW: A-100 Exterior Acrylic Gloss A8 Series.
      - 4) BM: Super Spec N185 100% Acrylic Latex Lustre Soft Gloss Finish.

- B. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
1. Full-Gloss, Enamel Finish: 2 finish coats over a rust-inhibitive primer.
    - a. Primer: Refer to Division 5 "Metal Fabrications."
    - b. First and Second Coats: Full-gloss, exterior, enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 3.0 mils.
      - 1) GP: Devflex #4208 Gloss DTM.
      - 2) PPG: 90-1310 Pitt-Tech Plus Interior/Exterior High Gloss DTM.
      - 3) S-W: B66100 DTM Acrylic Gloss Coating.
      - 4) BM: Super Spec HP P28 DTM Acrylic Gloss Enamel.
- C. Exterior Gypsum Soffit Board: Provide the following finish systems over exterior gypsum soffit board:
1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.
    - a. Primer: Exterior, acrylic-latex primer, applied at spreading rate achieve a total dry film thickness of not less than 1.5 mils .
      - 1) GP: Ultra-Hide Acrylic Gripper 3210.
      - 2) PPG: 4-603 Perma-Crete Interior/Exterior Acrylic Latex Alkali Resistant Primer.
      - 3) SW: Exterior Latex Wood Primer B42W8041.
      - 4) BM: Super Spec 0169 Latex Exterior Primer.
    - b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate to achieve a total dry film thickness of not less than 1.4 mils.
      - 1) GP: Fortis 350 2406V Exterior Acrylic Flat Masonry.
      - 2) PPG: 6-900 XI Speedhide Exterior Semi-Gloss Acrylic Latex.
      - 3) SW: A-100 Exterior Acrylic Gloss A8 Series.
      - 4) BM: Super Spec N185 100% Acrylic Latex Low Lustre Soft Gloss Finish.
- D. Trestle Steel and Other Exterior Exposed Steel:
1. Aliphatic, polyurethane coating applied to DFT of not less than 3.0 mils having:
    - a. GP: Amersshield Aliphatic Urethane Gloss Enamel.
    - b. PPG: 95-812 Series Pitthane ULTRA Gloss Urethane Enamel.
    - c. S-W: Acrolon 218 HS Acrylic Polyurethane B65-600 B65V600.
    - d. BM: Corotech V500 Aliphatic Acrylic Urethane Gloss.
  2. Color and Sheen: White, gloss

### **3.7 INTERIOR PAINT SCHEDULE**

- A. Concrete Masonry Units: Provide the following finish systems over interior concrete masonry block units:
1. Semigloss, Enamel Finish: 2 finish coats over an undercoat and a filled surface.
    - a. Block Filler: High-performance, latex-based, block filler applied at spreading rate to achieve a total dry film thickness of not less than 5.0 mils.
      - 1) GP: 3010 Ultra-Hide Block Filler, Latex Interior-Exterior.
      - 2) PPG: 6-7 Speedhide Interior/Exterior Masonry Latex Block Filler.
      - 3) S-W: Heavy-Duty Block Filler B42W46.
      - 4) BM: Super Spec 0206 Masonry Interior/Exterior Hi-Build Block Filler.
    - b. Undercoat: Interior, enamel undercoater, applied at spreading rate to achieve a total dry film thickness of not less than 1.2 mils.
      - 1) GP: Ultra-Hide #1416V Semigloss.
      - 2) PPG: Speedhide Interior Semi-Gloss Enamel 6-500 Series.
      - 3) S-W: ProMar 200 Zero VOC Latex Semi-Gloss B31W2600 Series.
      - 4) BM: Ultra Spec 500 N539 Interior Semi-Gloss Finish (zero VOC).
    - c. Finish Coat: Odorless, semigloss, interior enamel applied at spreading rate to achieve a total dry film thickness of not less than 1.5 mils.
      - 1) GP: Ultra-Hide #1416V Semigloss.

- 2) PPG: Speedhide Interior Semi-Gloss Enamel 6-500 Series.
  - 3) S-W: ProMar 200 Zero VOC Latex Semi-Gloss B31W2600 Series.
  - 4) BM: Ultra Spec 500 N539 Interior Semi-Gloss Finish (zero VOC).
2. Full-Gloss Epoxy:
- a. Primer: Factory-formulated for use with full-gloss epoxy system. Apply at spreading rate recommended by manufacturer.
    - 1) GP: Waterborne Epoxy Gloss Coating.
    - 2) PPG: Aquapon WB Low VOC Epoxy.
    - 3) S-W: .Pro industrial Water based Catalyzed Epoxy Gloss B73-300 Series (smooth) or SW Heavy duty Block Filler B42W46 (CMU).
    - 4) BM: Corotech V163 Waterborne Epoxy Block Filler.
  - b. Intermediate Coat: Applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 5.0 mils.
    - 1) GP: Waterborne Epoxy Gloss Coating.
    - 2) PPG: Aquapon WB Low VOC Epoxy.
    - 3) S-W: Pro industrial Water based Catalyzed Epoxy Gloss B73-300 Series.
    - 4) BM: Corotech V341 Pre-Catalyzed Waterborne Epoxy Semi-Gloss.
  - c. Finish Coat: High-gloss epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 5.0 mils.
    - 1) GP: Waterborne Epoxy Gloss Coating.
    - 2) PPG: Aquapon WB Low VOC Epoxy.
    - 3) S-W: Pro industrial Water based Catalyzed Epoxy Gloss B73-300 Series.
    - 4) BM: Corotech V341 Pre-Catalyzed Waterborne Epoxy Semi-Gloss.
- B. Ferrous Metal: Provide the following finish systems over exposed ferrous metal:
1. Semigloss, Enamel Finish: One finish coat over an enamel undercoater and a primer, for all ferrous metal surfaces, unless otherwise specified.
    - a. Primer: Refer to Division 5 “Metal Fabrications.”
    - b. Undercoat: Interior enamel undercoat or semigloss, interior, enamel finish coat, applied at spreading to achieve a total dry film thickness of not less than 1.2 mils.
      - 1) GP: Devflex #4020 Metal Primer.
      - 2) PPG: 90-912 Pitt-Tech Plus Interior/Exterior DTM Primer.
      - 3) S-W: ProCryl Universal Metal Primer B66 Series.
      - 4) BM: Corotech V110 Acrylic Metal Primer.
    - c. Finish Coat: Odorless, semigloss, interior enamel applied at spreading rate to achieve a total dry film thickness of not less than 1.4 mils.
      - 1) GP: Devflex #4206 Semigloss.
      - 2) PPG: 90-1210 Pitt-Tech Plus Interior/Exterior DTM Semi-Gloss.
      - 3) S-W: Pro Industrial Acrylic Semi-Gloss B66-650 Series.
      - 4) BM: Corotech V331 Acrylic DTM Enamel Semi-Gloss.
  2. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over an enamel undercoater and a primer, for stair railings.
    - a. Primer: Refer to Division 5 “Metal Fabrications.”
    - b. Undercoat: Interior enamel undercoat or full-gloss, interior, enamel finish coat, applied at spreading rate to achieve a total dry film thickness of not less than 1.2 mils.
      - 1) GP: Devflex #4208 Gloss.
      - 2) PPG: 90-1310 Pitt-Tech Plus Interior/Exterior High Gloss DTM Enamel.
      - 3) S-W: Pro Industrial Acrylic Gloss B66-600 Series.
      - 4) BM: Corotech V330 Acrylic DTM Enamel Gloss.
    - c. Finish Coat: Full-gloss, interior enamel applied at spreading rate to achieve a total dry film thickness of not less than 1.2 mils.
      - 1) GP: Devflex #4208 Gloss.
      - 2) PPG: 90-1310 Pitt-Tech Plus Interior/Exterior High Gloss DTM Enamel.
      - 3) S-W: Pro Industrial Acrylic Gloss B66-600 Series.
      - 4) BM: Corotech V330 Acrylic DTM Enamel Gloss.

3. Asphaltic Paint : Where indicated for the base of structural steel columns embedded in concrete slab:
  - a. Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.
  
- C. Interior Gypsum Board:
  1. Primer: Factory-formulated latex-based primer for interior application.
    - a. GP: 1000 Interior Latex Wall Primer: Applied at a dry film thickness of not less than 1.2 mils.
    - b. PPG: 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil.
    - c. S-W: ProMar 200 Zero VOC Latex Primer B28W2600: Applied at a dry film thickness of not less than 1.6 mils.
    - d. BM: Ultra Spec 500 N534 Interior Latex Primer.
  2. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.
    - a. GP: 1402N Acrylic Eggshell Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.4 mils.
    - b. PPG: 6-411 Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils.
    - c. S-W: ProMar 200 Zero VOC Interior Latex Eg-Shel B20W2600 Series: Applied at a dry film thickness of not less than 1.6 mils.
    - d. BM: Ultra Spec 500 N38 Interior Eggshell Finish.
  3. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.
    - a. GP: 1406N Acrylic Semi-Gloss Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.5 mils.
    - b. PPG: 6-500 Series SpeedHide Interior Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.0 mil.
    - c. S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-W2600 Series: Applied at a dry film thickness of not less than 1.3 mils.
    - d. BM: Ultra Spec 500 N539 Interior Semi-Gloss Finish.
  4. Interior Full-Gloss Acrylic Enamel: Factory-formulated full-gloss acrylic-latex interior enamel.
    - a. GP: 3028N Interior/Exterior Acrylic Gloss Finish: Applied at a dry film thickness of not less than 1.6 mils.
    - b. PPG: 6-8534 SpeedHide Interior Latex 100 Percent Acrylic Gloss Enamels: Applied at a dry film thickness of not less than 1.0 mil.
    - c. S-W: Pro Industrial Acrylic Gloss B66-600 Series Applied at a dry film thickness of not less than 1.5 mils.
    - d. BM: Ultra Spec 500 N540 Interior Gloss Finish.
  5. Interior Full-Gloss Epoxy: Factory-formulated full-gloss epoxy.
    - a. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 5.0 mils.
      - 1) GP: Waterborne Epoxy Gloss Coating.
      - 2) PPG: Aquapon WB Low VOC Epoxy.
      - 3) S-W: Pro Industrial Water Based Catalyzed Epoxy Gloss B73-300 Series.
      - 4) BM: Corotech V341 Pre-Catalyzed Waterborne Epoxy Semi-Gloss.
    - b. Finish Coat: High-gloss epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 5.0 mils.
      - 1) GP: Waterborne Epoxy Gloss Coating.
      - 2) PPG: Aquapon WB Low VOC Epoxy.
      - 3) S-W: Pro Industrial Water Based Catalyzed Epoxy Gloss B73-300 Series.
      - 4) BM: Corotech V341 Pre-Catalyzed Waterborne Epoxy Semi-Gloss.

### 3.8 COLUMN IDENTIFICATION

- A. Identify building columns by letter and number designation, as indicated on the Drawings. Exact designation will be supplied at a later date.
- B. Finish Coat: Full-gloss, interior enamel applied at spreading rate to achieve a total dry film thickness of not less than 1.2 mils.
  - 1. GP: Devflex #4208 Gloss DTM.
  - 2. PPG: 90-1310 Pitt-Tech Plus High Gloss DTM Enamel.
  - 3. S-W: Pro Industrial Acrylic Gloss B66-600 Series.
  - 4. BM: Corotech V330 Acrylic DTM Enamel Gloss.

### **3.9 MECHANICAL PIPE COLOR CODING AND COATINGS**

- A. Full-Gloss, Acrylic-Enamel Finish: 1 finish coat over a primer.
- B. Refer to Section 099150 for Finish Paint Color Schedule
  - 1. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, applied at spreading rate to achieve a total dry film thickness of not less than 1.5 mils .
  - 2. Finish Coat: Full-gloss, acrylic-latex, interior enamel applied at spreading rate to achieve a total dry film thickness of not less than 2.5 mils.
- C. Exterior (black iron/carbon steel) above ground Mechanical Piping to receive two component high performance environmental polymer barrier coating prior to the installation of heat trace, pipe insulation and jacketing.
  - 1. Basis of Design: Belzona 58111 two-component pull off adhesion system applied by brush or spray for protection of interior and exterior exposed metallic pipe surfaces to receive pipe insulation.
    - a. The pull-off adhesion: Greater than or equal to 4,000 psi on carbon steel when tested per ASTM D4541.
    - b. Tensile shear adhesion: Greater than or equal to 3,000 psi on carbon steel when tested per ASTM D1002.
    - c. Blistering rating of 10 and a rusting rating of 10 in both liquid and vapor phases when tested for six months in a water-filled atlas cell text held at 104 deg F as per NACE TM0174 with greater than 50 percent pull off adhesion retained when compared with unexposed and liquid exposed areas.
    - d. VOC content of less than 50 grams per liter tested per ASTM D2369 Method E.
    - e. Manufacturer certification of applicator is required with experience of twenty or more projects and/or 100 liters of coating material application.

END OF SECTION 099100

## **SECTION 101423- SIGNAGE**

### **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 interior room-identification signs for barrier free identification and exterior signage that are directly attached to the building.
- B. Coordination with the Charter Township of Redford sign standards are also a part of this contract.

#### **1.3 DEFINITIONS**

- A. Accessible: In accordance with the accessibility standard.

#### **1.4 COORDINATION**

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

#### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, tpestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
  - 1. Include representative Samples of available tpestyles and graphic symbols.
- D. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

**1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer.
- B. Sample Warranty: For special warranty.

**1.7 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For signs to include in maintenance manuals.

**1.8 QUALITY ASSURANCE**

- A. Installer Qualifications: [Manufacturer of products] [An entity that employs installers and supervisors who are trained and approved by manufacturer].

**1.9 FIELD CONDITIONS**

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

**1.10 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image.
    - c. Separation or delamination of sheet materials and components.
  - 2. Warranty Period: Five years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

**2.2 ROOM-IDENTIFICATION SIGNS**

- A. Interior Room-Identification Signs –Fusion Sign system manufactured by Takeform with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.
- B. Toilet Room-Identification Sign: Sign system with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; suitable for exterior installation, and as follows:



1. Manufacturers: Subject to compliance with requirements, provide products the following:
  - a. ACE Sign Systems, Inc.
  - b. Best Sign Systems, Inc.
  - c. Clarke Systems.
  - d. Cosco.
2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet.
  - a. Composite-Sheet Thickness: 0.25 inch.
  - b. Surface-Applied Graphics: Applied paint.
  - c. Subsurface Graphics: Reverse etch image.
  - d. Color(s): As selected by Architect from manufacturer's full range.
  - e. Mounting: Surface mounted to wall with concealed anchors.
  - f. Text and Typeface: Finish raised characters to contrast with background color, and finish Braille to match background color. Generally, retain "Sign-Panel Perimeter" or "Frame" Subparagraph below; retain both if sign panel is partially framed with horizontal or vertical retainers. Include requirements only to the extent that they are not indicated on Drawings or scheduled; delete others.

### **2.3 SIGN MATERIALS**

- A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

### **2.4 ACCESSORIES**

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
  1. Use concealed fasteners and anchors unless indicated to be exposed.
  2. Sign Mounting Fasteners:
    - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.

### **2.5 FABRICATION**

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
  2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

## **2.6 GENERAL FINISH REQUIREMENTS**

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **2.7 ALUMINUM FINISHES**

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
  - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls according to the accessibility standard.
- C. Mounting Methods:
  - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.

## **3.2 ADJUSTING AND CLEANING**

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423.16

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## **SECTION 102600 - WALL AND CORNER PROTECTION**

### **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. Corner guards.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For each type of wall and door protection showing locations and extent.
  - 1. Include plans, elevations, sections, and attachment details.
- C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.
  - 1. Include Samples of accent strips and accessories to verify color selection.
- D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
  - 1. Wall Guards: 12 inches long. Include examples of joinery, corners, end caps, and field splices.
  - 2. Corner Guards: 12 inches long.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Material Certificates: For each type of exposed plastic material.
- B. Sample Warranty: For special warranty.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
  1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
  2. Keep plastic materials out of direct sunlight.
  3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
    - a. Store corner-guard covers in a vertical position.

#### **1.7 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
    - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
  2. Warranty Period: Five years from date of Substantial Completion.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain wall-protection products of each type from single source from single manufacturer.

#### **2.2 PERFORMANCE REQUIREMENTS**

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing 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: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

### **2.3 CORNER GUARDS**

- A. Surface-Mounted, Aluminum Corner Guards (CG1): Fabricated as one piece from formed or extruded metal with formed edges; with 90-degree turn to match wall condition.
  - 1. Material: Extruded aluminum, minimum 0.0625 inch thick, with brushed satin finish.
  - 2. Wing Size: Nominal 1-1/2 by 1-1/2 inches.
  - 3. Corner Radius: 1/8 inch.
  - 4. Mounting: Adhesive.
- B. Surface-Mounted, Aluminum end wall corner Guard (CG2), width varies per wall schedule.

### **2.4 MATERIALS**

- A. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

### **2.5 FABRICATION**

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

### **2.6 FINISHES**

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
  - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

### **3.3 INSTALLATION**

- A. **Installation Quality:** Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. **Mounting Heights:** Install wall and door protection in locations and at mounting heights indicated on Drawings.
- C. **Accessories:** Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
  - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
  - 2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
  - 3. Adjust end and top caps as required to ensure tight seams.
- D. **Abuse-Resistant Wall Covering:** Install top and edge moldings, corners, and divider bars as required for a complete installation.

### **3.4 CLEANING**

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600



## **SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES**

### **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. Public-use washroom accessories.
  - 2. Underlavatory guards.
  - 3. Custodial accessories.
  - 4. Shower accessories
- B. Related Requirements:
  - 1. Section 102113 – Phenolic Toilet Compartments.

#### **1.3 COORDINATION**

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Include electrical characteristics.
- B. Samples: Full size, for each exposed product and for each finish specified.
  - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

### **1.5 INFORMATIONAL SUBMITTALS**

- A. Sample Warranty: For manufacturer's special warranty.

### **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For accessories to include in maintenance manuals.

### **1.7 WARRANTY**

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, visible silver spoilage defects.
  2. Warranty Period: 15 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- 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.

### **2.2 PUBLIC-USE WASHROOM ACCESSORIES**

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Soap Dispenser:
1. Design Basis: TA-01 Grainger "Model WWG# 52PG16
  2. City Standard – No substitutions
  3. Description: Surface mounted manual soap & Sanitary Dispenser, black
  4. Mounting: Surface/Wall Mounted
- C. Seat-Cover Dispenser: TA 02
1. Design Basis: American Specialties, Inc. Model 9477-SM .
  2. Other Manufacturers: Subject to compliance with requirements, provide products by one of the following other acceptable manufacturers:
    - a. Bobrick Washroom Equipment, Inc.
    - b. Bradley Corporation.
  3. Mounting: Surface mounted.
  4. Minimum Capacity: 250 seat covers.
  5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
  6. Lockset: Tumbler type.

D. Toilet Tissue (Roll) Dispenser:

1. Design Basis: TA-03 Grainger “Model WWW# 4TH54”
2. City Standard – No substitutions
3. Description: Black Side-By-Side Double Roll Toilet Paper Dispenser.
4. Mounting: Partition mounted, serving two adjacent toilet compartments.

E. Grab Bar:

1. Manufacturers: TA 04, 05, 06, Model B-5806.99 Series. Subject to compliance with requirements, provide products by one of the following:
  - a. American Specialties, Inc.
  - b. Bobrick Washroom Equipment, Inc.
  - c. Bradley Corporation.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
  - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit:

1. Design Basis: TA 07 Bobrick Washroom Equipment, Inc. “Model B-254 (double sided).”
2. Other Manufacturers: Subject to compliance with requirements, provide products by one of the following other acceptable manufacturers:
  - a. American Specialties, Inc.
  - b. Bradley Corporation.
3. Mounting: Partition mounted, dual access and surface mounted.
4. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
5. Receptacle: Removable.
6. Material and Finish: 18-8, Type-304 stainless steel.

G. Surface Mounted Paper Towel Dispenser (Rolls) Dispenser:

1. Design Basis: TA-08 Grainger “Model WWG# 52RW82”
2. City Standard – No substitutions
3. Description: black, GP Pro Pacific Blue Ultra#8 high capacity mechanical touchless paper towel dispenser.
4. Mounting: Wall Mounted.
5. Operation: C-fold and multi fold paper towels.
6. Capacity: Designed for 525 multifold paper towels.
7. Material and Finish: Stainless steel, No. 4 finish (satin)

H. Mirror Unit: TA 09 (24”x36”)

1. Design Basis: Bobrick Washroom Equipment, Inc. “Model B-1659 – with screw-lock design.
2. Other Manufacturers: Subject to compliance with requirements, provide products by one of the following other acceptable manufacturers:
  - a. AJW Architectural Products.
  - b. American Specialties, Inc.
  - c. Bradley Corporation.

- d. Brey-Krause Manufacturing Co.
  - e. GAMCO Specialty Accessories; a division of Bobrick.
  - f. Tubular Specialties Manufacturing, Inc.
3. Frame: Stainless-steel channel.
    - a. Corners: Manufacturer's standard
  4. Glazing: Laminated glass mirror.
  5. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
    - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
  6. Size: As indicated on Drawings.
- I. Coat Hook:
1. Design Basis: TA 10 Bobrick Washroom Equipment, Inc. "Model B-2116."
  2. Other Manufacturers: Subject to compliance with requirements, provide products by one of the following other acceptable manufacturers:
    - a. American Specialties, Inc.
    - b. Bradley Corporation.
  3. Description: Single-prong unit.
  4. Material and Finish: Solid brass, satin nickel-plated finish.
- J. Portable Trash Can
1. Design Basis: TA 12 Bobrick Washroom Equipment, Inc. "Model B-2280."
  2. Other Manufacturers: Subject to compliance with requirements, provide products by one of the following other acceptable manufacturers:
    - a. American Specialties, Inc.
    - b. Bradley Corporation.
  3. Description: 22 gauge with 21-gallon capacity, open top, no cover.
  4. Material and Finish: Stainless steel with satin finish.
  5. Accessories: Vinyl bumper strip and rubber feet to protect wall and floor finishes.
- K. Portable Trash Can (Kitchen)
1. Basis of Design TA 12 Winco PTCS-35G, 35-gallon capacity
  2. Material: Plastic
  3. Color: Gray
  4. Dimensions: 19-1/2" wide x 19-1/2" deep x 27-5/8" high

## **2.3 UNDERLAVATORY GUARDS**

- A. Underlavatory Guard:
1. Design Basis: Truebro by IPS Corporation "Lav Guard 2."
  2. Other Manufacturers: Subject to compliance with requirements, provide products by one of the following other acceptable manufacturers:
    - a. Buckaroos, Inc. GPLumberex Specialty Products, Inc.
  3. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.

4. Material and Finish: Antimicrobial, molded plastic, white.

## **2.4 CUSTODIAL ACCESSORIES**

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
- B. Mop and Broom Holder TA 11:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Specialties, Inc.
    - b. Bobrick Washroom Equipment, Inc.
    - c. Bradley Corporation.
  2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
  3. Length: 36 inches.
  4. Hooks: Three.
  5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
  6. Material and Finish: Stainless steel, No. 4 finish (satin).
    - a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.
    - b. Rod: Approximately 1/4-inch-diameter stainless steel.

## **2.5 MATERIALS**

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- C. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-laminated glass mirrors, nominal 6.0 mm thick.

## **2.6 FABRICATION**

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

### **3.2 ADJUSTING AND CLEANING**

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

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## **SECTION 104413 - FIRE PROTECTION CABINETS**

### **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-protection cabinets for the following:
    - a. Portable fire extinguishers.
- B. Related Requirements:
  - 1. Section 104416 "Fire Extinguishers."

#### **1.3 PREINSTALLATION CONFERENCE**

- A. Pre-installation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to fire-protection cabinets including, but not limited to, the following:
    - a. Schedules and coordination requirements.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Samples for Initial Selection: For each type of exposed finish required.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches square.
- F. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.



**1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

**1.6 COORDINATION**

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

**PART 2 - PRODUCTS**

**2.1 FIRE-PROTECTION CABINET**

- A. Cabinet Type: Suitable for fire extinguisher.
- B. Design Basis: Larsen's Manufacturing Company
- C. Other Manufacturers: Subject to compliance with requirements, provide products by one of the following acceptable manufacturers:
  - 1. Guardian Fire Equipment, Inc.
  - 2. JL Industries, Inc.; a division of the Activar Construction Products Group.
  - 3. Nystrom, Inc.
- D. Cabinet Construction: Nonrated.
- E. Cabinet Material: Cold-rolled steel sheet.
  - 1. Shelf: Same metal and finish as cabinet.
- F. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
  - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- G. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
- H. Cabinet Trim Material: Same material and finish as door.
- I. Door Material: Steel sheet.
- J. Door Style: Fully glazed panel with frame.
- K. Door Glazing: Tempered break glass.
- L. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  - 1. Provide projecting lever handle with cam-action latch.

2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

M. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
3. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
4. Door Lock: Cylinder lock, keyed alike to other cabinets.
5. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
  - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
    - 1) Location: Applied to cabinet glazing.
    - 2) Application Process: Decals.
    - 3) Lettering Color: Red.
    - 4) Orientation: Vertical.

N. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
  - a. Finish: Baked enamel or powder coat.
  - b. Color: Stainless steel door and trim – refer to material finish schedule

## 2.2 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
  2. Provide factory-drilled mounting holes.
  3. Prepare doors and frames to receive locks.
  4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
  2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.3 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

#### **3.3 INSTALLATION**

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
  - 1. Provide inside latch and lock for break-glass panels.
  - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply decals at locations indicated.

#### **3.4 ADJUSTING AND CLEANING**

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

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## **SECTION 104416 - FIRE EXTINGUISHERS**

### **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 portable, fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
  - 1. Section 104413 "Fire Protection Cabinets."

#### **1.3 PREINSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
    - a. Schedules and coordination requirements.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Warranty: Sample of special warranty.

#### **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

#### **1.7 COORDINATION**

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

## **1.8 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: Six years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
  - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

### **2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS**

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ansul Incorporated; Tyco International.
    - b. Buckeye Fire Equipment Company.
    - c. Guardian Fire Equipment, Inc.
    - d. Larsens Manufacturing Company. (Basis of Design)
    - e. Nystrom, Inc.
  - 2. Valves: Manufacturer's standard.
  - 3. Handles and Levers: Manufacturer's standard.
  - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 10-A:120-B:C, 20-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416



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## **SECTION 12 36 23.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS**

### **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 plastic-laminate-clad countertops and edge banding

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: For plastic-laminate-clad countertops.
  - 1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
  - 2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad countertops.
  - 3. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples for Verification: As follows:
  - 1. Plastic Laminates: For each type, color, pattern, and surface finish required, 8 by 10 inches in size.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For fabricator.
- B. Product Certificates: For the following:
  - 1. Composite wood and agrifiber products.
  - 2. High-pressure decorative laminate.
  - 3. Adhesives.
- C. Quality Standard Compliance Certificates: AWI Quality Certification Program.
- D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

## **1.5 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
- B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.

## **1.7 FIELD CONDITIONS**

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## **PART 2 - PRODUCTS**

### **2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS**

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.
  - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Design Basis: Formica as indicated in the Drawings Material Finish Schedule.
  - 1. PLAM-1: Wilsonart Low Line 7998K-18 Linearity Finish with Aeon:
    - a. Appearance: No ABC Defects per LD 3.1 Test.
    - b. Light Resistance: Slight per LD 3.3 Test.
    - c. Cleanability: 20 max. per LD 3.4 Test.
    - d. Stain Resistance:
      - 1) Reagents 1-10: No effect per LD 3.4 Test.
      - 2) Reagents 11-15: Moderate per LD 3.4 Test.

- e. Boiling Water Resistance: No effect per LD 3.5 Test.
  - f. High Temperature Resistance: Slight per LD 3.6 Test.
  - g. Ball Impact Resistance (inches): 50 minimum per LD 3.8 Test.
  - h. Radiant Heat Resistance (sec): 125 minutes per LD 3.10 Test.
  - i. Dimensional Change:
    - 1) Machine Direction: 0.50% max. per LD 3.11 Test.
    - 2) Cross Direction: 0.90% max per LD 3.11 Test.
  - j. Water Resistance (cycles): 400 min. per ASTM 3.13 Test.
2. PLAM-2: Formica Neo Cloud Matt Finish 6134:
- a. Appearance: No ABC Defects per LD 3.1 Test.
  - b. Light Resistance: Slight per LD 3.3 Test.
  - c. Cleanability: 20 max. per LD 3.4 Test.
  - d. Stain Resistance:
    - 1) Reagents 1-10: No effect per LD 3.4 Test.
    - 2) Reagents 11-15: Moderate per LD 3.4 Test.
  - e. Boiling Water Resistance: No effect per LD 3.5 Test.
  - f. High Temperature Resistance: Slight per LD 3.6 Test.
  - g. Ball Impact Resistance (inches): 50 minimum per LD 3.8 Test.
  - h. Radiant Heat Resistance (sec): 125 minutes per LD 3.10 Test.
  - i. Dimensional Change:
    - 1) Machine Direction: 0.50% max. per LD 3.11 Test.
    - 2) Cross Direction: 0.90% max per LD 3.11 Test.
  - j. Water Resistance (cycles): 400 min. per ASTM 3.13 Test.
- C. Parks and Recreation Design Basis: Wilsonart, "Contract Collection" as indicated in the Drawings Material Finish Schedule.
- D. Grade: Premium.
- E. High-Pressure Decorative Laminate: NEMA LD 3, Grade 10 HGS.
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
- 1. As indicated on the Drawings Material Finish Schedule.
- G. Edge Treatment: Same as laminate cladding on horizontal surfaces.
- H. Core Material: Particleboard.
- I. Core Thickness: 3/4 inch.
- 1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.
- J. Paper Backing: Provide paper backing on underside of countertop substrate.

## 2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
  - 1. Wood Moisture Content: 5 to 10 percent.

- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
  - 1. Particleboard: ANSI A208.1, Grade M-2.

### **2.3 EDGE BANDING**

- A. Edge Banding where indicated on the Contract Drawings shall be equal to.
  - 1. 3mm edge banding Charter Industries – F912 Storm

### **2.4 MISCELLANEOUS MATERIALS**

- A. Adhesive for Bonding Plastic Laminate: As selected by fabricator to comply with requirements.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

### **2.5 FIRE-RETARDANT-TREATED MATERIALS**

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.
  - 1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
  - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
  - 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
  - 2. For items indicated to receive a stained or natural transparent finish, use organic resin chemical formulation.
  - 3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
  - 4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of exposed treated woodwork.
- C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less when tested according to ASTM E84.
  - 1. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.

2. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf, respectively.
- D. Fire-Retardant MDF: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less according to ASTM E84.

## **2.6 FABRICATION**

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
  1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended, and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
  1. Seal edges of cutouts by saturating with varnish.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

### **3.2 INSTALLATION**

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
  1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical-treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- F. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
  2. Secure backsplashes to walls with adhesive.
  3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

### **3.3 ADJUSTING AND CLEANING**

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semi-exposed surfaces.
- C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123623.13

## **SECTION 123661.16 - SOLID SURFACING COUNTERTOPS**

### **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. Solid surface material countertops.
  - 2. Solid surface material backsplashes.
  - 3. Solid surface material end splashes.
  - 4. Solid surface material apron fronts.
  - 5. Solid surface material sinks.
  
- B. Related Requirements:
  - 1. Section 224000 "Plumbing Fixtures" for non-integral sinks and plumbing fittings.

#### **1.3 REFERENCES**

- A. ASTM International:
  - 1. C-97, Absorption and Bulk Specific Gravity of Dimension Stone.
  - 2. C-99, Modulus of Rupture of Dimension Stone.
  - 3. C-170, Compressive Strength of Dimension Stone.
  - 4. C-370, Moisture Expansion.
  - 5. C-501, Resistance Relative to Wear of Unglazed Tile to Taber Abrader.
  - 6. C-482, Bond Strength of Ceramic Tile for Portland Cement.
  - 7. C-484, Thermal Shock Resistance of Glazed Ceramic Tile.
  - 8. C-531, Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concrete.
  - 9. C-648, Breaking Strength of Ceramic Tile.
  - 10. C-1026, Resistance of Ceramic Tile to Freeze Thaw Cycling.
  - 11. E-84, Surface Burning Characteristics of Building Materials.



12. E-662, Smoke Density.

B. American National Standards Institute (ANSI):

1. Z 124.6, Stain Resistance.
2. A 137.1 Dynamic Coefficient of Friction.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For countertop materials and sinks.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
1. Show locations and details of joints.
  2. Show direction of directional pattern, if any.
- C. Samples for Verification: For the following products:
1. Countertop material, 6 inches square.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For fabricator.

#### **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

#### **1.7 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.

#### **1.8 FIELD CONDITIONS**

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

#### **1.9 COORDINATION**

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

## **PART 2 - PRODUCTS**

### **2.1 SOLID SURFACE COUNTERTOP MATERIALS**

- A. Manufacturers: Subject to requirements provide products from one of the following acceptable manufacturers:
  - 1. Avonite Surfaces.
  - 2. E.I. du Pont de Nemours and Company
  - 3. Formica Corporation.
  - 4. LG Chemical, Ltd.
  - 5. Samsung Chemical, USA.
  - 6. Wilsonart Contract.
- B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
- C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

### **2.2 PRODUCTS**

- A. Basis of Design:
  - 1. SSM-1: Corian, Deep Space. Refer to drawings for locations and quantities.
  - 2. SSM-2: Formica, 770 Bottle Glass Quartz.
  - 3. SSM-3: Wilsonart Bluestone 9074 (5).

### **2.3 COUNTERTOP FABRICATION**

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
  - 1. Grade: Premium.
- B. Configuration:
  - 1. Front: Straight, slightly eased at top.
  - 2. Backsplash: Straight, slightly eased at corner.
  - 3. End Splash: Matching backsplash.
- C. Countertops: 3/4-inch- thick, solid surface material with front edge built up with same material.
- D. Backsplashes: 1/2-inch- thick, solid surface material.
- E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
  - 1. Install integral sink bowls in countertops in the shop.
- F. Joints: Fabricate countertops in sections for joining in field.
  - 1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.

2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit.

G. Cutouts and Holes:

1. Under Counter Plumbing Fixtures and Integral Bowls: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
  - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting between 3/16 inch and 1/4 inch into fixture opening.
  - b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

## **2.4 INSTALLATION MATERIALS**

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into corner blocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply

with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
  - 1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
  - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Pre-drill holes for screws as recommended by manufacturer.
- H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
  - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

## SECTION 200500 - MECHANICAL GENERAL REQUIREMENTS

### 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 work of this Section.

#### 1.2 SUMMARY

- A. This Section includes mechanical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 01 Specification Sections.

#### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
  1. AABC - Associated Air Balance Council; [www.aabc.com](http://www.aabc.com).
  2. AASHTO - American Association of State Highway and Transportation Officials; [www.transportation.org](http://www.transportation.org).
  3. ABMA - American Bearing Manufacturers Association; [www.americanbearings.org](http://www.americanbearings.org).
  4. ABMA - American Boiler Manufacturers Association; [www.abma.com](http://www.abma.com).
  5. AGA - American Gas Association; [www.aga.org](http://www.aga.org).
  6. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); [www.ahrinet.org](http://www.ahrinet.org).
  7. AMCA - Air Movement and Control Association International, Inc.; [www.amca.org](http://www.amca.org).
  8. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  9. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; [www.ashrae.org](http://www.ashrae.org).
  10. ASME - ASME International; (American Society of Mechanical Engineers); [www.asme.org](http://www.asme.org).
  11. ASSE - American Society of Sanitary Engineering; [www.asse-plumbing.org](http://www.asse-plumbing.org).
  12. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
  13. AWS - American Welding Society; [www.aws.org](http://www.aws.org).
  14. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).
  15. CDA - Copper Development Association; [www.copper.org](http://www.copper.org).
  16. CGA - Compressed Gas Association; [www.cganet.com](http://www.cganet.com).
  17. CISPI - Cast Iron Soil Pipe Institute; [www.cispi.org](http://www.cispi.org).
  18. CSA - CSA International; (Formerly: IAS - International Approval Services); [www.csa-international.org](http://www.csa-international.org).
  19. CSI - Construction Specifications Institute (The); [www.csiresources.org](http://www.csiresources.org).
  20. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.cti.org](http://www.cti.org).
  21. FM Approvals - FM Approvals LLC; [www.fmglobal.com](http://www.fmglobal.com).
  22. HI - Hydraulic Institute; [www.pumps.org](http://www.pumps.org).
  23. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
  24. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
  25. IGSHPA - International Ground Source Heat Pump Association; [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu).

26. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); [www.intertek.com](http://www.intertek.com).
  27. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; [www.mss-hq.org](http://www.mss-hq.org)
  28. NADCA - National Air Duct Cleaners Association; [www.nadca.com](http://www.nadca.com).
  29. NAIMA - North American Insulation Manufacturers Association; [www.naima.org](http://www.naima.org).
  30. NEBB - National Environmental Balancing Bureau; [www.nebb.org](http://www.nebb.org).
  31. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
  32. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
  33. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
  34. NFPA - National Fire Protection Association; [www.nfpa.org](http://www.nfpa.org).
  35. NSF - NSF International; [www.nsf.org](http://www.nsf.org).
  36. NSPE - National Society of Professional Engineers; [www.nspe.org](http://www.nspe.org).
  37. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; [www.smacna.org](http://www.smacna.org).
  38. STI - Steel Tank Institute; [www.steeltank.com](http://www.steeltank.com).
  39. TEMA - Tubular Exchanger Manufacturers Association, Inc.; [www.tema.org](http://www.tema.org).
  40. UL - Underwriters Laboratories Inc.; [www.ul.com](http://www.ul.com).
  41. USGBC - U.S. Green Building Council; [www.usgbc.org](http://www.usgbc.org).
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Systems Components Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

#### 1.5 QUALITY ASSURANCE

- A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the mechanical systems as specified and as indicated on Drawings.
1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.
- B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of ASHRAE, NFPA, SMACNA and UL, unless otherwise indicated.
1. Notify the Architect/Engineer in writing before submitting a proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations.

2. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without notice to A/E, the Contractor shall bear all costs arising from corrective measures.
- C. Source Limitations: Obtain equipment and other components of the same or similar systems through one source from a single manufacturer.
- D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.
- E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.
- F. Sequence and Schedule: Perform work to avoid interference with the work of other trades. Remove and relocate work which in the opinion of the Owner's Representatives causes interference.
- G. Labeling Requirement for Packaged Equipment: Electrical panels on packaged mechanical equipment shall bear UL label or label of other Nationally Recognized Testing Laboratory (NRTL) (Intertek, CSA, etc.).

#### **1.6 CODES, PERMITS AND FEES**

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for Mechanical Work shall be secured and paid for by the Contractor. All Work shall conform to all applicable codes, rules and regulations.
- B. Rules of local utility companies shall be complied with. Check with each utility company supplying service to the installation and determine all devices including, but not limited to, all valves, meter boxes, and meters which will be required and include the cost of all such items in proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.
- D. Refer to Division 22 Section "Domestic Water Piping" for purchase and installation of potable water meters.

#### **1.7 DRAWINGS**

- A. The drawings show the location and general arrangement of equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly. Provide fittings, valves, and accessories as required to meet actual conditions.
- C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The Architectural and Structural Drawings take precedence in all matters pertaining to the building structure, Mechanical Drawings in all matters pertaining to Mechanical Trades and Electrical Drawings in all matters pertaining to Electrical Trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

- E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

### **1.8 MATERIAL AND EQUIPMENT MANUFACTURERS**

- A. Equipment: All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment and shall be the manufacturer's latest design.
- B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, piping, sheet metal, electrical work, and building alterations shall be included in the original Bid.
- C. All package unit equipment and skid mounted mechanical components that are factory assembled shall meet, in detail, the products named and specified within each section of the Mechanical and Electrical Specifications.
- D. Changes Involving Electrical Work: The design of the mechanical systems is based on the equipment scheduled on the Drawings. 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 with no additional cost to project. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
  - 1. Where equipment changes are made that involve additional Electrical Work (larger size motor, additional wiring of equipment, etc.) the Mechanical Trades involved shall compensate the Electrical Trades for the cost of the additional Work required.

### **1.9 INSPECTION OF SITE**

- A. Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.
- B. No contract sum adjustments or contract time extensions will be made for Contractor claims arising from conditions which were or could have been observable, ascertainable or reasonably foreseeable from a site visit or inquiry into local conditions affecting the execution of the work.

### **1.10 ITEMS REQUIRING PRIOR APPROVAL**

- A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 01 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment



schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.

1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.
  2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, piping, sheet metal, electrical, replacement of other components, and building alterations shall be included in the original bid.
- B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid, but will not affect the awarding of the contract.

### **1.11 ACTION SUBMITTALS**

- A. Submit for review in compliance with Division 01.
- B. Equipment and material submittals required are indicated in the Mechanical; Fire Suppression; Plumbing; and Heating, Ventilating and Air Conditioning Sections. Refer to Division 01 for submittal quantities.
- C. Submittals shall be in groupings of similar or related items. Plumbing fixture submittals shall be in one package including all fixtures intended to be used for this project. Incomplete submittal groupings will be returned "Rejected". Submit product data with identification mark number or symbol numbers as specified or scheduled on the Mechanical Drawings.
- D. Submittals shall be project specific. Standard detail drawings and schedule not clearly indicating which data is associated with this Project will be returned "Rejected".
- E. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of the project and the reasons therefore, shall be included with the submittal for approval.

### **1.12 INFORMATIONAL SUBMITTALS**

- A. Shop Drawings:
1. Prepare shop drawings to scale for the Architect/Engineer for review.
  2. Shop drawings shall be reviewed by the Mechanical Contractor for completeness and accuracy prior to submitting to the Architect/Engineer for review. The shop drawings shall be dated and signed by the Mechanical Contractor prior to submission.
  3. No equipment shall be shipped from stock or fabricated until shop drawings for them have been reviewed by the Architect/Engineer. Review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action indicated is subject to the requirement of the plans and specifications.
    - a. By the review of shop drawings, the Architect/Engineer does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Mechanical Trades of full responsibility for the proper and correct execution of the work required.
    - b. Contractor is responsible for:
      - 1) Dimensions, which shall be confirmed and correlated at the job site.

- 2) Fabrication processes and techniques of construction.
- 3) Quantities.
- 4) Coordination of Contractor's work with all other trades.
- 5) Satisfactory performance of Contractor's work.
- 6) Temporary aspects of the construction process.

B. Coordination Drawings:

1. Submit project specified coordination drawings for review in compliance with Division 01 Specification Sections.

### 1.13 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Instructional Manuals:

1. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 01 Specification Sections.
2. Provide complete operation and maintenance instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. One copy of all manuals shall be furnished for Owner. Maintenance and operating instructional manuals shall be provided when construction is approximately 75 percent complete.
3. Format: Submit operation and maintenance manuals in the following format:
  - a. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
    - 1) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - 2) Enable inserted reviewer comments on draft submittals.
4. The operating and maintenance instructions shall include a brief, general description for all mechanical systems including, but not limited to:
  - a. Routine maintenance procedures.
  - b. Lubrication chart listing all types of lubricants to be used for each piece of equipment and the recommended frequency of lubrication.
  - c. Trouble-shooting procedures.
  - d. Contractor's telephone numbers for warranty repair service.
  - e. Submittals.
  - f. Recommended spare parts list.
  - g. Names and telephone numbers of major material suppliers and subcontractors.
  - h. System schematic drawings.

B. Record Drawings:

1. Submit record drawings in compliance with Division 01.
2. Contractor shall submit to the Architect/Engineer, record drawings on electronic media or vellum which have been neatly marked to represent as-built conditions for all new mechanical work.
3. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request.

- C. Warranties:
1. Warranty: Comply with the requirements in Division 01 Specification Sections. Contractor shall warranty that the mechanical installation is free from defects and agrees to replace or repair, to the Owner's satisfaction, any part of this mechanical installation which becomes defective within a period of one year (unless specified otherwise in other Mechanical; Fire Suppression; Plumbing; or Heating, Ventilating and Air Conditioning Sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.
  2. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

#### 1.14 INSTRUCTION OF OWNER PERSONNEL

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of mechanical equipment and systems at agreed upon times. A minimum of 24 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
- B. For equipment requiring seasonal operation, perform instructions for other seasons within six months.
- C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. In addition to individual equipment training provide overview of each mechanical system. Utilize the as-built documents for this overview.
- E. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction.

#### 1.15 WARRANTY

- A. Warranty: Comply with the requirements in Division 01 Specification Sections. Contractor shall warranty that the mechanical installation is free from defects and agrees to replace or repair, to the Owner's satisfaction, any part of this mechanical installation which becomes defective within a period of one year (unless specified otherwise in other Mechanical; Fire Suppression; Plumbing; or Heating, Ventilating and Air Conditioning Sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.
- B. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

### PART 2 - PRODUCTS

Not Applicable

## PART 3 - EXECUTION

### 3.1 MECHANICAL DEMOLITION WORK

- A. Demolition of existing mechanical equipment and materials shall be done by the Contractor unless otherwise indicated. Include items such as, but not limited to, existing piping, pumps, ductwork, supports, and equipment where such items are not required for the proper operation of the modified system.
- B. Include draining of piping systems where required for demolition, modification of, or connection to existing systems.
- C. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this Work.
- D. Unless specifically noted to the contrary, removed materials shall not be reused in the work. Salvaged materials that are to be reused shall be stored safe against damage and turned over to the appropriate trade for reuse.
  - 1. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived.
  - 2. Remove items from the systems and turn over to the Owner in their condition prior to removal. The Owner will move and store these materials.
  - 3. Items on which the Owner waives ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises.
- E. Work that has been cut or partially removed shall be protected against damage until covered by permanent construction.
- F. Clean and flush the interior and exterior of existing relocated equipment and its related piping, valves, and accessories that are to be reused of mud, debris, pipe dope, oils, welding slag, loose mill scale, rust, and other extraneous material so that the existing equipment and accessories can be repainted and repaired as required for the proper operation and performance of the relocated equipment.
- G. Where existing equipment is to be removed, cap piping under floor, behind face of wall, above ceiling, or at mains.
- H. Cap ductwork and cap piping immediately adjacent to demolition as soon as demolition commences in order to allow existing systems to remain in operation.
  - 1. Cap or plug piping with same or compatible piping material.
  - 2. Cap or plug ducts with same or compatible ductwork material.

### 3.2 WORK IN EXISTING BUILDINGS

- A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once Work is started in the existing building, shall complete same without interruption so as to return work areas as soon as possible to Owner.
- B. Adequately protect and preserve all existing and newly installed Work. Promptly repair any damage to same at Contractor's expense.
- C. Consult with the Owner's Representative as to the methods of carrying on the Work so as not to interfere with the Owner's operation any more than absolutely necessary. Accordingly, all service lines shall be kept

in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's Representative.

- D. Prior to starting work in any area, obtain approval for doing so from a qualified representative of the Owner who is designated and authorized by the Owner to perform testing and abatement, if necessary, of all hazardous materials including but not limited to, asbestos. The Contractor shall not perform any inspection, testing, containment, removal or other work that is related in any way whatsoever to hazardous materials under the Contract.

### **3.3 TEMPORARY SERVICES**

- A. Provide temporary service as described in Division 01.
- B. The existing building will be occupied during construction. Maintain mechanical services and provide necessary temporary connections and their removal at no additional cost to the Owner.

### **3.4 WORK INVOLVING OTHER TRADES**

- A. Certain items of equipment or materials specified in the Mechanical Division may have to be installed by other trades due to code requirements or union jurisdictional requirements. In such instances, the Contractor shall complete the work through an approved, qualified subcontractor and shall include the full cost for same in proposal.

### **3.5 ACCEPTANCE PROCEDURE**

- A. Upon successful completion of start-up and recalibration, but prior to building acceptance, substantial completion and commencement of warranties, the Architect/Engineer shall be requested in writing to observe the satisfactory operation of all mechanical control systems.
- B. The Contractor shall demonstrate operation of equipment and control systems, including each individual component, to the Owner and Architect/Engineer.
- C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect/Engineer for observation and approval.
- D. After all items on the punch list are corrected and formal approval of the mechanical systems is provided by the Architect/Engineer, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.
- E. Operation of the following systems shall be demonstrated:
  - 1. Air Handling Systems.
  - 2. Domestic Hot Water Heaters.
  - 3. Temperature Controls.
  - 4. Exhaust Systems.
- F. For systems requiring seasonal operation, demonstrate system performance within six months when weather conditions are suitable.

END OF SECTION 200500

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## SECTION 200510 - BASIC MECHANICAL MATERIALS AND METHODS

### 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 22 Section "Domestic Water Piping" for flushing and cleaning of potable water piping.
  - 3. Division 23 Section "Piping Systems Flushing and Chemical Cleaning" for flushing and cleaning of HVAC piping.

#### 1.2 SUMMARY

- A. This section includes mechanical materials and installation methods common to mechanical piping systems, sheet metal systems and equipment. This section supplements all other Division 20, 21, 22, and 23 Mechanical Sections, and Division 01 Specification Sections.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, 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 duct shafts.
- 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.
  - 5. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
  - 6. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

#### **1.4 ACTION SUBMITTALS**

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

#### **1.5 INFORMATIONAL SUBMITTALS**

A. Welding certificates.

B. Brazing Certificates: As required by ASME Boiler and Pressure Vessel Code, Section IX, or AWS B2.2.

#### **1.6 QUALITY ASSURANCE**

A. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

C. Comply with NSF 372, "Drinking Water System Components – Lead Content" for potable domestic water piping and components.

D. 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.

E. Duct Joint and Seam Welding: Qualify procedures and personnel according to the following:

1. AWS D9.1, "Sheet Metal Welding Code."

F. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

G. Soldering: Qualify processes and operators according to AWS B2.3/2.3M, "Specification for Soldering Procedure and Performance Qualification."

H. Installer Qualifications:



1. Installers of Grooved Components: Installers shall be certified by the grooved component manufacturer as having been trained and qualified to join piping with grooved couplings, fittings, and specialties.
2. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Storage and Protection: Provide adequate weather protected storage space for all mechanical equipment and materials deliveries to the job site. Storage locations will be designated by the Owner's Representative. Equipment stored in unprotected areas must be provided with temporary protection.
  1. Protect equipment and materials from theft, injury or damage.
  2. Protect equipment outlets, pipe and duct openings with temporary plugs or caps.
  3. Materials with enamel or glaze surface shall be protected from damage by covering and/or coating as recommended in bulletin "Handling and Care of Enameled Cast Iron Plumbing Fixtures", issued by the Plumbing Fixtures Manufacturer Association, and as approved.
  4. Electrical equipment furnished by Mechanical Trades and installed by the Electrical Trades: Turn over to Electrical Trades in good condition, receive written confirmation of same.
  5. 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.
  6. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### **1.8 COORDINATION**

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations. Coordinate with other trades to ensure accurate locations and sizes of mechanical spaces, chases, slots, shafts, recesses and openings.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Install Work to avoid interference with work of other trades including, but not limited to, Architectural and Electrical Trades. Remove and relocate any work that causes an interference at Contractor's expense.
- D. Coordinate requirements for and provide access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- E. The mechanical trades shall be responsible for all damage to other work caused by their work or through the neglect of their workers.
  1. All patching and repair of any such damaged work shall be performed by the trades which installed the work. The cost shall be paid by the Mechanical Trades.

## 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. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21, 22, and 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.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 21, 22, and 23 piping Sections for special joining materials not listed below.
- B. Unions: Pipe Size 2 Inches and Smaller:
  - 1. Ferrous pipe: Malleable iron ground joint type unions.
  - 2. Unions in galvanized piping system shall be galvanized.
  - 3. Copper tube and pipe: Bronze unions with soldered joints.
- C. Flanges: Pipe Sizes 2-1/2 Inch and Larger:
  - 1. Ferrous pipe: Standard weight, forged steel weld neck flanges.
  - 2. Copper tube and pipe: Slip-on bronze flanges.
- D. 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 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 thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- E. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated. Square head bolts and nuts are not acceptable.
- F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- G. Solder Filler Metals: ASTM B 32, lead-free, antimony-free, silver-bearing alloys. Include water-flushable flux according to ASTM B 813.

- H. Brazing Filler Metals: Alloys meeting AWS A5.8.
  - 1. Use Type BcuP Series, silver-bearing, copper-phosphorus alloys for joining copper or bronze socket fittings with copper pipe. Flux is prohibited unless used with bronze fittings.
  - 2. Use Type Bag Series, cadmium-free silver alloys for joining copper with steel, stainless steel, or other ferrous alloys.
- I. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- J. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- K. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
- L. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- M. Solvent Cements for Joining ABS Piping: ASTM D 2235.
- N. Solvent Cements for Joining PVC to ABS Piping Transition: ASTM D 3138.
- O. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

#### 2.4 PIPE THREAD COMPOUNDS

- A. General: Pipe thread compounds for the fluid service compatible with piping materials provided.
- B. Potable Water Service and Similar Applications: Compounds acceptable to U.S. Department of Agriculture (USDA) or Food and Drug Administration (FDA). Compounds containing lead are prohibited.

#### 2.5 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. 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 and Smaller: Manufactured fitting or coupling.
  - 3. Underground Piping NPS 2 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. Manufacturers:

- a. IPEX Inc. (formerly 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. 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. 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. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Fernco, Inc.
    - c. Mission Rubber Company.
    - d. Plastic Oddities, Inc.
    - e. Can-Tex Industries Division of Harsco Corp. "CT-Adaptors".
    - f. Joint Inc., "Caulder".

## 2.6 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. Brass Unions, Brass Nipples, Brass Couplings: For systems up to 286 deg F.
- D. Dielectric-Flange Kits: Include full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Capitol Manufacturing Co.
    - d. GF Piping Systems; George Fischer Central Plastics.
    - e. Epco Sales, Inc.
    - f. Pipeline Seal and Insulator, Inc.
    - g. Watts Water Technologies, Inc.; Watts Regulator Co.
    - h. Zurn Industries, Inc.; Wilkins Div.
  2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

- E. Dielectric Nipple/Waterway Fittings: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, male NPT threaded, or grooved ends; and 300-psi minimum working pressure at 230 deg F.
  - 1. Manufacturers:
    - a. Anvil International, Inc.; Gruvlok Manufacturing; DI-LOK Nipples.
    - b. Elster Group; Perfection Corp.; ClearFlow.
    - c. Precision Plumbing Products, Inc.; ClearFlow.
    - d. Sioux Chief Manufacturing Co., Inc.
    - e. Tyco Fire & Building Products; Grinnell Mechanical Products; Figure 407 ClearFlow.
    - f. Victaulic Co. of America; Style 47 ClearFlow.

## **2.7 SLEEVES**

- A. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall black.
- B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall galvanized, plain ends.
- C. Water Stop: Cast or ductile-iron; fabricated steel; PVC; or rotationally molded HDPE pipe; with plain ends and integral water stop, unless otherwise indicated.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.; Infinity and Gal-Vo-Plast Sleeves.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.

## **2.8 ESCUTCHEONS**

- A. Description: Manufactured wall and ceiling escutcheons, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping or Piping in High Humidity Areas: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping in Finished Spaces: One-piece, stamped-steel type.
    - e. Bare Piping in Unfinished Service Spaces or Equipment Rooms: Split-plate, stamped-steel type 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, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

**2.10 EPOXY BONDING COMPOUND**

- A. Two-component system suitable for bonding wet or dry concrete to each other and to other materials.
- B. Manufacturers:
  - 1. Euco 452 #450; Euclid Chemical Co.
  - 2. Epobond; L & M Construction Chemicals.
  - 3. Sikadur 87; Sika Corp.

**2.11 LEAK DETECTOR SOLUTION**

- A. Commercial leak detector solution for pipe system testing.
- B. Manufacturers:
  - 1. American Gas and Chemicals Inc.; Leak Tec.
  - 2. Cole-Parmer Inst. Co.; Leak Detector.
  - 3. Guy Speaker Co. Inc.; Squirt 'n Bubbles.

**PART 3 - EXECUTION**

**3.1 PIPING SYSTEMS - COMMON REQUIREMENTS**

- A. Refer to piping application schedules on the Drawings.
- B. Install piping according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems, and in accordance with manufacturer's instructions.
- C. 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. The Drawings shall be followed as closely as elements of construction will permit.
- D. During the progress of construction, protect open ends of pipe, fittings, and valves to prevent the admission of foreign matter. Place plugs or flanges in the ends of all installed work whenever work stops. Plugs shall be commercially manufactured products.
- E. Prior to and during laying of pipe, maintain excavations dry and clear of water and extraneous materials. Provide minimum 4 inches of clearance in all directions for pipe passing under or through building grade beams.
- F. Weld-o-lets and thread-o-lets can be used for annular flow measuring devices, temperature control components, and thermal wells in steel pipe. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- G. Brazolets can be used for annular flow measuring devices, temperature control components, and thermal wells in copper tube. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- H. Clean and lubricate elastomer joints prior to assembly.
- I. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.

- J. Install piping to conserve building space and not interfere with use of space.
- K. Group piping whenever practical at common elevations.
- L. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
  - 1. Install piping to allow for expansion and contraction at locations where piping crosses building or structure expansion joints.
- M. Slope piping and arrange systems to drain at low points.
- N. Slope horizontal piping containing non-condensable gases 1 inch per 100 feet, upward in the direction of the flow.
- O. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- P. 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.
- Q. In concealed locations where piping, other than black steel, cast-iron, or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1-1/2 inches from the nearest edge of the member, the pipe shall be protected by shield plates. Protective shield plates shall be a minimum of 1/16 inch thick steel, shall cover the area of the pipe where the member is notched or bored, and shall extend a minimum of 2 inches above sole plates and below top plates.
- R. Do not penetrate building structural members unless specifically indicated on drawings.
- S. Install piping above accessible ceilings to allow sufficient space for ceiling panel and light fixture removal.
- T. Install valves with stems upright or horizontal, not inverted.
- U. Provide clearance for installation of insulation and access to valves and fittings.
- V. Install piping to permit valve and equipment servicing. Do not install piping below valves and/or terminal equipment. Do not install piping above electrical equipment.
- W. Install piping at indicated slopes. Provide drain valves with hose end connections and caps at all piping low points, where piping is trapped and at all equipment.
- X. Install piping free of sags and bends.
- Y. Install fittings for changes in direction and branch connections.
- Z. Unless otherwise indicated or specified, install branch connections to mains using tee fittings in main pipe:
  - 1. Branch connected to bottom of main pipe for HVAC systems. Side connection is acceptable. Connection above centerline of main is unacceptable. For up-feed risers, connect branch to top of main pipe.
  - 2. Branch connected to top of main for steam and condensate, plumbing systems, compressible gasses, and vacuum.
- AA. Install piping to allow application of insulation.
- BB. Select system components with pressure rating equal to or greater than system operating pressure.

- CC. After completion, fill, clean, and treat systems. Refer to Division 23 Sections "Hydronic Piping," "Piping Systems Flushing and Chemical Cleaning," and "HVAC Water Treatment."
- DD. Install escutcheons for penetrations of walls below ceiling, and ceilings.
- EE. Sleeves are not required for core-drilled holes in poured concrete walls.
- FF. Permanent sleeves are not required for holes formed by removable PE sleeves in poured concrete walls.
- GG. Install sleeves for pipes passing through footings and foundation walls, masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces of walls.
    - a. Exception: Extend sleeves installed in floors 2 inches above finished floor level.
  - 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 annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Schedule 40 Black Steel Sleeves: For pipes smaller than NPS 12 penetrating interior walls.
    - b. 0.375 Inch Wall Black Steel Sleeves: For pipes NPS 12 and larger penetrating interior walls.
    - c. Schedule 40 Galvanized Steel Sleeves: For pipes smaller than NPS 12 penetrating floors, and roof slabs.
    - d. 0.375 Inch Wall Galvanized Steel Sleeves: For pipes NPS 12 and larger penetrating floors and roof slabs.
  - 4. Seal sleeves in concrete floors roof slabs and masonry walls with grout.
  - 5. Seal sleeves in plaster/gypsum-board partitions with plaster or dry wall compound and caulk with non-hardening silicone sealant to provide airtight installation.
  - 6. 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.
- HH. Verify final equipment locations for roughing-in.
- II. 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 21, 22, and 23 Sections specifying piping systems.
- B. Cut piping square.
- C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- D. Remove scale, slag, dirt, oil, and debris from inside and outside of pipe and fittings before assembly.
- E. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.
- F. Use standard long sweep pipe fittings for changes in direction. No mitered joints or field fabricated pipe bends will be permitted. Short radius elbows may be used where specified or specifically authorized by the Architect.



- G. Make tee connections with screwed tee fittings, soldered fittings or specified welded connections. Make welded branch connections with either welding tees or forged branch outlet fittings in accordance with ASTM A234, ANSI B16.9 and ANSI B16.11. For forged branch outlets, furnish forged fittings flared for improved flow where attached to the run, reinforced against external strains and to full pipe-bursting strength requirements. "Fishmouth" connections are not acceptable.
- H. Use eccentric reducers for drainage and venting of pipe lines; bushings are not permitted.
- I. Provide pipe openings using fittings for all systems control devices, thermometers, gauges, etc. Drilling and tapping of pipe wall for connections is prohibited.
- J. Provide temperature sensing device thermal wells and similar piping specialty connections.
- K. Provide instrument connections except thermal wells with specified isolating valves at point of connection to system.
- L. Locate instrument connections in accordance with manufacturer's instructions for accurate read-out of function sensed. Locate instrument connections for easy reading and service of devices.
- M. 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."
- N. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- O. 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.
- P. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
  - 1. Weld-o-lets and thread-o-lets can be used for annular flow measuring devices, temperature control components, and thermal wells. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- Q. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on gaskets and bolt threads.
  - 1. Assemble flanged joints with fresh-stock gasket and hex head nuts, bolts or studs. Make clearance between flange faces such that the connections can be gasketed and bolted tight without strain on the piping system. Align flange faces parallel and bores concentric; center gaskets on the flange faces without projection into the bore.
  - 2. Lubricate bolts before assembly to insure uniform bolt stressing. Draw up and tighten bolts in staggered sequence to prevent unequal gasket compression and deformation of the flanges. Do not mate a flange with a raised face to a companion flange with a flat face; machine the raised face down to a smooth matching surface and use a full face gasket. After the piping system has been tested and is in service at its maximum temperature, check bolting torque to provide required gasket stress.
- R. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions. Grooved ends

shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Galvanized piping shall be cut grooved to prevent damage to galvanizing on internal pipe surfaces. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.

- S. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.
- T. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.
- U. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials. Refer to Application Schedules on the Drawings.
- V. 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.
- W. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- X. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- Y. 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.
- Z. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
- AA. Remake joints which fail pressure tests with new materials including pipe, fittings, gaskets and/or a filler.

### 3.3 EQUIPMENT CONNECTIONS

- A. Make connections to equipment, fixtures, and other items included in the work in accordance with the submittals and rough-in measurements furnished by the manufacturers of the particular equipment furnished.
  - 1. Any and all additional connections not shown on the drawings but shown on the equipment manufacturer's submittal or required for the successful operation of the equipment shall be installed as part of this Contract at no additional charge to the Owner.

- B. All piping connections to pumps, coils, and other equipment shall be installed without strain at the pipe connection of this equipment. When directed, remove the bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected.

### **3.4 PIPING CONNECTIONS**

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, where indicated on Drawings, at final connection to each piece of equipment and at all control valves.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, where indicated on Drawings, at final connection to each piece of equipment and at all control valves.

### **3.5 INSTALLATION OF PIPE CONCEALMENT SYSTEM**

- A. Install cover system, brackets, and cover components for piping according to manufacturer's "Installation Manual."

### **3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS**

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated. Housekeeping pad locations and sizes shall be coordinated by mechanical contractor prior to the placement of concrete slabs.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical 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.
- E. For suspended equipment, furnish and install all inserts, rods, structural steel frames, brackets and platforms required. Obtain approval of Architect for same including loads, locations and methods of attachment.
- F. The Contract Documents indicate items to be purchased and installed. The items are noted by a manufacturer's name, catalog number and/or brief description. The catalog number may not designate all the accessory parts for a particular application. Arrange with the manufacturer for the purchase of all items required for a complete installation.

### **3.7 PAINTING**

- A. Painting of mechanical systems, equipment, and components is specified in Division 09.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

**3.8 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 mechanical materials and equipment.
- C. Where pipe and/or equipment support members must be welded to structural building framing, Contractor shall seek prior approval from Architect and structural engineer. Scrape, brush clean, and apply one coat of zinc rich primer after welding.
- D. Field Welding: Comply with AWS D1.1.

**3.9 EPOXY BONDING TO EXISTING MATERIALS**

- A. Use epoxy bonding compound to set sleeves or pipes in existing concrete to bond new concrete and/or grout to existing materials or to bond dissimilar materials.
- B. The compound, when applied in accordance with the manufacturer's instructions, shall be capable of initial curing within 48 hours at temperatures as low as 40 deg F and shall be capable of bonding any combination of the following properly prepared materials: Wet or dry, cured or uncured concrete or mortar; vitrified clay; cast iron and carbon steel.

**3.10 JACKING OF PIPE**

- A. Do not jack pipe in place except upon prior approval of proposed materials and complete details of methods.

**3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES**

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical 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.

**3.12 GROUTING**

- A. Mix and install grout for mechanical 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.

**3.13 CUTTING, CORING AND PATCHING**

- A. Refer to Division 01 Specification Sections for requirements for cutting, coring, patching and refinishing work necessary for the installation of mechanical work.
- B. All cutting, coring, patching and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

**3.14 FLASHING**

- A. Provide all flashing required for mechanical work. Refer to Division 07 Specification Sections.

**3.15 LUBRICATION**

- A. Provide all lubrication for the operation of the equipment until acceptance by the Owner. Contractor is responsible for all damage to bearings up to the date of acceptance of the equipment. Protect all bearings and shafts during installation. Thoroughly grease steel shafts to prevent corrosion. Provide covers as required for proper protection of all motors and other equipment during construction.

**3.16 FILTERS**

- A. Provide and maintain filters in air handling systems throughout the construction period and prior to final acceptance of the building. Do not run air handling equipment, without all prefilters and final filters as specified.
- B. Immediately prior to final building acceptance by the Owner, Contractor shall:
  - 1. Replace all disposable type air filters with new units.

**3.17 CLEANING**

- A. Each Mechanical Trade shall be responsible for removing all debris daily as required to maintain the work area in a neat, orderly condition.
- B. After equipment, steam, condensate and HVAC water piping systems have been completed and tested, each entire system shall be cleaned and flushed. Refer to Division 23 Section "Piping Systems Flushing and Chemical Cleaning" for requirements. Provide temporary bypass piping and fittings, temporary valves and strainers, temporary water make-up piping with approved means of backflow prevention, and temporary pumps as needed to perform specified flushing and cleaning requirements.
- C. Prior to connection of new HVAC piping to existing HVAC piping systems, all new piping shall be subject to initial flushing, cleaning and final flushing. Refer to Division 23 Section "Piping Systems Flushing and Chemical Cleaning" for requirements. Provide temporary bypass piping and fittings, temporary valves and strainers, temporary water make-up piping with approved means of backflow prevention, and temporary pumps as needed to perform specified flushing and cleaning requirements.

- D. Flushing, cleaning, and disinfection of domestic water piping is specified in Division 22 Section “Domestic Water Piping.”
- E. Exterior surfaces of all piping, ductwork and equipment shall be wiped down to remove excess dirt and debris prior to concealment by Architectural Trades work.
- F. Upon completion of work in each respective area, clean and protect work. Just prior to final acceptance, perform additional cleaning as necessary to provide clean equipment and areas to the Owner.

END OF SECTION 200510

## SECTION 200513 - MOTORS

### 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Mechanical Vibration Controls" for mounting motors and vibration isolation devices.
  - 3. Division 21, 22, and 23 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.
  - 4. Division 26 Section "Enclosed Switches and Circuit Breakers".
  - 5. Division 26 Section "Enclosed Controllers".
  - 6. Division 26 Section "Fuses".

#### 1.2 SUMMARY

- A. This Section includes basic requirements for factory installed motors.

#### 1.3 DEFINITIONS

- A. ABMA: American Bearing Manufacturers Association. (Formerly AFBMA: Anti-Friction Bearing Manufacturers Association.)
- B. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- C. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.
- D. Packaged Self Contained Equipment: Equipment which includes component mechanical and electrical equipment mounted on common bases, skids or frames or in common enclosures with internal control and power wiring factory installed and ready to accept a single electrical service connection. Provide the equipment complete with enclosed controllers, main disconnect switches, control transformers, control devices, wiring and accessories as required.

#### 1.4 ACTION SUBMITTALS

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL), acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

## 1.7 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:
  - 1. Compatible with the following:
    - a. Magnetic controllers.
    - b. Multispeed controllers.
    - c. Reduced-voltage controllers.
    - d. Solid-state controllers.
  - 2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
  - 3. Matched to torque and horsepower requirements of the load.
  - 4. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate electrical scope of work to be provided by Division 20, 21, 22, and 23 with this Section, related Division 20, 21, 22, and 23 Specifications, Division 26 Specifications and the Drawings.
- C. Electrical work provided under Division 20, 21, 22, and 23: Furnish UL Listed components in accordance with this section, Division 26, and applicable NEMA and NEC (ANSI C 1) requirements. Provide wiring, external to electrical enclosures, in conduit.
- D. Furnished, installed and wired under Division 20, 21, 22, and 23 unless otherwise indicated:
  - 1. Disconnected components in packaged self-contained equipment that are so constructed that components of wiring must be disconnected for shipment and reconnected after installation.
- E. Furnished and installed under Division 20, 21, 22, and 23 and wired under Division 26 unless otherwise indicated:
  - 1. Motors required for mechanical equipment
  - 2. Packaged Self-Contained Equipment:
    - a. Provide equipment ready to accept a single electrical service connection.
    - b. For equipment with remote mounted control panels, provide mounting of the control panel and external wiring from the control panel to the package self-contained equipment.
  - 3. Variable frequency controllers.



## 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Quantity equal to 10 percent of each fuse type and size, but no fewer than 3 of each type and size.
  - 2. Spare Indicating Lights: Six of each type installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. Dayton.
  - 2. Toshiba Intl.
  - 3. Baldor Electric/Reliance.
  - 4. Rockwell Automation/Allen-Bradley.
  - 5. Nidec Motor Corporation; U.S. Electrical Motors.
  - 6. Regal Beloit/GE Commercial Motors.
  - 7. Regal Beloit/Leeson.
  - 8. Regal Beloit/Marathon.
  - 9. Siemens.

### 2.2 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory-installed motors except as follows:
  - 1. Different ratings, performance, or characteristics for a motor are specified in another Section.
  - 2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.
  - 3. Submersible motors integral to pumps and excluded from NEMA and EISA standards.
- B. Electrical Power Supply Characteristics: Coordinate electrical system requirements with Division 26.
- C. Electrical Power System Characteristics: As scheduled on the Drawings.
- D. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide screwed conduit connection in end frame.

### 2.3 MOTOR CHARACTERISTICS

- A. Motors Smaller Than 1/2 HP: Single phase, unless otherwise indicated.
- B. Frequency Rating: 60 Hz.
- C. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- D. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.

- E. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- F. 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.
- G. Brake Horsepower Input: Shall not exceed 90 percent of the rated motor horsepower.
- H. Enclosure: Open dripproof (ODP) for motors installed indoors and out of the airstream. Totally-enclosed fan-cooled (TEFC) for motors installed outdoors or within the airstream.

**2.4 POLYPHASE MOTORS**

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Fire pump motors, C-face motors, JP and JM frame motors, and motors over 200 horsepower shall be energy efficient motors. Efficiency of the motor shall be determined based on the NEMA MG1. The minimum efficiencies, nominal efficiencies and shall meet or exceed Table 12-11.

HP	1800 RPM OPEN DRIP-PROOF MOTORS 4 POLE		1800 RPM ENCLOSED MOTORS 4 POLE	
	NOMINAL	MINIMUM	NOMINAL	MINIMUM
	<u>EFF</u>	<u>EFF</u>	<u>EFF</u>	<u>EFF</u>
1	82.5	81.5	82.5	81.5
1.5	84	82.5	84	82.5
2	84	82.5	84	82.5
3	86.5	85.5	87.5	86.5
5	87.5	86.5	87.5	86.5
7.5	88.5	87.5	89.5	88.5
10	89.5	88.5	89.5	88.5
15	91	90.2	91	90.2
20	91	90.2	91	90.2
25	91.7	91	92.4	91.7
30	92.4	91.7	92.4	91.7
40	93	92.4	93	92.4
50	93	92.4	93	93
60	93.6	93	93.6	93
75	94.1	93.6	94.1	93.6
100	94.1	93.6	94.5	94.1
125	94.5	94.1	94.5	94.1
150	95	94.5	95	94.5
200	95	94.5	95	94.5

HP	1200 RPM OPEN DRIP-PROOF MOTORS 6 POLE		3600 RPM OPEN DRIPPROOF MOTORS 2 POLE	
	NOMINAL	MINIMUM	NOMINAL	MINIMUM
	<u>EFF</u>	<u>EFF</u>	<u>EFF</u>	<u>EFF</u>
1	80	78.5	--	--

HP	1200 RPM OPEN DRIP-PROOF MOTORS 6 POLE		3600 RPM OPEN DRIPPROOF MOTORS 2 POLE	
	NOMINAL	MINIMUM	NOMINAL	MINIMUM
	<u>EFF</u>	<u>EFF</u>	<u>EFF</u>	<u>EFF</u>
1.5	84	82.5	82.5	81.5
2	85.5	84	84	82.5
3	86.5	85.5	84	82.5
5	87.5	86.5	85.5	84
7.5	88.5	87.5	85.5	86.5
10	90.2	89.5	88.5	87.5
15	90.2	89.5	89.5	88.5
20	91	90.2	90.2	89.5
25	91.7	91	91	90.2
30	92.4	91.7	91	90.2
40	93	92.4	91.7	91
50	93	93	92.4	91.7
60	93.6	93	93	92.4
75	93.6	93	93	92.4
100	94.1	93.6	93	92.4
125	94.1	93.6	93.6	93
150	94.5	94.1	93.6	93
200	94.5	94.1	94.5	94.1

- C. Efficiency: Motors 1 horsepower to 200 horsepower shall be premium efficient motors meeting requirements of NEMA Premium Efficiency Motor Program. Efficiency of the motor shall be determined based on the NEMA MG1. The nominal efficiencies shall meet or exceed Table 12-12.

Nominal Efficiencies For "NEMA Premium™" Induction Motors  
Rated 600 Volts or Less (Random Wound)

HP	Open Drip-Proof			Totally Enclosed Fan-Cooled		
	<u>6-pole</u>	<u>4-pole</u>	<u>2-pole</u>	<u>6-pole</u>	<u>4-pole</u>	<u>2-pole</u>
1	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2	87.5	86.5	85.5	88.5	86.5	85.5
3	88.5	89.5	85.5	89.5	89.5	86.5
5	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7
30	93.6	94.1	91.7	93.0	93.6	91.7
40	94.1	94.1	92.4	94.1	94.1	92.4
50	94.1	94.5	93.0	94.1	94.5	93.0
60	94.5	95.0	93.6	94.5	95.0	93.6
75	94.5	95.0	93.6	94.5	95.4	93.6
100	95.0	95.4	93.6	95.0	95.4	94.1
125	95.0	95.4	94.1	95.0	95.4	95.0
150	95.4	95.8	94.1	95.8	95.8	95.0
200	95.4	95.8	95.0	95.8	96.2	95.4

Nominal Efficiencies For "NEMA Premium™" Induction Motors  
Rated Medium Volts for 5kV or Less (Form Wound)

HP	Open Drip-Proof			Totally Enclosed Fan-Cooled		
	6-pole	4-pole	2-pole	6-pole	4-pole	2-pole
250	95.0	95.0	94.5	95.0	95.0	95.0
300	95.0	95.0	94.5	95.0	95.0	95.0
350	95.0	95.0	94.5	95.0	95.0	95.0
400	95.0	95.0	94.5	95.0	95.0	95.0
450	95.0	95.0	94.5	95.0	95.0	95.0
500	95.0	95.0	94.5	95.0	95.0	95.0

- D. Stator: Copper windings, unless otherwise indicated.
- E. Rotor: Squirrel cage, unless otherwise indicated.
- F. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 120,000 hours. Calculate bearing load with NEMA minimum V- belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- G. Temperature Rise: Match insulation rating, unless otherwise indicated.
- H. Insulation: Class F, unless otherwise indicated.
- I. Code Letter Designation:
  - 1. Motors 10 HP and Larger: NEMA starting Code (KVA Code) F or G.
  - 2. Motors Smaller Than 10 HP: Manufacturer's standard starting characteristic.
  - 3. Fire Pump Motors: NEMA starting Code (KVA Code) B.
- J. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.
  - 1. Finish: Gray enamel.
- K. Sound Level: Not to exceed NEMA MG-1 12.54.

**2.5 SINGLE-PHASE MOTORS**

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split-phase start, capacitor run.
  - 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- C. 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.

- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

## **2.6 ENCLOSED CONTROLLERS**

- A. Provide enclosed controllers in accordance with requirements specified in Division 26 Section "Enclosed Controllers".

## **2.7 Enclosed Switches and Circuit Breakers**

- A. Provide enclosed switches and circuit breakers in accordance with requirements specified in Division 26 Section "Enclosed Switches and Circuit Breakers".

## **2.8 FUSES**

- A. Provide fuses in accordance with requirements specified in Division 26 Section "Fuses".

# **PART 3 - EXECUTION**

## **3.1 FIELD QUALITY CONTROL**

- A. All three phase motors 1/2 HP and above shall be tested by the Testing Agency.
- B. Prepare for acceptance tests as follows:
  - 1. Check motor nameplates for horsepower, speed, phase and voltage.
  - 2. Check coupling alignment and shaft end play.
  - 3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
  - 4. Test interlocks and control features for proper operation.
  - 5. Verify that current in each phase is within nameplate rating.
- C. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
  - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
  - 2. Jog motor as required to verify proper phase and shaft rotation. Immediately after start-up, check bearing temperature and smooth operation. Take current reading at full load using a clamp-on ammeter. If ammeter reading is over the rated full load current, determine reason for discrepancy and take necessary corrective actions. Record all readings, motor nameplate data and overload heater data.
  - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

## **3.2 ADJUSTING**

- A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

**3.3 CLEANING**

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 200513

## SECTION 200529 - HANGERS AND SUPPORTS

### 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.
- 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 20 Section "Mechanical General Requirements."
  - 3. Division 20 Section "Basic Mechanical Materials and Methods."
  - 4. Division 20 Section "Mechanical Vibration Controls" for vibration isolation devices.
  - 5. Division 20 Section "Pipe Flexible Connectors, Expansion Fittings and Loops" for pipe guides and anchors.
  - 6. Division 21 Section "Fire-Suppression System" for pipe hangers for fire-protection piping.
  - 7. Division 23 Section(s) "Metal Ducts" for duct hangers and support.

#### 1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry Inc.
- B. MFMA: Metal Framing Manufacturers Association.

#### 1.3 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.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. 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. Pipe stands. Include Product Data for components.
4. Equipment supports.

## **1.6 QUALITY ASSURANCE**

- A. MSS Standards: Pipe hangers, supports, and accessories shall comply with the following:
  1. MSS SP-58, Pipe Hangers and Supports – Materials, Design and Manufacture, Selection, Application, and Installation.

## **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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.2 HANGER ROD MATERIAL**

- A. Threaded, hot rolled, steel rod conforming to ASTM A 36 or A575.
  1. Rod continuously threaded.
  2. Use of rod couplings is prohibited.

### **2.3 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, and schedules and details on the Drawings for where to use specific hanger and support types.
  1. Hangers and Supports for Fire Protection Piping: UL listed or FMG approved.
- B. Manufacturers:
  1. Anvil; ASC Engineered Solutions.
  2. B-Line by Eaton.
  3. Carpenter & Paterson, Inc.
  4. Hilti USA.
  5. nVent Electric plc; CADDY.
  6. PHD Manufacturing, Inc.
- C. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.



## **2.4 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-58, 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.

## **2.5 METAL FRAMING SYSTEMS**

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
1. Anvil; Anvil-Strut; ASC Engineered Solutions.
  2. B-Line by Eaton.
  3. nVent Electrical plc; ERISTRUT Div.
  4. Power-Strut; a part of Atkore International.
  5. Unistrut; a part of Atkore International.
  6. Hilti USA.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- E. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## **2.6 METAL INSULATION SHIELDS**

- A. Manufacturers:
1. Anvil; ASC Engineered Solutions.
  2. B-Line by Eaton.
  3. Carpenter & Paterson, Inc.
  4. nVent Electric plc; CADDY.
  5. PHD Manufacturing, Inc.
- B. Description: MSS SP-58, Type 40, protective shields. Shields shall span an arc of 180 degrees.
- C. Shield Dimensions for Pipe: Not less than the following:
1. NPS 1/4 to NPS 2: 12 inches long and 0.048 inch thick.

## **2.7 PIPE COVERING PROTECTION SADDLES**

- A. Manufacturers:
1. Anvil; ASC Engineered Solutions.
  2. B-Line by Eaton.
  3. Carpenter & Paterson, Inc.
  4. nVent Electric plc; CADDY.
  5. PHD Manufacturing, Inc.

- B. Description: MSS SP-58, Type 39A and Type 39B, for suspension of insulated hot pipe where heat losses are to be kept to a minimum.
  - 1. Saddles shall match insulation thickness.
  - 2. Saddle length: 12 inches.
  - 3. Furnish with center rib for pipe sized NPS 12 and larger.

## **2.8 PLASTIC INSULATION SHIELDS**

- A. Manufacturers:
  - 1. Anvil; ASC Engineered Solutions.
  - 2. Armacell LLC; Insuguard.
  - 3. B-Line by Eaton; Snap'N Shield.
  - 4. Hydra-Zorb Company; Bronco.
- B. Description: Polypropylene copolymer protective shields with modular elements designed to snap directly onto strut channel, clevis hangers, or structural members. Shields shall span an arc of 180 degrees.
  - 1. Operating Temperature Range: Minus 40 deg F to plus 178 deg F .
- C. Certifications:
  - 1. UL Classified for USA: UL-723 (ASTM E 84).
  - 2. UL listed for Canada: ULC-S102.2.
  - 3. Meets UL94 HB flammability standards.
- D. Shield Dimensions for Pipe: Not less than the following:
  - 1. NPS 1/4 to NPS 4: 12 inches long.

## **2.9 THERMAL-HANGER SHIELDS**

- A. Manufacturers:
  - 1. American Mechanical Insulation Sales Inc. (AMIS).
  - 2. B-Line by Eaton.
  - 3. nVent Electric plc; CADDY.
  - 4. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
  - 5. Rilco Manufacturing Company, Inc.
  - 6. Value Engineered Products, Inc.
- B. Description: Manufactured assembly consisting of insulation insert encased in 360 degree sheet metal shield.
  - 1. Minimum Compressive Strength of Insert Material:
    - a. 100-psig- for sizes smaller than NPS 6.
    - b. 600-psig- for sizes NPS 6 and larger.
- C. Insulation-Insert Material for Cold Piping: Full 360 degree, water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.

- D. Insulation-Insert Material for Hot Piping: Full 360 degree, water-repellent treated, ASTM C 533, Type I calcium silicate.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
- F. Include carbon steel ASTM A36 load distribution plates as required by load, pipe movement, hanger style, and hanger spacing.
- G. Thermal-Hanger Shields for Flexible Foamed Elastomeric Insulated Piping:
  - 1. Manufacturer:
    - a. B-Line by Eaton/Armacell; Armafix IPH.
    - b. Aeroflex USA, Inc.; Aerofix-U.
    - c. ZSi-Foster, Inc.; Cush-A-Therm.
  - 2. Insulation-Insert Material for Copper Piping with Flexible Foamed Elastomeric Insulation: Use the following:
    - a. Flexible foamed elastomeric, ASTM 534, Type I-Tubular Grade 1 with PUR/PIP support inserts.
- H. Thermal-Hanger Shields for Small Diameter Piping:
  - 1. Manufacturer:
    - a. Hydra-Zorb Company; Klo-Shure Insulation Couplings.
  - 2. Insulation-Insert Material for Small Diameter Piping with Flexible Foamed Elastomeric or Glass Fiber Insulation: Use the following:
    - a. Rigid Hytrel thermoplastic insulation coupling designed for use with pipe or tube NPS 4 and smaller, and insulation from 3/8 inch to 1-1/2 inch thick.

## **2.10 FASTENER SYSTEMS**

- A. Post-Installed Anchors:
  - 1. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers:
      - 1) B-Line by Eaton.
      - 2) DeWalt Engineered by Powers.
      - 3) Hilti, Inc.
      - 4) ITW Ramset/Red Head.
      - 5) MKT Fastening, LLC.
  - 2. Internally Threaded Screw Anchors: Internally threaded, self-tapping screw anchor designed for performance in cracked and uncracked concrete. Suitable base materials include normal-weight concrete, sand-lightweight concrete and concrete over steel deck.

- a. UL Listed or FMG approved for fire sprinkler piping.
  - b. Available Sizes: For 1/4-inch, 3/8-inch, and 1/2-inch diameter rod sizes
  - c. Manufacturers:
    - 1) B-Line by Eaton; Rapid Rod Hangers.
    - 2) DeWalt Engineered by Powers; Snake+.
3. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application. Exception: Do not use chemical fasteners to support hanger systems for fire protection piping.
- a. Manufacturers:
    - 1) DeWalt Engineered by Powers.
    - 2) Hilti, Inc.
    - 3) ITW Ramset/Red Head.
    - 4) MKT Fastening, LLC.
  - b. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
  - c. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
  - d. Washer and Nut: Zinc-coated steel.

## 2.11 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## 2.12 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, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Refer to application schedules on the Drawings.
- B. For insulated pipe, oversize hanger elements to accommodate insulation thickness.
- C. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- D. Comply with MSS SP-58 for pipe hanger selections and applications that are not specified in piping system Sections.

- E. Use hangers and supports with galvanized, metallic coatings for outdoor applications or where exposed to outdoor conditions.
- F. Use hangers and supports with plastic coating, or galvanized metallic coatings for applications in corrosive atmospheres.
- G. Use metal framing, with plastic coating, or galvanized metallic coatings for metal framing in corrosive atmospheres.
- H. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- I. Use padded hangers for piping that is subject to scratching.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. MSS Type 8 or spring type to meet system requirements.
- K. 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 for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F 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 piping installations.
- L. Concrete Structure Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Anchor Devices, Concrete and Masonry: in accordance with Group I, Group II, Type 2, Class 2, Style 1 and Style 2, Group III and Group VIII or FS FF-S-325A. Furnish cast-in floor type equipment anchor devices with adjustable positions. Furnish built in anchor devices for masonry, unless otherwise approved by the Architect. Powder actuated anchoring devices shall not be used to support any mechanical systems components.
  - 2. Inserts, Concrete: TYPE 18 or 19. When applied to loads equivalent to piping in sizes NPS 2 and larger, and where otherwise required by imposed loads, a one foot length of 1/2 inch reinforcing rod shall be inserted and wired through wing slots. Proprietary type continuous inserts may be proposed and shall be submitted for approval.
  - 3. Use mechanical-expansion anchors where required in concrete construction.
  - 4. Use chemical fasteners where required in concrete construction.
- M. Steel Frame Structure Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Beam Clamps:
    - a. Center Loading: TYPE 21, 28, 29 and 30, unless otherwise indicated. Type 27 shall be allowed to support single pipes NPS 6 size or smaller only.
    - b. "C" Clamps: Type 19, 20 or 23, for supporting single pipes NPS 2-1/2 size or smaller only. Use of "C" clamps, or beam clamps of "C" pattern, or any modification thereof, is prohibited for supporting multiple pipes or pipes larger than NPS 2-1/2.

- N. Hanger-Rod Attachments for Wood Construction: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. All Steel Ceiling Plates: UL listed and suitable for attachment to wood beams. For pipe sizes NPS 1/2 to NPS 2. Install in accordance with manufacturer's instructions to maintain listing.
  2. Threaded Side Beam Brackets: UL listed and FMG approved, suitable for attachment to wood beams. For pipe sizes NPS 2 to NPS 4. Install in accordance with manufacturer's instructions to maintain listing.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Use spring supports and sway braces TYPES 48, 49, 50, 51, 52, 53, 54, 55 or 56. For specific points:
    - a. Provide spring supports at point of support where vertical movement will occur.
    - b. For light loads and vertical movement less than 1/4 inch, TYPES 48 or 49 spring cushion supports.
    - c. For vertical movements in excess of 1/4 inch but less than 1/2 inch, TYPES 51, 52 or 53 variable spring supports shall be used, loaded to not more than 75 percent of published load rating.
    - d. For vertical movements of 1/2 inch and more, TYPES 54, 55 and 56 constant support spring hangers.
    - e. Sway braces; TYPE 50.
    - f. Variable spring hangers in accordance with referenced MSS Standards with "medium" allowable load change.
- P. Comply with MSS SP-58 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structural frame.
- B. Provide necessary piping and equipment supporting elements including: building structure attachments, supplementary steel, hanger rods, stanchions and fixtures, vertical pipe attachments, horizontal pipe attachments, anchors, guides, spring supports in accordance with the referenced codes, standards, and requirements specified. Support piping and equipment from building structure, not from roof deck, floor slab, other pipe, duct or equipment.
- C. At connections between piping systems, hangers and equipment of dissimilar metals, insulate, using dielectric insulating material, nonferrous piping against direct contact with the building steel by insulating the contact point of the hanger and pipe or the hanger and building steel. Test each point of dielectric insulation with an ohm meter to ensure proper isolation of dissimilar materials. Test shall be observed by the Owner's Representative and/or Architect.
- D. Use copper plated or plastic coated supporting element in contact with copper tubing or glass piping.
- E. File and paint cut ends and shop or field prime paint supporting element components.

- F. Secure Type 40 shields to support elements in a manner that prevents movement and damage to insulation and jacket materials.
- G. Hang piping parallel with the lines of the building, unless otherwise indicated. Route piping in an orderly manner and maintain gradient. Space piping and components so a threaded pipe fitting may be removed between adjacent pipes and so there will be not less than 1/2 inch of clear space between finished surfaces and piping. Arrange hangers on adjacent parallel service lines in line with each other.
- H. Flange loads on connected equipment shall not exceed 75 percent of maximum allowed by equipment manufacturer. Flange loads in liquid containing systems shall be checked in the presence of the Architect when piping is full of liquid. No flange load is allowed on pumps, vibration isolated equipment or flexible connectors.
- I. Spring supports, within specified limitations: Constant support type, where necessary to avoid transfer of load from support to support or onto connected equipment; otherwise, variable support type located at points subject to vertical movement.
- J. Incorporate pipe anchors into piping systems to maintain permanent pipe positions. Install alignment guides for the piping adjacent to and on each side of pipe expansion loops and expansion joints to maintain alignment.
- K. Where necessary, brace piping and supports against reaction, sway and vibration.
- L. Do not hang piping from joist pans, floor decks, roof decks, equipment, ductwork, or other piping.
- M. Install turnbuckles, swing eyes and clevises to accommodate temperature changes, pipe accessibility, and adjustment for load pitch. Rod couplings are not acceptable.
- N. Install hangers and supports for piping at intervals specified, at locations not more than 3 feet from the ends of each runout, not more than 3 feet from connections to equipment, and not over 25 percent of specified interval from each change in direction of piping and for concentrated loads such as valves, etc.
- O. Base the load rating for pipe support elements on loads imposed by insulated weight of pipe filled with water. The span deflection shall not exceed slope gradient of pipe.
- P. If structural steel, roofs, or tunnels will allow support spacing greater than that shown above, Contractor shall submit proposed support system along with structural calculations documenting the allowance of such spacing, in accordance with ANSI, B31.1, and MSS Guidelines.
- Q. Support vertical risers independently of connected horizontal piping whenever practical, with supports at the base and at intervals to accommodate system range of load with thermal conditions. Support vertical risers at each floor penetration for piping in shafts or chases. Guide for lateral stability. Fit horizontal piping connected to moving risers with two spring supports connected adjacent to riser, spaced according to required hanger spacing.
- R. For risers at temperatures of 100 deg F or less place riser clamps under fittings. Support carbon steel pipe at each operating level or floor and at not more than 15-foot intervals for pipe 2 inches and smaller, and at not more than 20 foot intervals for pipe 2-1/2 inches and larger.
- S. After the piping systems have been installed, tested and placed in satisfactory operation, firmly tighten hanger rod nut and jam nut and upset threads to prevent movement of fasteners.
- T. Attach pipe anchors and pipe alignment guides to the building structure where indicated. If not indicated, the method used is optional to the Contractor, subject to approval by the Architect. In the case of structural

steel, make attachment by clamping in accordance with the American Institute of Steel Construction Specification for the Design, Fabrication and Erection of Structural Steel for Building.

- U. Attach supporting elements connected to structural steel columns to preclude vertical slippage and cascading failure.
- V. Attach pipe hangers and other supporting elements to roof purlins and trusses at panel points.
- W. Where eccentric loading beam clamps are approved and where other work is supported by similar eccentric loading support element from the same structural member, locate eccentric loading support elements to minimize structural member torsion load.
- X. Limit the location of supporting elements for piping and equipment, when supported from roof, to panel points of the bar joists.
- Y. Building structure shall not be reinforced except as approved by the Architect in writing.
- Z. Use approved cast-in-place inserts or built-in anchors for attachment to concrete structure. Size inserts and anchors for the total applied load with a safety factor in accordance with applicable codes but in no case less than 5. Coordinate installation of all imbedded items in accordance with manufacturer's instructions. Position anchorage and imbedded items as indicated and/or where required and support against displacement during placing of concrete. Cutting or repositioning of concrete beam or girder or reinforcing steel to accommodate inserts will not be allowed. Provide removable closures in imbedded device openings to prevent entry of concrete.
- AA. Support piping and equipment from concrete building frame, not from roof or floor slabs unless otherwise indicated.
- BB. Use cast-in-place inserts in concrete beams and girders. Drilled anchors/wedge type inserts shall be used on vertical surfaces only. Coordinate with structural engineer.
- CC. Attach piping supports to the side of concrete beams and concrete joist. Provide supplementary support steel as required. Cast-in-place or drilled anchors will not be permitted in the bottom of concrete beams and concrete joist.
- DD. Attach piping supports to the side of concrete beams or concrete joist. Where intermediate hangers are required to meet the hanger spacing schedule, the Contractor may propose attachment of intermediate pipe supports to the bottom of the concrete slab pending submittal of a satisfactory pull out test. The Contractor shall submit pull out test criteria, pull out test results, proposed hanger detail and hanger point loads to the Architect for written approval.
- EE. 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 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.
- FF. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- GG. Fastener System Installation:



1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- HH. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- II. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- JJ. Install hangers and supports to allow controlled thermal 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.
- KK. Install lateral bracing with pipe hangers and supports to prevent swaying.
- LL. 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.
- MM. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- NN. 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.
- OO. Refer to individual piping sections for hanger spacing and hanger rod sizes.

### 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.

**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.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 200529

## SECTION 200553 - MECHANICAL IDENTIFICATION

### 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Samples: For color, letter style, and graphic representation required for each identification material and device.
- B. Valve numbering scheme.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in Maintenance Manuals.

#### 1.5 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME (ANSI) A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

#### 1.6 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:
1. Seton.
  2. Brady.
  3. EMED.
  4. Craftmark.
  5. Brimar Industries, Inc.
  6. Marking Services Inc. (MSI).
  7. Kolbi Pipe Marker Co.

### 2.2 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
1. Data:
    - a. Manufacturer, product name, model number, and serial number.
    - b. Capacity, operating and power characteristics, and essential data.
    - c. Labels of tested compliances.
  2. Location: Accessible and visible.
  3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
1. Terminology: Match schedules as closely as possible.
  2. Data:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Data: Instructions for operation of equipment and for safety procedures.
  2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  3. Thickness: Minimum 1/16 inch, unless otherwise indicated.
  4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

### 2.3 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
  - 1. Colors: Comply with ASME (ANSI) A13.1, unless otherwise indicated.
  - 2. Type and Size of Letters: Comply with ANSI A13.1, unless otherwise indicated.
  - 3. Legends: Spelled out in full or commonly used and accepted abbreviations.
  - 4. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
  - 5. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
  - 6. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
  - 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
  - 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

### 2.4 DUCT IDENTIFICATION DEVICES

- A. Duct Markers: Vinyl, 2-inch minimum character height, with permanent pressure sensitive adhesive. Include direction and quantity of airflow, air handling unit or fan number, and duct service (such as supply, return, and exhaust).

### 2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme. To match existing numbering scheme. Provide 5/32-inch hole for fastener.
  - 1. Material: 0.032-inch- thick brass.
  - 2. Valve-Tag Fasteners: Brass wire-link chain or beaded chain.

### 2.6 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
  - 2. Frame: Finished hardwood or extruded aluminum.
  - 3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 20, 21, 22, and 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

### 3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
1. Fans, blowers, primary balancing dampers, and mixing boxes.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
    - a. Fans, blowers, primary balancing dampers, and mixing boxes.
    - b. Tanks and pressure vessels.
- C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
1. Identify mechanical equipment with equipment markers in the following color codes:
    - a. Green: For cooling equipment and components.
    - b. Yellow: For heating equipment and components.
    - c. Orange: For combination cooling and heating equipment and components.
    - d. Brown: For energy-reclamation equipment and components.
  2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  4. Include signs for the following general categories of equipment:
    - a. Fans, blowers, primary balancing dampers, and mixing boxes.
    - b. Tanks and pressure vessels.
- D. Install access panel markers with screws on equipment access panels.

- E. Area Served: Equipment serving different areas of a building other than where the equipment is installed shall be permanently marked in a manner that, in addition to identifying the equipment as specified in this Section, also identifies the area it serves.

### 3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
  - 1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.
  - 2. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, minimum 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed 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 nonaccessible 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 along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

### 3.4 DUCT IDENTIFICATION

- A. Install engraved duct markers with permanent adhesive on air ducts in the following color codes:
  - 1. Refer to Schedule.
  - 2. ASME (ANSI) A13.1 Colors and Designs: For hazardous material exhaust.
  - 3. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- B. Identify ductwork with vinyl markers and flow direction arrows.
- C. Locate markers at air handling units, each side of floor and wall penetrations, near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

### 3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
  - 1. Valve-Tag Size and Shape:
    - a. Cold Water: Minimum 1-1/2 inches, round or square.
    - b. Hot Water: Minimum 1-1/2 inches, round or square.
    - c. Fire Protection: Minimum 1-1/2 inches, round or square.

**3.6 VALVE-SCHEDULE INSTALLATION**

- A. Mount valve schedule on wall in accessible location in each major equipment room.

**3.7 ADJUSTING**

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

**3.8 CLEANING**

- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

**3.9 SCHEDULES**

- A. Paint colors are listed here for reference only. Painting is specified under Division 9.

**PIPE LABELING AND COLOR CODING**

<u>Pipe System Label</u>	<u>Drawing Abbrev.</u>	<u>Labels</u>	<u>Piping</u>
Sanitary Sewer	SAN	White on Green	Dark Brown
Sanitary Vent	V	White on Green	Dark Brown
Domestic Cold Water	CW	White on Green	Light Green
Domestic Hot Water	HW	Black on Yellow	Dark Green
Fire Protection	FP	White on Red	Bright Red

**SHEET METAL WORK**

<u>Service</u>	<u>Abbrev.</u>	<u>Labels</u>	<u>Ductwork</u>
Air Conditioning Supply	Supply Air	White on Green	White
Air Conditioning Return	Return Air	White on Green	White
Exhaust Systems	Exhaust Air	Black on Yellow	Green

END OF SECTION 200553



## SECTION 200700 - MECHANICAL 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 20 Section "Hanger and Supports" for thermal hanger shield inserts.
  - 4. Division 22 Section "Plumbing Fixtures: for protective shielding guards.
  - 5. Division 23 Section "Metal Ducts" for duct liners.

#### 1.2 SUMMARY

- A. This Section includes mechanical insulation for pipe, duct, and equipment.

#### 1.3 DEFINITIONS

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. PSK: Polypropylene, scrim, kraft paper.
- D. PVC: Polyvinyl Chloride.
- E. SSL: Self-sealing lap.

#### 1.4 INDOOR PIPING INSULATION SYSTEMS DESCRIPTION

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are scheduled on the Drawings, or identified for each piping system and pipe size range.

#### 1.5 INDOOR DUCT AND PLENUM INSULATION SYSTEMS DESCRIPTION

- A. Acceptable indoor duct and plenum insulation materials and thicknesses are scheduled on the Drawings.

#### 1.6 EQUIPMENT INSULATION SYSTEMS DESCRIPTION

- A. Acceptable equipment insulation materials and thicknesses are scheduled on the Drawings.

### 1.7 FIELD-APPLIED JACKETING SYSTEMS DESCRIPTION

- A. Acceptable field-applied jacketing materials and thicknesses are scheduled on the Drawings, or identified for each piping system and pipe specialty.
- B. Steam Condensate Piping within Air Handling Units: Aluminum, Stucco Embossed: 0.016 inch thick.
- C. Piping Within Energy Recovery Units: Type 304 Stainless Steel, Smooth: 0.010 inch thick. Seams and joints calked with chemically resistant sealer.
- D. Steam Pressure Reducing Valves: Sound Barrier Jacketing: Smooth or stucco embossed.

### 1.8 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
  - 1. ESR Report: For fire-rated grease duct insulation.

### 1.9 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, 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.
- B. Ductwork Maximum Temperature Limits: Based on ASTM C 411 test procedures.

### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Prior to installation, protect insulation from exposure to water and from physical damage. Prior to installation, store insulation in manufacturer's original packaging.

### 1.11 COORDINATION

- A. Coordinate size and location of supports, hangers, and pre-insulated pipe shields/supports specified in Division 20 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork 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.

## 1.12 SCHEDULING

- A. Schedule insulation application after pressure testing systems. 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, GENERAL REQUIREMENTS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. 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.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Adhesives used shall be fire resistant in their dry states and UL listed.

### 2.2 PIPE INSULATION MATERIALS

- A. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Aeroflex USA, Inc.; Aerocel Tube and Sheet.
    - b. Armacell LLC; AP Armaflex.
    - c. IK Insulation Group; K-Flex USA LLC; Insul-Tube and Insul-Sheet.
- B. Glass-Fiber, Preformed Pipe Insulation, Type I:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Johns Manville; Micro-Lok.
    - b. Knauf Insulation; 1000 Pipe Insulation.
    - c. Manson Insulation Inc.; Alley-K.
    - d. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F Materials: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

### 2.3 DUCTWORK INSULATION MATERIALS

- A. Blanket Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket **[I] [II with factory-applied vinyl jacket] [III with factory-applied FSP jacket] [or Type III with factory-applied PSK jacket]**. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. CertainTeed Corp.; Duct Wrap.
    - b. Johns Manville; Microlite EQ.
    - c. Knauf Insulation; Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap B.
    - e. Owens Corning; All-Service Duct Wrap.

### 2.4 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, provide one of the products specified.
    - 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.

### 2.5 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to it and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Aeroflex USA, Inc.; Aero seal and Aero seal LVOC.
    - b. Armacell LCC; 520 Adhesive.
    - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
- C. 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, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. Johns Manville Industrial Insulation; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the products specified.

- 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. Red Devil, Inc.; Celulon Ultra Clear.
- e. Speedline Corporation; Speedline Vinyl Adhesive.

## 2.6 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, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. Johns Manville Industrial Insulation; 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 at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  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, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-10.
    - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
    - c. Johns Manville Industrial Insulation; 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 at 0.0625-inch dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 200 deg F.
  4. Solids Content: 63 percent by volume and 73 percent by weight.
  5. Color: White.

## 2.7 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; 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.
  5. Color: Aluminum.
- B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; 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.
    5. Color: White.

## 2.8 FACTORY-APPLIED JACKETS

- A. Insulation systems 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. PSK Jacket: Metalized polypropylene, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
- C. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
- D. Metal Jacket:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. PABCO-Childers Metals; Johns Manville Industrial Insulation; Metal Jacketing Systems.
    - b. RPR Products, Inc.; Insul-Mate.
  2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
    - a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
    - b. Finish and thickness are indicated in field-applied jacket schedules.

- c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
- d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick Polysurlyn.
- e. Factory-Fabricated Fitting Covers:
  - 1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
  - 2) Provide factory fabricated PVC tee covers, flange and union covers, beveled collars and valve covers.
  - 3) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.10 REMOVABLE AND REUSABLE INSULATION COVERS

- A. Flexible Style: Custom fabricated composite jackets for valves, flanges, and expansion joints consisting of 4 inches of high temperature fiberglass insulation compressed between Teflon impregnated fiberglass inner and outer facing stitched with fiberglass core Teflon thread, and secured with Velcro fasteners and double D-ring cinching. Service temperature range of minus 40 deg F to 500 deg F.
  - 1. Fabricators:
    - a. Apex Energy & Environmental Products Inc.
    - b. 3i Supply Co.; K-TEX.
    - c. Valley Group of Companies.
- B. Rigid Style: Custom fabricated composite jackets for valves, flanges, and expansion joints consisting of rigid foam insulation with silicone impregnated fiberglass outer facing stitched with fiberglass thread, and secured with Velcro fasteners and double D-ring cinching. Service temperature range of minus 40 deg F to 500 deg F.
  - 1. Fabricators:
    - a. Valley Group of Companies.

## 2.11 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Ideal Tape Co., Inc., an American Biltrite company; 728 Cold Seal ASJ or comparable products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. 3M Venture Tape.
  - 2. Width: 3 inches.
  - 3. Thickness: 9 mils.
  - 4. Adhesion: 70 ounces force/inch in width.
  - 5. Elongation: 3 percent.
  - 6. Tensile Strength: 45 lbf/inch 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 rubber or acrylic adhesive; complying with ASTM C 1136 and UL listed.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ideal Tape Co., Inc., an American Biltrite company; 491 FSK or 791 Cold Seal Acrylic FSK, or comparable products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. 3M Venture Tape.
  2. Width: 3 inches.
  3. Thickness: 6 mils.
  4. Adhesion (Rubber Adhesive): 100 ounces force/inch in width.
  5. Adhesion (Acrylic Adhesive): 90 ounces force/inch in width.
  6. Elongation: 3 percent.
  7. Tensile Strength: 35 lbf/inch in width.
  8. 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. Basis-of-Design Product: Subject to compliance with requirements, provide Ideal Tape Co., Inc., an American Biltrite company; 370 White PVC tape, or comparable products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. 3M Venture Tape.
  2. Width: 2 inches.
  3. Thickness: 5 mils.
  4. Adhesion: 20 ounces force/inch in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: 15 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Ideal Tape Co., Inc., an American Biltrite company; 488 AWF rubber adhesive or 788 Cold Seal acrylic adhesive, or comparable products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. 3M Venture Tape.
  2. Width: 3 inches.
  3. Thickness: 3.0 to 4.0 mils.
  4. Adhesion (Rubber Adhesive): 90 ounces force/inch in width.
  5. Adhesion (Acrylic Adhesive): 50 ounces force/inch in width.
  6. Elongation: 3 percent.
  7. Tensile Strength: 14 to 20 lbf/inch in width.

## 2.12 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. PABCO-Childers Metals; Johns Manville Industrial Insulation; Pab-Bands and Fabstraps.



- b. RPR Products, Inc.; Bands.
  2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
  3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch 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, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
    - a. Products: Subject to compliance with requirements, provide one of the products specified.
      - 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, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
    - a. Products: Subject to compliance with requirements, provide one of the products specified.
      - 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, provide one of the products specified.
      - 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 thick by 2 inches square.
    - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- 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, provide one of the products specified.

- 1) GEMCO; Nylon Hangers.
  - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
  - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
  - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
  - 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, provide one of the products specified.
    - 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 thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- 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- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Products: Subject to compliance with requirements, provide one of the products specified.
    - 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- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Manufacturers:
    - 1) GEMCO.
    - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.
1. Manufacturers:
    - a. ACS Industries, Inc.

- b. C & F Wire.
- c. PABCO-Childers Metals; Johns Manville Industrial Insulation.
- d. RPR Products, Inc.

### **2.13 CORNER ANGLES**

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, 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. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that applies 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.

### **3.3 COMMON 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 the 4 o'clock or 8 o'clock position on 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 as recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. For services with surface temperatures below ambient, install a continuous unbroken vapor barrier. 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 thermal hanger 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 thermal hanger 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- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at the 4 o'clock or 8 o'clock position on the pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches 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. Where compression of insulation is possible, fabricate/install insulation per manufacturer's recommendations.
- 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 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 below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations that Are Not Fire Rated: Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations:
1. Terminate ductwork insulation at angle closure of fire damper sleeves.
  2. Install pipe insulation continuously through penetrations of fire-rated walls and partitions.
    - a. Firestopping is specified in Division 07 Section "Through-Penetration Firestop Systems."
- D. 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 angle closure of fire damper sleeves.
  2. Pipe: Install insulation continuously through floor penetrations.
    - a. Seal penetrations through fire-rated assemblies according to Division 07 Section "Through-Penetration Firestop Systems."

### 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, 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 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 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.
- E. Install removable and reusable insulation covers in accordance with fabricator's instructions, and at the following locations:

### 3.6 FLEXIBLE ELASTOMERIC PIPE 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 GLASS-FIBER AND MINERAL WOOL PIPE 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 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 PVC fitting covers when available.
  - 2. When PVC fitting covers are not available, install preformed pipe insulation to outer diameter of pipe flange:
    - a. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

- b. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with fiberglass or mineral wool blanket insulation as specified for system.
  3. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install PVC fitting covers when available.
  2. When PVC fitting covers 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 PVC fitting covers when available.
  2. When PVC fitting covers 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.

### 3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. 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 overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- C. Where PVC jackets are indicated, install with 1-inch 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 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 o.c. and at end joints.
- E. Where self-adhesive jackets are indicated, install according to manufacturer's instructions and details on the drawings. Overlap seams arranged to shed water.
- F. Where sound barrier jackets are indicated, install in accordance with manufacturer's instructions.

### 3.9 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system specified in Division 09 painting Sections.



- 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.

END OF SECTION 200700

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## SECTION 211100 - FIRE-SUPPRESSION 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.
- B. Provisions of Division 20 Section "Mechanical General Requirements" apply to this Section.
- C. Related Sections include the following:
  - 1. Division 10 Section "Fire-Protection Specialties" for cabinets and fire extinguishers.
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 20 Section "Hangers and Supports."
  - 4. Division 28 Section "Fire Alarm" for alarm devices not specified in this Section.

#### 1.2 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure higher than standard 175 psig.
- C. PE: Polyethylene plastic.
- D. Underground Service-Entrance Piping: Underground service piping below the building.
- E. Hose Connection: Valve with threaded outlet matching fire hose coupling thread for attaching fire hose.
- F. Hose Station: Hose connection, fire hose rack, and fire hose.
- G. Working Plans: Documents, including drawings, calculations, and material specifications prepared according to NFPA 13 and NFPA 14 for obtaining approval from authorities having jurisdiction.

#### 1.3 SYSTEM DESCRIPTIONS

- A. Automatic Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.
- B. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.
- C. Preaction Sprinkler System: Automatic sprinklers are attached to piping containing air. Actuation of fire-detection system in same area as sprinklers opens deluge valve, permitting water to flow into piping and to discharge from sprinklers that have opened.

- D. Deluge Sprinkler System: Open sprinklers are attached to piping connected to water supply through deluge valve. Fire-detection system in same area as sprinklers opens valve. Water flows into piping system and discharges from attached sprinklers when valve opens.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. High-Pressure Piping System Component Working Pressure: Listed for 300 psig.
- C. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- D. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
  - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
  - 2. Sprinkler Occupancy Hazard Classifications, for bidding purposes, as follows:
    - a. Automobile Parking Areas: Ordinary Hazard, Group 1.
    - b. General Storage Areas: Ordinary Hazard, Group 1.
    - c. Office and Public Areas: Light Hazard.
    - d. Residential Living Areas: Light Hazard.
  - 3. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Light-Hazard Occupancy: 0.10 gpm/sq. ft. over 1500-sq. ft. area.
    - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
  - 4. Minimum Density for Deluge-Sprinkler Piping Design:
    - a. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/sq. ft. over entire area.
    - b. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm/sq. ft over entire area.
  - 5. Maximum Protection Area per Sprinkler:
    - a. Office Spaces: 225 sq. ft.
    - b. Storage Areas: 130 sq. ft.
    - c. Mechanical Equipment Rooms: 130 sq. ft.
    - d. Electrical Equipment Rooms: 130 sq. ft.
    - e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.
- E. Water velocity in the piping system shall not exceed the following:
  - 1. Underground mains: 16 ft./sec.
  - 2. Aboveground mains: 32 ft./sec.
  - 3. Sprinkler branch lines: 24 ft./sec.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- B. Delegated-Design Submittal: For sprinkler systems 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. Qualification Data: For qualified Installer.
- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.
  - 1. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification number (SIN) or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.
- E. Fire-hydrant flow test report.

## 1.7 CLOSEOUT SUBMITTALS

- A. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping".
- B. Field quality-control reports.
- C. Operation and Maintenance Data: For sprinkler specialties to include in operation and maintenance manuals.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. The provisions and requirements of the NFPA and FMG constitute mandatory minimum requirements for the work of this Section.
- C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13, "Installation of Sprinkler Systems."
- D. Grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer.

## 1.9 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Coordinate with ceiling installer to ensure proper grid type and installation for use with flexible sprinkler drops.

## 1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

## 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, pressure class 350, with mechanical-joint bell end and plain end.
  - 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 gland, rubber gasket, and steel bolts and nuts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, pressure class 350, with push-on-joint bell end and plain end.
  - 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.

### 2.3 STANDARD-WEIGHT BLACK STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends, and with factory applied antimicrobial coating on inner wall of pipe.
  - 1. Cast-Iron Threaded Flanges: ASME B16.1.
  - 2. Malleable-Iron Threaded Fittings: ASME B16.3.
  - 3. Gray-Iron Threaded Fittings: ASME B16.4.
  - 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.

5. Steel Threaded Couplings: ASTM A 865.
- B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, and with factory applied antimicrobial coating on inner wall of pipe.
1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
  2. Steel Flanges and Flanged Fittings: ASME B16.5.

## 2.4 STANDARD-WEIGHT GALVANIZED STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized, with factory- or field-formed threaded ends.
1. Cast-Iron Threaded Flanges: ASME B16.1, hot-dip galvanized.
  2. Malleable-Iron Threaded Fittings: ASME B16.3, hot-dip galvanized.
  3. Gray-Iron Threaded Fittings: ASME B16.4, hot-dip galvanized.
  4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe, hot-dip galvanized. Include ends matching joining method.
  5. Steel Threaded Couplings: ASTM A 865, hot-dip galvanized.

## 2.5 SCHEDULE 10 BLACK STEEL PIPE AND FITTINGS

- A. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13 specified wall thickness in NPS 6 to NPS 10, and with factory applied antimicrobial coating on inner wall of pipe.
1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
  2. Steel Flanges and Flanged Fittings: ASME B16.5.
- B. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10; with factory- or field-formed, roll-grooved ends, and with factory applied antimicrobial coating on inner wall of pipe.
1. Grooved-Joint Piping Systems:
    - a. Manufacturers:
      - 1) Anvil; Model 7401; ASC Engineered Solutions.
      - 2) Tyco Fire Protection Products by Johnson Controls Company; Grinnell G-Fire.
      - 3) Victaulic Co. of America; Style 005H, 009N, or !07N.
    - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
    - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, rubber gasket listed for use with housing, and steel bolts and nuts.

## 2.6 COVER SYSTEM FOR SPRINKLER PIPING

- A. Manufacturers:

1. DecoShield Systems, Inc.
- B. Description: System of support brackets and covers made to protect sprinkler piping.
- C. Brackets: Glass-reinforced nylon.
- D. Covers: Extruded PVC sections of length, shape, and size required for size and routing of CPVC piping.

## 2.7 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 300-psig working-pressure rating if fittings are components of high-pressure piping system.
- B. Sprinkler Drain and Alarm Test Fittings: Cast-bronze or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
  1. Manufacturers:
    - a. Tyco Fire Protection Products by Johnson Controls Company.
    - b. Fire-End and Croker Corp.
    - c. Viking Corp.
    - d. Victaulic Co. of America; Style 720 TestMaster II.
- C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
  1. Manufacturers:
    - a. Elkhart Brass Mfg. Co., Inc.
- D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
  1. Manufacturers:
    - a. AGF Manufacturing Co.
    - b. G/J Innovations, Inc.
    - c. Triple R Specialty of Ajax, Inc.
    - d. Tyco Fire Protection Products by Johnson Controls Company.
- E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
  1. Manufacturers:
    - a. CECA, LLC.
    - b. Merit.
- F. Flexible Sprinkler Drop Fittings:
  1. Manufacturers:
    - a. Victaulic Co. of America; VicFlex Sprinkler Fittings; AH-2 or AH2-CC with AB1 Bracket Assembly.



- b. Reliable Automatic Sprinkler Co., Inc.; RASCOflex Series RFB.
  - c. FlexHead Industries, Inc.; ASC Engineered Solutions
- 2. Description: UL listed and FMG approved stainless steel flexible hose for connection to sprinkler, and with bracket for connection to commercial ceiling grid.
  - 3. Standard: UL 2443.
  - 4. Pressure Rating: 175 psig minimum; 300 psig if fittings are components of high-pressure piping system.
  - 5. Size: Same as connected piping, for sprinkler.
- G. Dry-Pipe-System Fittings: UL listed for dry-pipe service.

## 2.8 LISTED FIRE-PROTECTION VALVES

- A. Valves: UL listed or FMG approved.
- 1. Valves shall have 175-psig minimum pressure rating.
- B. Gate Valves with Wall Indicator Posts:
- 1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
  - 2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with operating wrench, extension rod, locking device, and cast-iron barrel.
  - 3. Manufacturers:
    - a. McWane, Inc.; Kennedy Valve Div.
    - b. NIBCO.
    - c. Crane Co.; Crane Valve Group; Stockham Valves.
- C. Ball Valves: Comply with UL 1091, except with ball instead of disc.
- 1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
  - 2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
  - 3. NPS 3: Ductile-iron body with grooved ends.
  - 4. Manufacturers:
    - a. NIBCO.
    - b. Victaulic Co. of America.
- D. Butterfly Valves: UL 1091.
- 1. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
    - a. Manufacturers:
      - 1) McWane, Inc.; Kennedy Valve Div.
      - 2) Mueller Company; ASC Engineered Solutions.
      - 3) NIBCO.
      - 4) Tyco Fire Protection Products by Johnson Controls Company.
      - 5) Victaulic Co. of America; Series 705.
- E. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Manufacturers:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Valves.
  - d. Hammond Valve.
  - e. McWane, Inc.; Kennedy Valve Div.
  - f. Mueller Company; ASC Engineered Solutions.
  - g. NIBCO.
  - h. Tyco Fire Protection Products by Johnson Controls.
  - i. Victaulic Co. of America.
  - j. Watts Water Technologies, Inc.; Watts Regulator Co.

F. Gate Valves: UL 262, OS&Y type.

1. NPS 2 and Smaller: Bronze body with threaded ends.
  - a. Manufacturers:
    - 1) Crane Co.; Crane Valve Group; Crane Valves.
    - 2) Hammond Valve.
    - 3) NIBCO.
2. NPS 2-1/2 and Larger: Cast or ductile -iron body with flanged or grooved ends.
  - a. Manufacturers:
    - 1) McWane, Inc.; Clow Valve Co.
    - 2) Crane Co.; Crane Valve Group; Crane Valves.
    - 3) Crane Co.; Crane Valve Group; Jenkins Valves.
    - 4) Hammond Valve.
    - 5) Milwaukee Valve Company.
    - 6) Mueller Company.
    - 7) NIBCO.
    - 8) Victaulic Co. of America: Series 771.

## 2.9 UNLISTED GENERAL-DUTY VALVES

- A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.
- B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

## 2.10 ALARM CHECK VALVES

- A. General Requirements:

1. Standard: UL listed or FMG approved.
2. Pressure Rating:
  - a. Standard-Pressure Valves: 175 psig minimum.
  - b. High-Pressure Valves: 300 psig .
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Manufacturers:

1. Reliable Automatic Sprinkler Co., Inc.
2. Tyco Fire Protection Products by Johnson Controls Company.
3. Viking Corp.
4. Victaulic Co. of America.

C. Description: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.

1. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
2. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

## 2.11 AUTOMATIC (BALL DRIP) DRAIN VALVES

A. General:

1. Standard: UL 1726.
2. Pressure Rating: 175 psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

B. Manufacturer:

1. Reliable Automatic Sprinkler Co., Inc.
2. Tyco Fire Protection Products by Johnson Controls Company.

## 2.12 MANUAL CONTROL STATIONS

- A. Manual Control Stations: UL listed or FMG approved, hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

## 2.13 CONTROL PANELS

- A. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.

1. Panels: UL listed and FMG approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
2. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and a cover held closed by breakable strut.
3. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut.

## 2.14 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 300-psig pressure rating if sprinklers are components of high-pressure piping system.
- B. Manufacturers:
  1. Reliable Automatic Sprinkler Co., Inc.
  2. Tyco Fire Protection Products by Johnson Controls Company.
  3. Victaulic Co. of America.
  4. Viking Corp.
- C. Automatic Sprinklers:
  1. With heat-responsive glass bulb element complying with the following:
    - a. UL 199, for nonresidential applications.
    - b. UL 1626, for residential applications.
    - c. UL 1767, for early-suppression, fast-response applications.
    - d. Orifice: 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
    - e. Orifice: 17/32 inch, with discharge coefficient K between 7.4 and 8.2.
- D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for 165 deg F "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
- E. Sprinkler types, features, and options as follows:
  1. Pendent sprinklers.
  2. Quick-response sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and painted.
- G. Special Coatings: Wax, lead, and corrosion-resistant paint.
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers. Escutcheons listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.
  1. Ceiling Mounting: Chrome-plated steel, 2 piece, with 3/4-inch vertical adjustment.
  2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler. Sprinkler guards listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

### 2.15 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.

### 2.16 PRESSURE GAGES

- A. Manufacturers:
  - 1. AMETEK, Inc.; U.S. Gauge.
  - 2. Ashcroft Inc.
  - 3. Marsh Bellofram.
  - 4. Viking Corp.
  - 5. Weiss Instruments, Inc.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of 0 to 250 psig minimum.
  - 1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
  - 2. Air System Piping: Include caption "AIR" or "AIR/WATER" on dial face.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.

### 3.2 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 PIPING APPLICATIONS, GENERAL

- A. Flanges, flanged fittings, unions, nipples, grooved-joint couplings, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- B. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints; or grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

- C. Underground Service-Entrance Piping: Ductile-iron, push-on or mechanical-joint pipe and fittings and restrained joints.

### 3.4 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Wet-Pipe Sprinklers: Use the following:

Pipe Type	1 ½" & Smaller	2"	2 ½" – 3 ½"	4"	5" – 6"
Standard weight steel, threaded fittings	YES	YES	YES	YES	NO
Standard weight steel, grooved fittings	NO	NO	YES	YES	YES
Standard weight steel, welded fittings	NO	YES	YES	YES	YES
Schedule 10 steel, welded fittings	NO	YES	YES	YES	YES
Schedule 10 steel, grooved fittings	NO	NO	YES	YES	YES
Type K copper, brazed fittings	NO	NO	NO	NO	NO
Type L copper, brazed fittings	NO	NO	NO	NO	NO
Type K copper, brazed fittings	NO	NO	NO	NO	NO
Type L copper, grooved fittings	NO	NO	NO	NO	NO
CPVC pipe, solvent cement fittings	YES	YES	YES	NO	NO

### 3.5 VALVE APPLICATIONS

- A. The following requirements apply:
1. Listed Fire-Protection Valves: UL listed or FMG approved for applications where required by NFPA 13.
    - a. Shutoff Duty: Use ball, butterfly, or gate valves.
  2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13.
    - a. Shutoff Duty: Use ball, butterfly, or gate valves.
    - b. Throttling Duty: Use ball or globe valves.

### 3.6 JOINT CONSTRUCTION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

- C. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
  - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- D. Use of saddle style tees is not acceptable.
- E. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
  - 1. All grooved couplings, fittings, gaskets, valves, and specialties shall be the product of a single manufacturer.
  - 2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
- F. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for additional requirements.

### 3.7 SERVICE-ENTRANCE PIPING

- A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 33 Section "Water Distribution" for exterior piping.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

### 3.8 WATER-SUPPLY CONNECTION

- A. Connect fire-suppression piping to building's interior water distribution piping.
- B. Install shutoff valve, backflow prevention device, pressure gage, drain, and other accessories indicated at connection to water distribution piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

### 3.9 PIPING INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Install underground ductile-iron service-entrance piping according to NFPA 24 and with restrained joints.
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.

- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install drain valves on standpipes.
- J. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- K. Install alarm devices in piping systems.
- L. Hangers and Supports: Comply with NFPA 13 for hanger materials.
  - 1. Install standpipe system piping according to NFPA 14.
  - 2. Install sprinkler system piping according to NFPA 13, except use of "C" clamps, or beam clamps of "C" pattern, or any modification thereof, is prohibited for supporting pipes larger than NPS 2-1/2.
  - 3. Refer to Division 20 Section "Hangers and Supports" for additional requirements.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- N. Drain dry-type standpipe piping.
- O. Drain dry-pipe sprinkler piping.
- P. Pressurize and check dry-pipe sprinkler system piping.
- Q. Fill wet-standpipe system piping with water.
- R. Fill wet-pipe sprinkler system piping with water.

### **3.10 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING**

- A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and with NFPA 13 or NFPA 13R for supports.

### **3.11 VALVE INSTALLATION**

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Valves for Wall-Type Fire Hydrants: Install nonrising-stem gate valve in water-supply pipe.



- D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.
- E. Specialty Valves:
  - 1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.
  - 2. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
    - a. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.
    - b. Install air compressor and compressed-air supply piping.
  - 3. Deluge Valves: Install in vertical position, in proper direction of flow, in main supply to deluge system.

### 3.12 SPRINKLER APPLICATIONS

- A. Use the following sprinkler types:
  - 1. Rooms with Suspended Ceilings: Pendent sprinklers.
  - 2. Sprinkler Finishes:
    - a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes; white polyester finish in natatoriums.
  - 3. Sprinkler Guards: For exposed sprinkler heads subject to damage.

### 3.13 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.
- B. Install sprinklers into flexible sprinkler drop fittings and install into bracket on ceiling grid. Install according to manufacturer's instructions and NFPA, State, and local guidelines. Ceiling grid must meet requirements of ASTM C 635 and C 636, coordinate with ceiling installer.

### 3.14 CONNECTIONS

- A. Install piping adjacent to equipment to allow service and maintenance.
- B. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.
- C. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.
- D. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

- E. Connect excess-pressure pumps to the following piping and wiring:
  - 1. Sprinkler system, hydraulically.
  - 2. Pressure gages and controls, hydraulically.
  - 3. Electrical power system.
  - 4. Alarm device accessories for pump.
  - 5. Fire alarm.
- F. Connect compressed-air supply to dry-pipe sprinkler piping.
- G. Connect air compressor to the following piping and wiring:
  - 1. Pressure gages and controls.
  - 2. Electrical power system.
  - 3. Fire alarm devices, including low-pressure alarm.
- H. Electrical Connections: Power wiring and fire alarm wiring are specified in Division 26.
- I. Connect alarm devices to fire alarm.
- J. Ground equipment according to Division 26 Section "Grounding and Bonding."
- K. Connect wiring according to Division 26 Section "Conductors and Cables."
- L. 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.

### 3.15 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 20 Section "Mechanical Identification."

### 3.16 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 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. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
  - 5. Verify that equipment hose threads are same as local fire department equipment.
  - 6. Test each backflow prevention device according to authorities having jurisdiction and the device's reference standard.
- B. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- C. Verify that excess-pressure pumps and accessories are installed and operate correctly.
- D. Verify that air compressors and their accessories are installed and operate correctly.
- E. Verify that specified tests of piping are complete.

- F. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- G. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- H. Verify that potable-water supplies have correct types of backflow preventers.
- I. Pressurize and check dry-pipe sprinkler piping air-pressure maintenance devices and air compressors.
- J. Verify that hose connections are correct type and size.
- K. Verify that hose stations are correct type and size.
- L. Energize circuits to electrical equipment and devices.
- M. Start and run excess-pressure pumps.
- N. Start and run air compressors.
- O. Adjust operating controls and pressure settings.
- P. Coordinate with fire alarm tests. Operate as required.
- Q. Coordinate with fire-pump tests. Operate as required.
- R. Report test results promptly and in writing to Architect and authorities having jurisdiction.

**3.17 CLEANING AND PROTECTION**

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Protect sprinklers from damage until Substantial Completion.

**3.18 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

END OF SECTION 211100

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## 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods" for materials and methods common to mechanical piping systems.
  - 3. Division 20 Section "Hangers and Supports."
  - 4. Division 22 Section "General-Duty Valves for Plumbing."
  - 5. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

#### 1.2 SUMMARY

- A. This Section includes domestic water piping inside the building.

#### 1.3 DEFINITIONS

- A. PEX: Crosslinked polyethylene plastic.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Where not indicated on the Drawings, provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.
  - 1. Exception: PEX plastic piping insert fittings specified are limited to 100 psig.

#### 1.5 SYSTEMS DESCRIPTION

- A. Potable and non-potable domestic water piping system materials are scheduled on the Drawing.
- B. Refer to Application Schedules on the Drawings for valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
  - 2. Drain Duty: Hose-end drain valves.
- C. Transition and special fittings with pressure ratings at least equal to piping rating may be used unless otherwise indicated.

**1.6 ACTION SUBMITTALS**

- A. Product Data: For pipe, tube, fittings, and couplings.

**1.7 INFORMATIONAL SUBMITTALS**

- A. 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.

**1.8 CLOSEOUT SUBMITTALS**

- A. Field quality-control test reports.
- B. Water Samples: Specified in Part 3 "Cleaning" Article.

**1.9 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- C. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components – Lead Content for potable domestic water piping and components.
- E. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be as recommended by the manufacturer of the grooved components.

**1.10 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.

## 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 PIPING MATERIALS

- A. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

### 2.3 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L, 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. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
  3. 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.
- B. Grooved-Joint Systems:
1. Manufacturers:
    - a. Anvil International, Inc.; Gruvlok; Fig. 64 CTS SlideLOK.
    - b. Victaulic Company; Style 606 and Style 607.
  2. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.
  3. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
- C. Copper or Bronze Pressure-Seal Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Viega North America; ProPress System.
    - b. NIBCO Inc.; Press System.
    - c. Mueller Industries, Inc.; Streamline PRS.
    - d. Elkhart Products Corporation; an Aalberts Industries Company; Xpress.
    - e. Apollo Valves; by Conbraco Industries; ApolloXpress.
    - f. Anvil International, Inc.; Anvil Press.
  2. Housing: Copper.
  3. O-Rings and Pipe Stops: EPDM.
  4. Tools: Manufacturer's special tools.
  5. Maximum 200-psig working-pressure rating at 250 deg F.

- D. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube. Mechanically formed tee fittings may be used up to half size of main.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. T-DRILL Industries Inc.

## **2.4 VALVES**

- A. General-duty plumbing valves; and drain valves are specified in Division 22 Section "Plumbing Valves."
- B. Balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."

## **PART 3 - EXECUTION**

### **3.1 EXCAVATION**

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earthwork."

### **3.2 PIPING SYSTEM INSTALLATION**

- A. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 20 Section "Meters and Gages," and strainers are specified in Division 22 Section "Domestic Water Piping Specialties."
- C. 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.
- D. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
  - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
  - 2. Install stop-and-waste drain valves where indicated.
- 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. Calibrated balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."

### **3.3 JOINT CONSTRUCTION**

- A. Basic piping joint construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."



### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 20 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 20 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for drawn-temper copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60-inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 6. NPS 6: 10 feet with 5/8-inch rod.
  - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Soft copper tube: Continuous support using v-shaped plastic pipe channel, maximum hanger spacing 8 feet with 3/8-inch rod.
- H. Alternate support for copper tubing NPS 3/4 and smaller: Continuous support using v-shaped plastic pipe channel, maximum hanger spacing 8 feet with 3/8-inch rod.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect domestic water piping to distribution side of water meter with shutoff valve.
- C. Connect domestic water piping to existing domestic water distribution piping. Use dielectric fitting if connection dissimilar metals. Refer to Application Schedule on the Drawings and Division 20 Section "Basic Mechanical Materials and Methods" for dielectric fittings.

- D. Install piping adjacent to equipment and machines to allow service and maintenance.
- E. Connect domestic water piping to the following:
  - 1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
  - 2. 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 and larger.
  - 3. Booster Pumps: Cold-water suction and discharge piping.
  - 4. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

### 3.6 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
  - 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 24 hours 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 test or inspection, make required corrections and arrange for reinspection.
  - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
  - 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 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 150 psig. 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 required corrective action.

### 3.7 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 plugs used 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.

### 3.8 CLEANING AND DISINFECTION

- A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.
- B. Clean and disinfect potable domestic water piping as follows:
  1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
  2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as 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 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 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.
- C. Prepare and submit reports of purging and disinfecting activities.

END OF SECTION 221116

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## 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 22 Section "Domestic Water Piping " for water meters.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Diagram power, signal, and control wiring.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Field quality-control test reports.
- B. Flow Reports and Settings: For calibrated balancing valves.
- C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- C. 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."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content" for components with wetted surfaces in contact with potable water.

## **PART 2 - PRODUCTS**

### **2.1 BACKFLOW PREVENTERS**

A. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Apollo Valves; Conbraco Industries, Inc.
  - b. Watts Water Technologies, Inc.; Watts Regulator Co.
  - c. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel or Acetal plastic.
6. End Connections: Threaded.

### **2.2 BALANCING VALVES**

A. Calibrated Balancing Valves NPS 1/2 :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Apollo Valves; by Conbraco Industries, Inc.
  - d. Bell & Gossett; Xylem Inc.
  - e. Flo Fab Inc.
  - f. Flow Design Inc.
  - g. Griswold Controls.
  - h. NIBCO INC.
  - i. IMI Indoor Climate; Tour & Andersson.
  - j. Taco, Inc.
  - k. Watts Water Technologies, Inc.; Watts Regulator Co.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: Dezincification resistant brass, or bronze.
4. Minimum Flow Rate: 0.3 gpm.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Calibrated Balancing Valves NPS 3/4 to NPS 2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Apollo Valves; by Conbraco Industries, Inc.
  - d. Bell & Gossett; Xylem Inc.
  - e. Flo Fab Inc.
  - f. Flow Design Inc.
  - g. Griswold Controls.
  - h. NIBCO INC.
  - i. IMI Indoor Climate; Tour & Andersson.
  - j. Taco, Inc.
  - k. Watts Water Technologies, Inc.; Watts Regulator Co.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: Dezincification resistant brass, or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

## 2.1 TEMPERATURE-ACTUATED WATER MIXING VALVES

### A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Controls; Morris Group International; ST70.
  - b. Apollo Valves; Conbraco Industries, Inc.; Model MVD (34D Series).
  - c. Bradley Corporation.
  - d. Lawler Manufacturing Company, Inc.
  - e. Leonard Valve Company; Series 170-LF and 270-LF.
  - f. Watts Water Technologies, Inc.; Powers Division; Hydroguard Series LFe480, LFG480, and LFLM495.
  - g. Watts Water Technologies, Inc.; Watts Regulator Co.
  - h. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1070.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: 1/2-inch union or 3/8-inch compression; with integral check valves.
7. Accessories: Adjustable temperature-control knob.
8. Outlet Temperature Range: Adjustable from 85 deg F to 120 deg F. Set at 105 deg F .
9. Minimum Flow Rate: 0.5 gpm.
10. Valve Finish: Chrome plated.

## 2.2 OUTLET BOXES

### A. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Sioux Chief Manufacturing Company, Inc.; Ox Box.
  - b. Oatey SCS.
  - c. LSP Products Group, Inc.
  - d. Acorn Engineering Company.
2. Mounting: Recessed.
  3. Material and Finish: Enameled- or epoxy-painted-steel or Stainless-steel box and faceplate.
  4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
  5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

### 2.3 STRAINERS FOR DOMESTIC WATER PIPING

#### A. Y-Pattern Strainers:

1. Manufacturers:
  - a. Apollo Valves; Conbraco Industries, Inc.
  - b. Keckley Company.
  - c. Metraflex Company.
  - d. Mueller Steam Specialty; a Watts Brand.
  - e. NIBCO, Inc.
  - f. Titan Flow Control, Inc.
  - g. Watts.
  - h. Yarway; Emerson Automation Solutions.
2. CWP: 200 psig minimum, unless otherwise indicated.
3. SWP: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
5. End Connections: Threaded or soldered for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Screen: Stainless steel with round perforations, unless otherwise indicated.
7. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.033 inch.
  - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
8. Drain: Pipe plug.

### 2.4 AIR VENTS

#### A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 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 minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

## **2.5 TRAP-SEAL PRIMER VALVES**

### **A. Supply-Type, Trap-Seal Primer Valves:**

1. 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 Water Technologies, Inc.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" 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.
  4. Install strainer and soft-seated check valve upstream of backflow preventer. Exception: Fire protection backflow preventers.
- C. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.

- E. Install temperature-actuated water mixing valves with strainers, and 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.
- F. Install Y-pattern strainers for water on supply side of each control valve.
- G. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- H. 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 fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- I. Install ground hydrants with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with grade.
- J. Install draining-type post hydrants with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.
- K. Install nonfreeze, nondraining-type post hydrants set in concrete or pavement.
- L. Install freeze-resistant yard hydrants with riser pipe set in concrete or pavement. Do not encase canister in concrete.
- M. Install water hammer arresters in water piping according to PDI-WH 201.
- N. Install air vents at high points of water piping.
- O. 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.
- P. 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.
- Q. 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 20 and 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."
- C. Connect wiring according to Division 26 Section "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. Carbonated-beverage-machine backflow preventers.
  - 4. Primary, thermostatic, water mixing valves.
  - 5. Outlet boxes.
- 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 20 Section "Mechanical Identification."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
  - 1. Test each backflow prevention device 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 as follows:
  - 1. Set calibrated balancing valves at calculated presettings.
  - 2. Measure flow each station and adjust where necessary.
  - 3. Record settings and mark balancing devices.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

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## 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements".
  - 2. Division 20 Section "Basic Mechanical Materials and Methods".
  - 3. Division 22 Section "Drainage Piping Specialties".
  - 4. Division 22 Section "Sanitary Waste and Vent Piping" for piping outside building.

#### 1.2 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.

#### 1.3 SYSTEMS DESCRIPTIONS

- A. Sanitary waste and vent piping system materials are scheduled on the Drawing.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.

#### 1.5 CLOSEOUT SUBMITTALS

- A. 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. Cast-iron soil pipe shall be marked with the collective trademark of Cast Iron Soil Pipe Institute (CISPI).
- C. 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.

## 1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
  - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

## 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers:
    - a. ANACO-Husky; McWane Plumbing Group.
    - b. Ferguson Enterprises, Inc.; ProFlo (Private labeled IDEAL-TRIDON).
    - c. IDEAL-TRIDON.
    - d. MIFAB, Inc.
    - e. Mission Rubber Company; a division of MCP Industries, Inc.
    - f. Tyler Pipe; McWane Plumbing Group.
  - 2. Standards: CISPI 310.
  - 3. Description: NSF certified for compliance with CISPI 310. Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

- C. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Manufacturers:
    - a. ANACO-Husky; McWane Plumbing Group; SD 4000.
    - b. Ferguson Enterprises, Inc.; ProFlo (Private labeled IDEAL-TRIDON).
    - c. IDEAL-TRIDON; Heavy-Duty "HD" No-Hub Couplings.
    - d. Norma Group; Clamp-All Products; HI-TORQ 125.
  - 2. Standards: ASTM C 1277 and ASTM C 1540, or ASTM C 1277 and FM 1680 Class I.
  - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.1 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.

## 2.2 SPECIALTY 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. 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. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Mission Rubber Co.

- C. 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. Manufacturers:
    - a. SIGMA Corp.

## **PART 3 - EXECUTION**

### **3.1 EXCAVATION**

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

### **3.2 PIPING SYSTEM 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 coordination drawings.
- B. Sanitary sewer piping outside the building is specified in Division 22 Section "Sanitary Sewerage."
- C. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- 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 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 20 Section "Basic Mechanical Materials and Methods."
- G. 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."
- H. 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.
- I. 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.



- J. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Sanitary Drain: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
  - 2. Horizontal Sanitary Drainage Piping: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
  - 3. Vent Piping: 1/8-inch per foot down toward vertical fixture vent or toward vent stack.
- K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### **3.3 JOINT CONSTRUCTION**

- A. Basic piping joint construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- 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. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

### **3.4 SPECIALTY PIPE FITTING INSTALLATION**

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in OD's.
  - 2. In Drainage Piping: Shielded, nonpressure transition couplings.
  - 3. In Aboveground Force Main Piping: Fitting-type transition couplings.
  - 4. In Underground Force Main Piping:
    - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    - b. NPS 2 and Larger: Pressure transition couplings.

### **3.5 VALVE INSTALLATION**

- A. General valve installation requirements are specified in Division 20 Section "Valves."
- B. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 20 Section "Hangers and Supports." 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 and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 20 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. 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: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 5. NPS 6: 10 feet with 5/8-inch rod.
  - 6. NPS 8: 10 feet with 3/4-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.
- I. 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 and larger.

### 3.8 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 20 Section "Mechanical Identification."

### 3.9 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. 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. 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.

**3.10 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 221316

## SECTION 221319 - 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 22 Section "Plumbing Fixtures" for hair interceptors.

#### 1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene plastic.
- D. PE: Polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in operation and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary and storm piping specialty components.

## PART 2 - PRODUCTS

### 2.1 CAST-IRON CLEANOUTS

- A. Size: Cleanouts shall be same nominal size as the pipe they serve up to 4 inches. For pipes larger than 4 inches nominal size, minimum size of cleanout shall be 4 inches.
- B. Exposed Cast-Iron Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.; Series 58910.
    - b. MIFAB, Inc.; C1460.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; 4510 Series.
    - d. Tyler Pipe; Wade Div.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
  2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
  3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
  4. Closure: Countersunk or raised-head, brass or bronze plug with tapered threads.
- C. Cast-Iron Floor Cleanouts (On-Grade Interior Floor Areas):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.; C1220-R.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 4023S-F.
    - e. Tyler Pipe; Wade Div.
    - f. Watts Drainage Products Inc.
    - g. Zurn Plumbing Products Group; Specification Drainage Operation.
  2. Standard: ASME A112.36.2M.
  3. Type: Adjustable housing.
  4. Body or Ferrule: Cast iron.
  5. Clamping Device: Not required.
  6. Outlet Connection: Spigot.
  7. Closure: Brass, bronze, or plastic plug with tapered threads.
  8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
  9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy with scoriated cover in service areas, and recessed cover to accept floor finish material in finished floor areas.
  10. Frame and Cover Shape: Round.
  11. Top Loading Classification: Medium Duty.
  12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- D. Cast-Iron Floor Cleanouts (Not-On-Grade Interior Floor Areas):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Josam Company; Josam Div.
  - b. MIFAB, Inc.; C-1100-C-R-34.
  - c. Sioux Chief Manufacturing Company, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 4333C.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M.
  3. Type: Adjustable housing.
  4. Body or Ferrule: Cast iron.
  5. Clamping Device: Required.
  6. Outlet Connection: Spigot.
  7. Closure: Brass, bronze, or plastic plug with tapered threads.
  8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
  9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy with scoriated cover in service areas, and recessed cover to accept floor finish material in finished floor areas.
  10. Frame and Cover Shape: Round.
  11. Top Loading Classification: Medium Duty.
  12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- E. Cast-Iron Wall Cleanouts (Finished Wall Areas):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.; Model 58790-20.
    - b. MIFAB, Inc.; C1460-RD.
    - 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.
  2. Standard: ASME A112.36.2M. Include wall access.
  3. Body: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
  4. Closure: Countersunk or raised-head, drilled-and-threaded bronze or brass plug with tapered threads.
  5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

## 2.2 TRAP SEAL PROTECTION DEVICES

- A. Barrier Type Trap Seal Protection Devices:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Smith, Jay R. Mfg. Co.; Quad Close Trap Seal Device Fig. 2692.
    - b. Rectorseal; a CSW Industrials Company; SureSeal Plus Inline Floor Drain Trap Sealer.
  2. Standard: ASSE 1072-2007.
  3. Sealing Element: Neoprene rubber or chemically resistant elastomer.
  4. Size: 2 inch, 3 inch, 3-1/2 inch, or 4 inch.
  5. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.

### 2.3 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

- A. 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.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" 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. Use NPS 4 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 for piping NPS 4 and smaller and 100 feet 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 fixture air-admittance valves on fixture drain piping.
- G. Install stack air-admittance valves at top of stack vent and vent stack piping.
- H. Install air-admittance-valve wall boxes recessed in wall.
- I. Assemble open drain fittings and install with top of hub 2 inches above floor.
- J. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.



- M. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- N. Install wood-blocking reinforcement for wall-mounting-type specialties.
- O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- P. 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.
- Q. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated assemblies.
  - 1. Comply with requirements in Division 07 Section "Penetration Firestopping."

### **3.2 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### **3.3 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 221319

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## SECTION 224200 - PLUMBING FIXTURES

### 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers; individual-fixture, water tempering valves; and specialty fixtures not included in this Section.
  - 4. Division 22 Section "Drainage Piping Specialties" for floor drains, and specialty fixtures not included in this Section.

#### 1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Shop Drawings: Diagram power, signal, and control wiring.
- B. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For plumbing fixtures and trim to include in operation and maintenance manuals.

**1.6 QUALITY ASSURANCE**

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- F. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components – Lead Content for potable domestic water piping and components.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with applicable ANSI, ASME, ASSE, ASTM, ICC, NSF, and UL standards and other requirements specified for plumbing fixtures, trim, fittings, components, and features.

**1.7 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

## PART 2 - PRODUCTS

### 2.1 WATER CLOSETS

#### A. Water Closets, WC-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Basis of Design: American Standard Companies, Inc.; Madera FloWise 16-1/2" Elongated Toilet.
  - b. Kohler Co.; Highcliff Ultra K-96057.
  - c. Sloan Valve Company.
  - d. Zurn Plumbing Products Group.
2. Description: Accessible, floor-mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
  - a. Style: Flushometer valve.
    - 1) Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
    - 2) Supply Spud Location: Top.
    - 3) Height: 16-1/2 to 16-3/4 inches, universal/accessible.
    - 4) Design Consumption: 1.28 gal./flush or 1.6 gal./flush.
    - 5) Color: White.
  - b. Flushometer: FV-2-1.
  - c. Toilet Seat: TS-1.

### 2.2 MANUAL WATER CLOSET FLUSHOMETERS

#### A. Flushometers, FV-2-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Basis of Design: Sloan Valve Company; 113-1.6
  - b. American Standard Companies, Inc.
  - c. Delany Products.
  - d. Delta Faucet Company; 81T201.
  - e. Kohler Co.: MACH Series.
  - f. Zurn Plumbing Products Group.
2. Description: Flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
  - a. Internal Design: Diaphragm or piston operation.
  - b. Style: Exposed.
  - c. Inlet Size: NPS 1
  - d. Trip Mechanism: Oscillating, low-force ADA compliant lever-handle actuator.
  - e. Consumption: 1.6 gal./flush.
  - f. Tailpiece Size: NPS 1-1/2 and standard length to top of bowl.

### 2.3 TOILET SEATS

#### A. Toilet Seats, TS-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Bemis Manufacturing Company; 1955SSC/1955SSCT.
  - b. Centoco Manufacturing Corp.
  - c. Church Seats; 295SSC/295SSCT.
  - d. Comfort Seats; a Jones Stephens Brand; Model Number C106SSC.
  - e. Ferguson Enterprises, Inc.; ProFlo PFTSCOF2000WH.
  - f. Olsonite Seat Company; Model 10SSC/10SSCT.
  - g. Plumbtech; Plumbing Technologies, LLC.
  - h. Sanderson Plumbing Products, Inc.; Beneke Div.
  - i. Zurn Plumbing Products Group; 5955STS-WH.
2. Description: Toilet seat for water-closet-type fixture.
  - a. Material: Molded, solid plastic.
  - b. Configuration: Open front without cover.
  - c. Size: Elongated.
  - d. Hinge Type: SC, self-sustaining, check.
  - e. Class: Standard commercial.
  - f. Color: White.

### 2.4 LAVATORIES

#### A. Lavatories, LAV-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Basis of Design: American Standard Companies, Inc.; Lucerne Model 0365.041.
  - b. Ferguson Enterprises, Inc.; ProFlo PF5504.
  - c. Kohler Co.; K 2005 Kingston.
  - d. Sloan Valve Company.
  - e. Zurn Plumbing Products Group; Z5344.
2. Description: Accessible, wall-mounting, vitreous-china fixture.
  - a. Type: With contoured back and side shields.
  - b. Size: 20 by 18 inches rectangular.
  - c. Faucet Hole Punching: Three holes, 2-inch centers.
  - d. Color: White.
  - e. Faucet: LF-1.
  - f. Water Temperature Limiting Device: Required.
  - g. Drain: Grid.
  - h. Drain Piping: NPS 1-1/4 chrome-plated, cast-brass P-trap; NPS 1-1/4, 17 gage tubular brass waste to wall; and wall escutcheon.
  - i. Fixture Support: Lavatory with concealed arms.

### 2.5 LAVATORY FAUCETS

#### A. Lavatory Faucets, LF-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Basis of Design: American Standard Companies, Inc.; Reliant 3 Model 7385.003.
  - b. Chicago Faucets.
  - c. Delta Faucet Company; Model 523LF-HDF.
  - d. Kohler Co.
  - e. Moen Commercial.
  - f. Speakman Company; Model S-3561.
  - g. T & S Brass and Bronze Works, Inc.; B-2711.
  - h. Zurn Plumbing Products Group; Z7440.
  
2. Description: Single handle mixing faucet, vandal resistant, 2 or 3 holes, with metal grid strainer, no lift rod hole, high temperature limit stop.
  - a. Body Material: Commercial, all metal construction meeting NSF 61.
  - b. Finish: Polished chrome plate.
  - c. Centers: 4 inches.
  - d. Mounting: Deck, concealed.
  - e. Inlet(s): NPS 1/2.
  - f. Spout Outlet:
    - 1) Vandal resistant aerator.
    - 2) Laminar flow or plain end for patient care areas.
  
  - g. Maximum Flow Rate:
    - 1) 0.5 gpm for faucets in public restrooms.

## 2.6 COUNTER-MOUNTING SINKS

### A. Sinks, SK-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Basis of Design: Elkay Manufacturing Co.; ELUH1814PD
  - b. Franke Consumer Products, Inc., Commercial Div.
  - c. Just Manufacturing Company.
  - d. Moen Commercial.
  
2. Description: Single-bowl, counter-mounting, undermount stainless-steel sink.
  - a. Overall Dimensions: 20-1/2 inches left to right by 16-1/2 inches front to back.
  - b. Metal Thickness: 18 gage, with sound dampened underside.
  - c. Bowl:
    - 1) Dimensions: 18 inches by 14 inches by 7-7/8 inches deep.
    - 2) Drain: 3-1/2-inch grid with outlet for disposer.
  
  - d. Sink Faucet: SF-1.
  - e. Water Temperature Limiting Device: Required.
  - f. Drain Piping: NPS 1-1/2 chrome-plated, cast-brass P-trap; 17 gage tubular brass waste to wall; and wall escutcheon(s).
  - g. Disposer: D-1.
  - h. Dishwasher Air-Gap Fitting: Not required.

- i. Hot-Water Dispenser: Not required.

## 2.7 SERVICE SINKS

### A. Service Sinks, SS-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Basis of Design: American Standard Companies, Inc.; Florwell Cast Iron Service Sink.
  - b. Kohler Co.; Whitby K 6710.
  - c. Zurn Plumbing Products Group; Z5850.
2. Description: Floor-mounting, enameled, cast-iron fixture with front apron, raised back, and coated, wire rim guard.
  - a. Size: 28 by 28 inches.
  - b. Color: White.
  - c. Faucet: Sink SF-2.
  - d. Drain: Grid with NPS 3 outlet.

## 2.8 SINK FAUCETS

### A. Sink Faucets, SF-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.
  - b. Chicago Faucets; No. 631-R.
  - c. Delta Faucet Company; Model 28C4934-R2.
  - d. Elkay Manufacturing Co.; LK940GNO8T4H.
  - e. Kohler Co.; K7320-4.
  - f. Moen Commercial.
  - g. Speakman Company; SC-5749.
  - h. T & S Brass and Bronze Works, Inc.
  - i. Zurn Plumbing Products Group; Z842B4.
2. Description: Commercial/Industrial sink faucet. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
  - a. Body Material: Commercial, solid brass.
  - b. Finish: Polished chrome plate.
  - c. Mixing Valve: Two handle.
  - d. Centers: 8 inches.
  - e. Mounting: Back/wall.
  - f. Handle(s): Wrist blade, 4 inches.
  - g. Operation: Noncompression, manual.
  - h. Inlet(s): NPS 1/2.
  - i. Spout Type: 70 to 120-degree restricted swing gooseneck.
  - j. Spout Outlet: Aerator.
  - k. Maximum Flow Rate:
    - 1) 1.5 gpm.
    - 2) 1.59 gpm.



3) 2.2 gpm.

B. Sink Faucets, SF-2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Basis of Design: American Standard Companies, Inc.; 8350.235
  - b. Chicago Faucets; Model 897.
  - c. Delta Faucet Company; Model 28C2383.
  - d. Ferguson Enterprises, Inc.; ProFlo PF1118.
  - e. Kohler Co.
  - f. Moen Commercial.
  - g. Speakman Company; SC5811-RCP-LEV-5H-WHK.
  - h. Symmons Industries, Inc.
  - i. T & S Brass and Bronze Works, Inc.
  - j. Zurn Plumbing Products Group.
2. Description: Service sink faucet with stops in shanks, vacuum breaker, hose-thread outlet, and pail hook. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor. Include 5 foot rubber hose and wall mounted hose clamp.
  - a. Body Material: Commercial, solid brass.
  - b. Finish: Polished chrome plate.
  - c. Maximum Flow Rate: 2.5 gpm, unless otherwise indicated.
  - d. Mixing Valve: Two handle.
  - e. Centers: 8 inches.
  - f. Mounting: Back/wall.
  - g. Handle(s): Lever.
  - h. Inlet(s): NPS 1/2.
  - i. Spout Type: Rigid, solid brass with wall brace and pail hook.
  - j. Spout Outlet: Hose thread.
  - k. Vacuum Breaker: Required.
  - l. Operation: Noncompression, manual.

C. Sink Faucets, SF-8:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Basis of Design: Kohler Co.; Simplice K-596.
  - b. American Standard Companies, Inc.
  - c. Chicago Faucets; No. 2300-8CP.
  - d. Delta Faucet Company; Model 100LF-HDF.
  - e. Moen Commercial.
  - f. Speakman Company.
  - g. T & S Brass and Bronze Works, Inc.
  - h. Zurn Plumbing Products Group.
2. Description: Kitchen sink style faucet. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
  - a. Body Material: Commercial, solid brass.
  - b. Finish: Vibrant Stainless.
  - c. Mixing Valve: Single handle.
  - d. Centers: Single Hold.

- e. Mounting: Deck.
- f. Handle(s): Lever, ADA compliant.
- g. Operation: Noncompression, manual.
- h. Inlet(s): NPS 3/8.
- i. Spout Type: Pull-down sprayhead with touch-control.
- j. Spout Outlet: Aerator.
- k. Maximum Flow Rate:
  - 1) 1.5 gpm.

## 2.9 DISPOSERS

### A. Disposers, D-1:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. In-Sink-Erator; a div. of Emerson Electric Co.; Badger 5XP.
- 2. Description: Continuous-feed, household type food-waste disposer. Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; antislash guard; and combination cover/stopper. Include cord with grounded plug.
  - a. Motor: 115-V ac, 1725 rpm, 3/4 hp with overload protection.

## 2.10 FIXTURE SUPPLIES

### A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. BrassCraft; a Masco Company.
- 2. McGuire Mfg. Co., Inc.
- 3. Any of the approved plumbing fixture manufacturers.

### B. Description: Chrome-plated brass, loose-key or screwdriver angle stops with brass stems; rigid, chrome-plated copper risers; and chrome-plated wall flanges.

## 2.11 PROTECTIVE SHIELDING GUARDS

### A. Protective Shielding Pipe Covers (PSG-1):

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Engineered Brass Co.
  - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
  - c. McGuire Manufacturing Co., Inc.
  - d. Oatey; Dearborn Safety Series.
  - e. Plumberex Specialty Products Inc.
  - f. TCI Products; SG-200BV.
  - g. TRUEBRO, Inc.
  - h. Zurn Plumbing Products Group; Z8946-3-NT.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## 2.12 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Josam Company.
  2. MIFAB Manufacturing Inc.
  3. Smith, Jay R. Mfg. Co.
  4. Tyler Pipe; Wade Div.
  5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
  6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Lavatory Supports:
  1. Description: Lavatory carrier with concealed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
  2. Accessible-Fixture Support: Include rectangular steel uprights.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- D. Install wall-mounting fixtures with tubular waste piping attached to supports.
- E. Install counter-mounting fixtures in and attached to casework.
- F. Install fixtures level and plumb according to roughing-in drawings. Install accessible fixtures at heights required by local codes.

- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - 1. Exception: Fixtures with flushometer valves, and faucets or valves with integral stops.
- H. Install ASSE 1070 water-temperature limiting devices on supplies for lavatories and sinks that will be used for handwashing, and where specified. Refer to Division 20 Section "Domestic Water Piping Specialties."
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- K. Install protective shielding guards PSG-1 on exposed traps and supplies of lavatories, and sinks used for hand washing.
- L. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- M. Install toilet seats on water closets.
- N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- P. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- Q. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- R. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- S. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- T. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- U. Set service basins in leveling bed of cement grout. Grout is specified in Division 20 Section "Basic Mechanical Materials and Methods."
- V. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Individual water line branches, waste lines, vents, and traps for connection to individual fixtures, fixture fittings and specialties shall be in accordance with the schedule on the Drawings.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding."
- E. Connect wiring according to Division 26 Section "Conductors and Cables."

### **3.4 FIELD QUALITY CONTROL**

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

### **3.5 ADJUSTING**

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers. Replace damaged and malfunctioning units.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals, or cartridges of leaking and dripping faucets and stops.

### **3.6 CLEANING**

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

### **3.7 PROTECTION**

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224200

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## **SECTION 224700 - DRINKING FOUNTAINS, WATER COOLERS, AND CUSPIDORS**

### **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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

#### **1.2 DEFINITIONS**

- A. Accessible Drinking Fountain or Water Cooler: Fixture that can be approached and used by people with disabilities.
- B. Cast Polymer: Dense, cast-filled-polymer plastic.
- C. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.
- D. Fitting: Device that controls flow of water into or out of fixture.
- E. Fixture: Drinking fountain or water cooler.
- F. Remote Water Cooler: Electrically powered equipment for generating cooled drinking water.
- G. TDS: Total dissolved solids.
- H. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Shop Drawings: Diagram power, signal, and control wiring.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Field quality-control test reports.

- B. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

## **1.6 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in the U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about fixtures for people with disabilities.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.
- E. AHRI Standard: Comply with AHRI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with AHRI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

## **PART 2 - PRODUCTS**

### **2.1 PRESSURE (ELECTRIC) WATER COOLERS**

- A. Water Coolers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Elkay Manufacturing Co.; EZH2O System EZSTL8WS.
    - b. Halsey Taylor.
    - c. Haws Corporation.
    - d. Murdock Manufacturing; A Member of Morris Group International.
    - e. Oasis Corporation.
    - f. Sunroc Corp.
  - 2. Description: Accessible, AHRI 1010, Type PB, pressure with bubbler, Style W, wall-mounting water cooler for adult/child-mounting height with bottle filling station.
    - a. Cabinet: Bilevel with two attached cabinets baked enamel finish or vinyl-covered steel with stainless-steel top, and single filtered cooler with bottle filling station.
    - b. Bubbler: One, flexible or elastomeric overmolded, with adjustable stream regulator, located on each cabinet deck.
    - c. Control: Push bar.
    - d. Supply: NPS 3/8 with isolation valve.



- e. Filter: Complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
- f. Drain(s): Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.1.
- g. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
  - 1) Capacity: 8 gph of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.
  - 2) Electrical Characteristics: 1/5 hp; 120-V ac; single phase; 60 Hz.
- h. Bottle Filling Station: Recessed design constructed of 18 gage Type 300 series stainless steel and ABS plastic. Include:
  - 1) Electronic sensor for no-touch activation.
  - 2) Automatic 20-second shut-off timer.
  - 3) 1.1 gpm flow rate
  - 4) Anti-microbial protected plastic components.
- i. Support: Refer to "Fixture Supports" Article.

## **2.2 FIXTURE SUPPORTS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Josam Co.
  - 2. MIFAB Manufacturing, Inc.
  - 3. Smith, Jay R. Mfg. Co.; A Member of Morris Group International.
  - 4. Tyler Pipe; Wade Div.
  - 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
  - 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
  - 1. Type I: Hanger-type carrier with two vertical uprights.
  - 2. Type II: Bilevel, hanger-type carrier with three vertical uprights.
  - 3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 APPLICATIONS**

- A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

### **3.3 INSTALLATION**

- A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.
- B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
- C. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing."
- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

### **3.4 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

### **3.5 FIELD QUALITY CONTROL**

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.

1. Remove and replace malfunctioning units and retest as specified above.
2. Report test results in writing.

**3.6 ADJUSTING**

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

**3.7 CLEANING**

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 22 4700

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## SECTION 230933 - TEMPERATURE CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Section "Testing, Adjusting, and Balancing."

#### 1.2 SUMMARY

- A. This Section includes control equipment for HVAC system components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

#### 1.3 DEFINITIONS

- A. CAD: Computer Aided Design.
- B. TC: Temperature Control.

#### 1.4 SYSTEM DESCRIPTION

- A. CO2 sensors, where indicated, for addition of demand control ventilation to existing RTU and field wiring of various control components applicable for this project.
- B. Installation/relocation of electric thermostats, control wiring, etc.

#### 1.5 SEQUENCE OF OPERATION

- A. Control sequences for HVAC systems, subsystems, and equipment are indicated on project drawings.

#### 1.6 SUBMITTALS

- A. Submit under Division 20 and 23 provisions of respective project and as supplemented in this section.
- B. All control submittal requirements shall be submitted at one time.
- C. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

1. Each control device labeled with setting or adjustable range of control
- D. Shop Drawings:
1. Shop drawings shall be done on CAD. Minimum size 11" x 17".
  2. Schematic flow diagrams showing control devices.
  3. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
  4. Details of control enclosure including panel faces and interior, including controls, instruments, terminations blocks and component labeling.
  5. Written sequence of operation for each controlled system.
  6. Complete bill of materials to identify and quantify all control components.
- E. Submit field reports indicating operating conditions after detailed check out of systems at Date of Substantial Completion.
- F. Project Record Documents: Include the following:
1. Revise Shop Drawings to reflect actual installation and operating sequences.
  2. Record actual locations of control components, including control units, thermostats, and sensors.
  3. Submit the electronic files for all as-built shop drawings in pdf format on USB Flash Drives (3 Total).

## **1.7 REFERENCES**

- A. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. ASTM B75 - Seamless Copper Tube for General Engineering Purposes.
- C. MMC – Michigan Mechanical Code, version applicable for project.
- D. NEMA DC 3 - Low-Voltage Room Thermostats.

## **1.8 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer who is a certified installer of the automatic control system manufacturer for both installation and maintenance of units required for this Project.
- 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 all applicable code requirements for project.

## **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated or optional to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

## **1.10 COORDINATION**

- A. Coordinate work under Division 20 and 23 provisions and as supplemented in this section.

- B. Coordinate location of space temperature sensors and other exposed control sensors with plans and room details before installation.
- C. Coordinate installation of system components with installation of mechanical systems and equipment to achieve compatibility.
- D. Ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate control wiring requirements, including actual terminal block numbers, with mechanical equipment manufacturers or suppliers.
- F. Ensure control system installation is complete, checked, tested and functioning properly prior to system balancing and Owner/Engineer system checkout.
- G. Cooperate fully with the Test and Balance Contractor and provide labor to operate the temperature control system as required to meet the scope of work defined in Division 23 Section "Testing, Adjusting and Balancing."

#### **1.11 WARRANTY**

- A. Provide warranty per Division 20 Section "Mechanical General Requirements" and as supplemented in this section.
- B. Provide 24 hour per day emergency service during warranty period, with maximum response period of four (4) hours. Provide phone number(s) for quick assistance by a Service Engineer regarding hardware or software problems.
- C. Provide scheduled maintenance service during warranty period to inspect, calibrate, and adjust controls. Submit written reports upon completion of service.

#### **1.12 POSTED OPERATING INSTRUCTIONS**

- A. Provide controller related as-built documents in protective binder or clear plastic display envelope for each control enclosure panel. These instructions shall include such items as as-built control diagrams and sequence of operation, simplified narrative instructions and materials necessary to aid in the operation of the equipment at the local control panels.

#### **1.13 SPECIAL TOOLS**

- A. Deliver two sets of any special tools required for operation, adjustment, resetting or maintenance, excluding PC laptop.

### **PART 2 - PRODUCTS**

#### **2.1 DESCRIPTION OF THE BUILDING AUTOMATION SYSTEM (BAS)**

- A. Approved Installer (Locations) as listed:
  - 1. Conti Corp Controls Group. (Sterling Heights, MI).
  - 2. Metro Controls, Inc. (Clinton Twp, MI).

3. SyEnergy Engineering Services, (Rochester Hills, MI).
4. Trane U.S. Inc., Southeast Michigan (Livonia, M) – NOT Trane ICS Products.
5. W.J. O'Neil Controls Group. (Livonia, MI).
6. Knight Watch/Vertex Integration (Hudsonville, MI).
7. BASS Controls (Sterling Heights, MI).
8. Limbach Company. (Pontiac, MI).

## 2.2 RTU CONTROLLER INPUT/OUTPUT SENSORS

### A. Carbon Dioxide Sensors:

1. Carbon dioxide sensing cell shall consist of a nondispersive infrared carbon dioxide gas cell that uses a pulsed source and has no free air optical path. Output shall be linearized 4-20 mA with the 24 VDC input. In addition, the unit shall be capable of providing SPDT switching of an external low voltage circuit at an adjustable setpoint. The unit shall be specifically designed for the wall or duct application specified. Return air aspiration boxes shall be designed by and approved by the manufacturer. Unit shall have single point setpoint and span adjustment. The unit shall have no moving parts.
2. Power for the sensor shall be extended from a transformer or adaptor installed adjacent to the DDC controller enclosure panel and shall be run parallel to the 4-20 mA signal cable.
3. Minimum sensing range shall be 0-2,000ppm.
4. Overall Accuracy shall be 3% of full-scale including calibration error, repeatability, hysteresis and yearly drift.
5. Minimum calibration interval shall be 5 years.
6. Contractor shall provide all necessary equipment and test gas for calibration and shall calibrate all CO<sub>2</sub> sensors in accordance with the manufacturer's recommendations.
7. Manufacturer:
  - a. Belimo.
  - b. TelAire.
  - c. Vaisala.
  - d. Veris.

## 2.3 ELECTRICAL REQUIREMENTS FOR CONTROLS WORK

- A. Electrical accessories such as relays, switches, contactors and control transformers shall meet the requirements of the Division 26 Specifications of respective project.
- B. Electrical wiring and conduit shall meet the requirements of the Division 26 Specifications.
- C. All control wiring in mechanical rooms and any other exposed areas shall be run in conduit. Low voltage temperature control wiring in concealed accessible locations (i.e. above lay-in ceilings), as well as low voltage temperature control wiring within partitions, may be run using plenum rated cable, neatly tie-wrapped and fastened to the building structure (not to ceiling or ceiling support wires).
- D. Conduits carrying control wiring shall be sized for a maximum fill of 40% of capacity.
- E. Where raceway is required, two separate raceway systems shall be provided; one for A.C. wiring and the other for D.C. wiring.
- F. All control wiring sizes and types shall meet or exceed the equipment manufacturer's recommendations.



## PART 3 - EXECUTION

### 3.1 INSTALLATION - CONTROL SYSTEMS

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate room temperature sensors and thermostats 48 inches above floor unless noted otherwise.
- C. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. Sensors used for closed loop control must be connected to the same controller as the associated output signal.
- D. Provide conduit and electrical wiring where required.
- E. All wiring in altered and unaltered areas shall be run concealed. "Wiremold" in finished areas shall be allowed when wiring cannot be run concealed in walls or partitions. Minimize "wiremold" routing.
- F. Splicing of sensor cabling at junction boxes shall not be acceptable.
- G. Locate all control components and accessories such that they are easily accessible for adjustment, service and replacement.
- H. Locate, size and support sensing elements in airstreams so that they properly sense the representative condition. Controlling, transmitting and indicating elements shall be located to sense the average condition. Safety elements shall be located to sense the extreme condition.
- I. Locate, support and install all control components and accessories so that they will not be subject to vibration, excessive temperatures, dirt, moisture or other harmful conditions beyond their rated limitations.
- J. Where insulation is penetrated due to the installation of sensing elements or tubing, reseal the openings air and vapor tight. Provide brackets for devices to be located on insulated surfaces so as to clear the finished surface of the insulation and to avoid puncturing the vapor seal.
- K. Provide all necessary relays, switches, linkages, control devices, accessories and connections as required for a complete and operational control system as specified herein and shown.

### 3.2 IDENTIFICATION AND MARKING

- A. All sensors, relays, switches, etc. shall be marked with the same identification number as used on the as-built shop drawings. Use Brother P-touch label maker or similar with black text on clear or white super adhesive tape. If label applied in wet environment, spray label with clear enamel for waterproofing.
- B. Wire shall be color coded according to functional use. Identify color coding format on record drawings.
- C. Identify each wire as to ID number at each controller termination, field device termination or on the field device.
- D. All control panels and auxiliary enclosures shall be supplied with engraved phenolic nameplate permanently attached on the front exterior with panel identification to match details of temperature control submittals and include system(s) served and area(s) served on the labeling. Include labeling near 120VAC terminations within panel identifying power source panel ID and specific circuit breaker used.

**3.3 OWNER INSTRUCTION AND TRAINING**

- A. Provide a minimum of two (2) hours of on-site training to the Owner on the operation of the control systems for the initial installation.
- B. Instruction and training shall be performed by a competent Contractor representative familiar with the control systems operation, maintenance and calibration.
- C. Training shall take place after check, test, start-up of temperature controls system at a time mutually agreed upon by the Owner and Contractor.

**3.4 CALIBRATION AND START-UP**

- A. After installation and connection of control components, test, adjust and re-adjust as required all control components in terms of function, design, systems balance and performance. Make systems ready for environmental equipment acceptance tests.

**3.5 ACCEPTANCE PROCEDURE**

- A. Upon successful completion of start-up and recalibration as indicated in this section, the Architect shall be requested in writing to inspect the satisfactory operation of the control systems.
- B. Demonstrate operation of all control systems, including each individual component, to the Owner and Architect.
- C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect for inspection and approval.
- D. After all items on the punch list are corrected and formal approval of the control systems is provided by the Architect, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.

END OF SECTION 230933

## SECTION 233113 - METAL DUCTS

### 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
  - 3. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### 1.2 SUMMARY

- A. This Section includes metal ducts for supply, return, outside, relief air, and exhaust air-distribution systems.

#### 1.3 DEFINITIONS

- A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain sizes inside lining.
- B. Low Pressure: Up to and including 2 inch WG and velocities less than 1,500 fpm.
- C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm.
- D. FRP: Fiberglass-reinforced plastic.
- E. PVC: Polyvinyl Chloride.

#### 1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

#### 1.5 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 Application Schedule" Article.

#### **1.6 ACTION SUBMITTALS**

- A. Shop Drawings: Drawn to scale. Show fabrication and installation details for metal ducts. Shop drawings shall be reviewed and approved by the Architect prior to any fabrication.
  - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  - 2. Duct layout indicating sizes and pressure classes.
  - 3. Elevations of top and bottom 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. Duct accessories, including access doors and panels.
  - 11. Hangers and supports, including methods for duct and building attachment, vibration isolation.

#### **1.7 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Reflected ceiling 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. Ceiling suspension assembly members.
  - 2. Other systems installed in same space as ducts.
  - 3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
  - 4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

#### **1.8 CLOSEOUT SUBMITTALS**

- A. Field quality-control test reports.

#### **1.9 QUALITY ASSURANCE**

- A. NFPA Compliance:
  - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
  - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Duct Liner Maximum Temperature Limits: Based on ASTM C 411 test procedures.

#### **1.10 COORDINATION**

- A. Sheet metal trades shall cooperate fully with the Laboratory Airflow Controls Trades and shall attend all field installation training sessions.

- B. Sheet metal trades shall cooperate fully with the Test and Balance Contractor and provide all miscellaneous caps and any other materials required for structural integrity and leakage testing of the complete duct system in whole or in part. Refer to Division 23 Section "Testing, Adjusting and Balancing."
  - 1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
- C. Sheet metal trades shall participate in the above ceiling coordination program. Refer to Division 01 requirements.

## **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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.2 SHEET METAL 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: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation.
- C. Reinforcement Shapes and Plates:
  - 1. Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
  - 2. Compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods:
  - 1. Galvanized Steel Duct: Galvanized steel, 3/8-inch minimum diameter.
  - 2. Ducts in Humid or Corrosive Atmospheres: Stainless steel, 1/4-inch diameter for lengths 36 inches or less; 3/8-inch diameter for lengths longer than 36 inches.

### **2.3 DUCT LINER**

- A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.
  - 1. Manufacturers:
    - a. CertainTeed Corp.; Insulation Group.
    - b. Johns Manville International, Inc.
    - c. Knauf Fiber Glass GmbH.

2. Materials: ASTM C 1071, Type I, flexible; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
  - a. Thickness: 1 inch.
  - b. Density: 1-1/2 pounds per cubic foot.
  - c. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
  - d. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
  - e. Maximum Operating Temperature: 250 deg F when tested according to ASTM C 411.
  - f. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
  - g. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
    - 1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
    - 2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
    - 3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.
  
3. Noise reduction coefficient (NRC): Sound absorption coefficients shall not be less than those in the table below as tested by ASTM C423 using an ASTM E795 Type A mounting.

Thickness Inches (mm)	Sound absorption coefficients at octave band center frequencies, Hz						NRC
	125	250	500	1000	2000	4000	
1 (25)	.08	.31	.59	.84	.91	.90	.70

**2.4 SEALANTS 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. Elastomeric Sealant Tape: 3 inches wide; modified butyl adhesive backed.
  1. Manufacturers:
    - a. Hardcast; Foil-Grip 1402 and Foil-Grip 1402-181BFX.
  
- C. Water-Based Joint and Seam Sealant:
  1. Manufacturers:
    - a. Design Polymeric; DP1010 Water Based Duct Sealant.
    - b. Hardcast; Flex-Grip 550 and Versa-Grip 181.
    - c. Polymer Adhesives; No. 11.
    - d. United McGill.
  
  2. Application Method: Brush on.
  3. Solids Content: Minimum 63 percent.

4. Shore A Hardness: Minimum 20.
5. Water resistant.
6. Mold and mildew resistant.
7. VOC: Maximum 75 g/L (less water).
8. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Manufacturers:
  - a. Hardcast; Sure-Grip 404.
  - b. United McGill.
2. Application Method: Brush on.
3. Base: Synthetic rubber resin.
4. Solvent: Toluene and heptane.
5. Solids Content: Minimum 60 percent.
6. Shore A Hardness: Minimum 60.
7. Water resistant.
8. Mold and mildew resistant.
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

E. 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.

F. Gaskets: Chloroprene elastomer, 40 durometer, 1/8 inch thick, full face, one piece vulcanized or dovetailed at joints.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg 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.

## 2.5 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
  2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
  3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials. Attachments for stainless steel and PVC-coated duct shall be stainless steel.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
  3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.
- E. Load Rated Cable Suspension System for Noncorrosive Environments: Tested to five times the Safe Working Loads and verified by the SMACNA Testing and Research Institute.
1. Cable: Aircraft quality 7 x 7 and 7 x 19 wire rope.
    - a. Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
    - b. Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
  2. Fastener: One-piece, die-cast zinc housing with Type 302 S26 stainless steel hardened and tempered springs, and oil impregnated, sintered, hardened and tempered steel locking wedges.
  3. End Fixings: Loop, stud or toggle; or plain end suitable for wire rope beam clamp.
  4. Manufacturers:
    - a. B-Line by Eaton; KwikWire.
    - b. Ductmate Industries, Inc.; Clutcher and EZ-Lock.
    - c. Duro Dyne Corp.; Dyna-Tite System.
    - d. Gripple Inc.; Hang-Fast System.
- F. Stainless Steel Load Rated Cable Suspension System for Corrosive Environments: Tested to five times the Safe Working Loads and verified by the SMACNA Testing and Research Institute.
1. Cable: Aircraft quality stainless steel 7 x 7 and 7 x 19 wire rope.
    - a. Stainless steel complying with ASTM A 492.
  2. Fastener: One-piece, stainless steel housing with Type 302 S26 stainless steel hardened and tempered springs, and ceramic locking wedges.
  3. End Fixings:
    - a. Loop End: Type 316L/A4 stainless steel.
    - b. Stud or Toggle End: Type 304L/A2 stainless steel.
    - c. Plain end suitable for stainless steel wire rope beam clamp.
  4. Manufacturers:
    - a. B-Line by Eaton; KwikWire.
    - b. Ductmate Industries, Inc.; Clutcher and EZ-Lock.



- c. Duro Dyne Corp.; Dyna-Tite System.
  - d. Gripple Inc.; Hang-Fast System.
- G. Welded Supports: Structural steel shapes with zinc rich paint. Equivalent, proprietary design, rolled steel structural support systems may be used in lieu of mill rolled structural steel.

## 2.6 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
- 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
  - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
  - 3. Internal Tie Rods: As allowed by SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's and SMACNA guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
- 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Nexus Inc.
    - c. Ward Industries, Inc.
- C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

## 2.7 APPLICATION OF LINER IN RECTANGULAR DUCTS

- A. 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.
- B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
- E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.
- F. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
- G. 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:
- 1. Fan discharges.
  - 2. Intervals of lined duct preceding unlined duct.

3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm or where indicated.

## 2.8 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

- A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.
- B. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" or SMACNA "Industrial Duct Construction Standards" as required based on pressure class.
  1. Round fittings shall be factory fabricated welded design. Use of field fabricated fittings (welded design) shall only be permitted when factory fabricated fittings are unavailable.
- C. Duct Joints:
  1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
  2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
  3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
  4. Bolts and fasteners for galvanized steel duct shall be carbon steel, zinc coated per ASTM A153. Bolts and fasteners for stainless steel and polyvinyl chloride coated steel duct shall be stainless steel.
  5. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
  6. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.
- D. Low Pressure Ductwork (plus or minus 2 inches W.G. Static Pressure Class)
  1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible provide single thickness turning vanes.
  2. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
- E. Medium and High Pressure Ductwork (For Static Pressure Class Greater than plus or minus 2 inches W.G.)
  1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible provide single thickness turning vanes.
  2. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.
  3. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
  4. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- F. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

- G. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- H. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
  - 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

### **PART 3 - EXECUTION**

#### **3.1 DUCTWORK APPLICATION SCHEDULE**

- A. Ductwork materials and performance requirements are scheduled on the Drawing.

#### **3.2 DUCT INSTALLATION**

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- 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, plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, and sleeves. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories."
  - 1. Where ducts not having fire dampers, smoke dampers, or combination fire and smoke dampers pass through fire-rated partitions, maintain indicated fire rating. Seal penetrations with firestop materials. Refer to Division 07 Specification Sections for materials and UL classified firestop systems.
- O. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.
- P. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
  - 1. Intermediate level.

### 3.3 DUCT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated. Ducts must be properly cleaned and sealed in strict accordance with sealant manufacturer's instructions.
  - 1. Seal Class: Refer to Application Schedule on the Drawings.
  - 2. Seal ducts before external insulation is applied.
  - 3. After pressure testing, remake leaking joints until leakage is equal to or less than maximum allowable. Refer to Application Schedule on the Drawings for allowable leakage rates.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. 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 maximum intervals of 16 feet.
- D. Support ductwork from building structure, not from roof deck, floor slab, pipe, other ducts, or equipment.
- E. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- F. Install roof mounted duct supports in accordance with manufacturer's instructions. Provide additional membrane layer or walkpads under support bases as required.
- G. Use load rated cable suspension system for round duct in exposed locations.

**3.5 CONNECTIONS**

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

**3.6 PAINTING**

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

**3.7 FIELD QUALITY CONTROL**

- A. Duct System Cleanliness Tests:
  - 1. Visually inspect duct system to ensure that no visible contaminants are present.
- B. Duct system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

**3.8 START UP**

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION 233113

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## SECTION 233300 - DUCT ACCESSORIES

### 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 23 Section "Testing, Adjusting, and Balancing" for duct test holes.
  - 3. Division 23 Section "Temperature Controls" for motorized control dampers.
  - 4. Division 28 Section "Fire Alarm" for duct-mounting fire and smoke detectors.

#### 1.2 DEFINITIONS

- A. NVLAP: National Voluntary Laboratory Accreditation Program.
- B. Low Pressure: Up to 2 inch WG and velocities less than 1,500 fpm. Construct for 2 inch WG positive or negative static pressure.
- C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm. Construct for 6 inch WG positive or negative static pressure.
- D. High Pressure: Greater than 6 inch WG to 12 inch WG and velocities greater than 2,500 fpm. Construct for 12 inch WG positive or negative static pressure.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. For turning vanes, include data for pressure loss generated sound power levels.
  - 2. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. 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, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
  - e. Duct security bars.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.
- C. Source quality-control reports.

### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

### **1.6 QUALITY ASSURANCE**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

### **1.7 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed for each temperature rating.

## **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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.2 SHEET METAL 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.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation.



- C. Stainless Steel: ASTM A 480/A 480M, Types 304 and 316 as indicated.
- D. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.
- E. Bird Screens: No. 2 mesh, 0.063 inch diameter galvanized wire screen with open area of not less than 72 percent. Conceal sharp edges by adding metal edging consisting of rod, flat or angle iron, or 16 gage galvanized sheet steel turned over at least 3/4 inch on both sides.

### **2.3 LOW PRESSURE MANUAL VOLUME DAMPERS**

- A. Manufacturers:
  - 1. American Warming and Ventilating; Mestek, Inc.
  - 2. Arrow United Industries; Mestek, Inc.
  - 3. Greenheck Fan Corporation.
  - 4. Krueger-HVAC; Air Distribution Technologies, Inc.; a JCI Company.
  - 5. Louvers and Dampers, Inc.; Mestek, Inc.
  - 6. Nailor Industries Inc.
  - 7. Ruskin Company.
  - 8. Vent Products Co., Inc.
  - 9. Young Regulator Co.
- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
  - 1. Except for dampers in round ductwork sized 12 inches and smaller, provide end bearings.
- C. Rectangular Volume Dampers: Multiple-opposed-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.
- D. Round Volume Dampers 16-inch Diameter and Smaller: Single-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.
- E. Round Volume Dampers Larger than 16-inch Diameter: Multiple-opposed-blade design AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.
- F. Damper Materials:
  - 1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
  - 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
  - 3. Blade Axles: Galvanized steel.
  - 4. Bearings: Oil-impregnated bronze, molded synthetic, or stainless-steel sleeve type.
  - 5. Tie Bars and Brackets: Galvanized steel.
- G. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

- H. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

## 2.4 MEDIUM OR HIGH PRESSURE MANUAL VOLUME DAMPERS

- A. Manufacturers:
  - 1. American Warming and Ventilating; Mestek, Inc.
  - 2. Greenheck Fan Corporation.
  - 3. Louvers and Dampers, Inc.; Mestek, Inc.
  - 4. Nailor Industries Inc.
  - 5. Ruskin Company.
  - 6. Vent Products Co., Inc.
- B. General Description: Factory fabricated, galvanized steel or extruded aluminum construction, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
- C. Rectangular Volume Dampers: Multiple-opposed-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications. Construction and assembly such that no noise producing blade vibration occurs at velocities 20 percent greater than maximum system design velocity.
- D. Round Volume Dampers 16-inch Diameter and Smaller: Single-blade, or multiple-opposed-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications. Construction and assembly such that no noise producing blade vibration occurs at velocities 20 percent greater than maximum system design velocity.
- E. Round Volume Dampers Larger than 16-inch Diameter: Multiple-opposed-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications. Construction and assembly such that no noise producing blade vibration occurs at velocities 20 percent greater than maximum system design velocity.
- F. Damper Materials:
  - 1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
  - 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
  - 3. Aluminum Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  - 4. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
  - 5. Blade Axles: Galvanized steel or stainless steel.
  - 6. Bearings: Oil-impregnated bronze, molded synthetic, or stainless-steel sleeve type.
  - 7. Tie Bars and Brackets: Aluminum or galvanized steel.
- G. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

- H. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

## 2.5 LOW LEAKAGE MANUAL VOLUME DAMPERS

### A. Low-Leakage, Steel, Manual Volume Dampers:

- 1. Manufacturers:
  - a. American Warming and Ventilating; Mestek, Inc.
  - b. Greenheck Fan Corporation.
  - c. Louvers and Dampers, Inc.; Mestek, Inc.
  - d. Nailor Industries Inc.
  - e. Ruskin Company.
  - f. Vent Products Co., Inc.
- 2. Low-leakage rating and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- 3. Suitable for horizontal or vertical applications.
- 4. Frames:
  - a. Hat shaped.
  - b. Galvanized-steel channels, 0.064 inch thick.
  - c. Mitered and welded corners.
  - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:
  - a. Multiple or single blade.
  - b. Opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized, roll-formed steel, 0.064 inch thick.
- 6. Blade Axles: Galvanized steel.
- 7. Bearings:
  - a. Oil-impregnated bronze.
  - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Blade Seals: Neoprene.
- 9. Jamb Seals: Cambered stainless steel.
- 10. Tie Bars and Brackets: Galvanized steel.
- 11. Accessories:
  - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

## 2.6 MOTORIZED CONTROL DAMPERS

- A. Refer to Division 23 Section "Temperature Controls."

**2.7 FIRE DAMPERS (CURTAIN STYLE)**

- A. Manufacturers:
  - 1. Air Balance, Inc.; Mestek, Inc
  - 2. Greenheck Fan Corporation.
  - 3. NCA; a brand of Metal Industries Inc.
  - 4. Nailor Industries Inc.
  - 5. Ruskin Company.
- B. Dynamic fire dampers with curtain style blades, and labeled according to UL 555, maximum velocity 2000 fpm, maximum static pressure 4 inches w.g.
- C. Fire Rating:
  - 1. 1-1/2 hours for 2 hour rated walls.
  - 2. 3 hours for 4 hour rated walls.
- D. Frame: Type B or Type C Curtain type with blades outside airstream; fabricated with roll-formed, galvanized steel in gages required by manufacturer's UL listing; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  - 1. Thickness: Equal to or thicker than the duct connected to it, and of length to suit application.
  - 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- H. Fusible Links: Replaceable, 212 deg F rated.

**2.8 FIRE DAMPERS (MULTIPLE BLADE TYPE)**

- A. Manufacturers:
  - 1. Greenheck Fan Corporation.
  - 2. NCA; a brand of Metal Industries Inc.
  - 3. Nailor Industries Inc.
  - 4. Ruskin Company.
- B. Dynamic fire dampers with multiple blades, and labeled according to UL 555, maximum velocity of 2000 fpm, maximum static pressure 4 inches w.g.
- C. Fire Rating:
  - 1. 1-1/2 hours for 2 hour rated walls.
  - 2. 3 hours for 4 hour rated walls.
- D. Frame: Fabricated with roll-formed, galvanized steel in gages required by manufacturer's UL listing; with mitered and interlocking corners.

- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  - 1. Thickness: Equal to or thicker than the duct connected to it, and of length to suit application.
  - 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Parallel operation, single-piece airfoil type construction with 0.078 inch equivalent thickness, or 0.064 inch thick, roll-formed, triple v-groove.
- H. Axles: 1/2 inch plated steel hex.
- I. Bearings: Stainless steel, or oil-impregnated bronze sleeve type, pressed into frame.
- J. Linkage: Concealed in frame.
- K. Fusible Links: Replaceable, 212 deg F rated.

## **2.1 DUCT SILENCERS (FIBERGLASS FILL)**

- A. Manufacturers:
  - 1. IAC Acoustics; a Division of Sound Seal.
  - 2. Price Industries.
  - 3. Ruskin Company.
  - 4. VAW Systems Ltd.
  - 5. Vibro-Acoustics; A Swegon Group Company.
- B. General Requirements:
  - 1. Factory fabricated.
  - 2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
- C. Rectangular Units: Unless otherwise scheduled on the Drawings, fabricate casings with a minimum of 20 gage, solid galvanized sheet metal for outer casing and 22 gage, ASTM A 653/A 653M, G90, perforated galvanized sheet metal for inner casing.
- D. Sheet Metal Perforations: 1/8-inch diameter for inner casing and baffle sheet metal.
- E. Fill Material: Inert and vermin-proof fibrous glass material, packed under not less than 5 percent compression.
- F. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.
  - 1. Do not use nuts, bolts, or sheet metal screws for unit assemblies.
  - 2. Lock form and seal or continuously weld joints.
  - 3. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
  - 4. Reinforcement: Cross or trapeze angles for rigid suspension.

G. Source Quality Control:

1. Acoustic Performance: Test according to ASTM E 477.
  - a. Tests performed in NVLAP accredited laboratory.
  - b. Include accreditation certificate with submittals.
  - c. Submittals from non-NVLAP accredited facilities will not be accepted.
2. Record acoustic ratings, including dynamic insertion loss and self-noise power levels with an airflow of at least 2000-fpm face velocity.
3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

**2.2 TURNING VANES**

A. Manufactured Turning Vanes:

1. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
2. Double-vane or airfoil-shaped, curved blades of galvanized sheet steel set into vane runners suitable for duct mounting.
3. Generated sound power level shall not exceed 54 decibels in octave band 4 at 2000 fpm in a 24-inch by 24-inch duct.
4. Manufacturers:
  - a. Aero-Dyne Sound Control; H-E-P Turning Vanes & Rail.
  - b. Ductmate Industries, Inc.
  - c. Duro Dyne Corporation.
  - d. Ward Industries, Inc.; a JCI Company.

B. Manufactured Acoustic Turning Vanes:

1. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
2. Double-vane curved blades of galvanized sheet steel with perforated faces and fibrous-glass fill set into vane runners suitable for duct mounting.
3. Manufacturers:
  - a. Ductmate Industries, Inc.
  - b. Ward Industries, Inc.; a JCI Company.

**2.3 DUCT-MOUNTING ACCESS DOORS**

A. General Description: Fabricate doors airtight and suitable for duct pressure class. Doors may be field fabricated in accordance with SMACNA Standards, or commercially produced.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Manufacturers:
  - a. Air Balance, Inc.; Mestek, Inc.

- b. Greenheck Gan Corporation.
    - c. Nailor Industries Inc.
    - d. Ruskin Company.
  2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  3. Provide number of hinges and locks as follows:
    - a. Less Than 12 Inches Square: Secure with two sash locks.
    - b. Up to 18 Inches Square: Two hinges and two compression locks.
    - c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
    - d. Sizes 24 by 48 Inches and Larger: One additional hinge.
- C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.
  1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Flexmaster U.S.A.; a Masterduct Company.
  2. Frame: Galvanized sheet steel, with spin-in notched frame.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch-thick, fibrous-glass or polystyrene-foam board.

## 2.4 FLEXIBLE CONNECTORS

- A. Manufacturers:
  1. ADSCO Manufacturing LLC.
  2. Duro Dyne Corp.
  3. Senior Flexonics Pathway.
  4. Ventfabrics, Inc.
- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip minimum 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  1. Minimum Weight: 26 oz./sq. yd.
  2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  3. Service Temperature: Minus 20 to plus 200 deg F.

## 2.5 FLEXIBLE DUCTS, LOW AND MEDIUM PRESSURE

- A. Manufacturers:

1. Flexmaster U.S.A.; a Masterduct Company; Type 1M Acoustical.
  2. Hart & Cooley.
  3. Thermaflex; part of the Flexible Technologies Group.
- B. Flexible Ducts: Interlocking spiral of galvanized steel or aluminum construction or fabric supported by helically wound spring steel wire or flat steel bands; rated to 6 inches WG positive and 4 inches WG negative for low and medium pressure ducts.
- C. Insulated Flexible Ducts: UL 181, Class 1, flexible duct wrapped with flexible glass fiber insulation, enclosed by a fire retardant polyethylene vapor barrier jacket; maximum 0.23 K value at 75 deg F.
- D. Acoustical performance tested in accordance with the Air Diffusion Council's *Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties* shall be as follows:

The insertion loss (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

Octave Band Hz.	2	3	4	5	6	7
6" diameter	8	32	38	35	39	25
8" diameter	13	32	36	35	36	21
12" diameter	15	29	28	33	26	14

The radiated noise reduction (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

Octave Band Hz.	2	3	4	5	6	7
6" diameter	6	8	7	8	9	13
8" diameter	9	6	6	7	8	10
12" diameter	9	7	6	6	8	11

The self-generated sound power levels (LW) dB are 10-12 Watt of a 10 foot length of straight duct for an empty sheet metal duct when tested in accordance with ASTM E477, at a velocity of 1000 feet per minute, shall not exceed:

Octave Band Hz.	2	3	4	5	6	7
6" diameter	42	31	23	18	17	21
8" diameter	41	34	27	19	18	21
12" diameter	53	44	36	27	21	22

- E. Flexible Duct Fittings: Galvanized steel, twist-in design with damper. Size as indicated.
- F. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

## 2.6 FLEXIBLE DUCT ELBOW SUPPORTS

- A. Manufacturer:
1. Titus; Air Distribution Technologies, Inc.; a JCI Company; FlexRight.
  2. Thermaflex; part of the Flexible Technologies Group; FlexFlow Elbow.
  3. Hart and Cooley, Inc.; Smart Flow Elbow.
- B. Elbow supports shall be constructed of durable composite material and be fully adjustable to support flexible duct diameters 6 inches through 16 inches.



- C. Elbow supports shall be UL listed for use in return air plenum spaces.

## **2.7 DUCT ACCESSORY HARDWARE**

- A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## **2.8 FINISHES**

- A. Chemical Resistant Coating: P-403 manufactured by Heresite Chemical Company.

# **PART 3 - EXECUTION**

## **3.1 APPLICATION AND 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. Provide 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 PVC coated ducts; and aluminum accessories in aluminum ducts.
- C. Install control 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.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install fire dampers according to UL listing.
- G. Install duct silencers rigidly to ducts.
- H. Install duct access doors on ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. On upstream side of duct coils.
  - 2. Upstream from duct filters.
  - 3. Downstream from control dampers, backdraft dampers, and duct mounted equipment.
  - 4. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links.
  - 5. Control devices requiring inspection, including airflow measuring devices. Size access doors appropriately to facilitate service of each device.
  - 6. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.

- J. Install duct-mounting, rectangular access doors with long dimension at right angles to direction of airflow and of largest standard size which can be accommodated in duct. Maximum size: 21 by 14 inches.
- K. Label access doors according to Division 20 Section "Mechanical Identification."
- L. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- M. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- N. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- O. Connect diffusers or light troffer boots to low pressure ducts flexible duct clamped or strapped in place.
- P. Connect flexible ducts to metal ducts with plenum-rated draw bands.
- Q. Install flexible duct elbow supports at each diffuser, grille, or register, and elsewhere as indicated.
- R. Install turning vanes in rectangular duct elbows in excess of 45 degrees, and where indicated:
  - 1. Use manufactured double-vane turning vanes unless otherwise specified.
  - 2. Seat outboard-most vane in heel of duct elbow.
  - 3. Provide vanes for all runner punchings. Practice of eliminating every other vane is prohibited.
  - 4. Use single-vane turning vanes in low pressure square elbows.

### **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, smoke, and combination 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.
  - 5. Operate remote damper operators to verify full range of movement of operator and damper.

### **3.3 ADJUSTING**

- A. Adjust duct accessories for proper settings.
- B. Adjust fire dampers, combination fire and smoke dampers, and smoke dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION 233300

## SECTION 233423 - POWER VENTILATORS

### 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Motors."
  - 3. Division 23 Section "Common Work Results for HVAC" for common mechanical drive requirements for fans and air moving equipment.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Classify according to AMCA 99.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness.
  - 5. Dampers, including housings, linkages, and operators.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
  - 2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
  - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Field quality-control test reports.
- B. Operation and Maintenance Data: For power ventilators to include in operation and maintenance manuals.

## **1.6 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

## **1.8 COORDINATION**

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- C. Coordinate delivery and placement of roof curbs, and equipment supports. Installation of roof curbs, equipment supports, and roof penetrations is specified in Division 07 Section "Roof Accessories."

## **1.9 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Belts: One set for each belt-drive unit.

## **PART 2 - PRODUCTS**

### **2.1 CEILING-MOUNTING VENTILATORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Aerovent; a Twin City Fan Company.
  - 2. Greenheck Fan Corporation; Models SP and CSP.
  - 3. Loren Cook Company.
  - 4. PennBarry; Division of Air System Components.

- B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- C. Housing: Steel, lined with acoustical insulation.
- D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- E. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:
  - 1. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
  - 2. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
  - 3. Motion Sensor: Motion detector with adjustable shutoff timer.
  - 4. Isolation: Rubber-in-shear vibration isolators.
  - 5. Manufacturer's standard roof jack or wall cap, and transition fittings.
- H. Capacities and Characteristics: Refer to schedule(s) on Drawings.

## **2.2 MOTORS**

- A. Comply with requirements in Division 20 Section "Motors."

## **2.3 SOURCE QUALITY CONTROL**

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install power ventilators level and plumb.
- B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- C. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 20 Section "Mechanical Vibration Controls."
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Division 20 Section "Mechanical Identification."

### 3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 10. Shut unit down and reconnect automatic temperature-control operators.
  - 11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor sheaves as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423

## SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

### 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.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each 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.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling 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. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Duct access panels.

### PART 2 - PRODUCTS

#### 2.1 AIR DIFFUSION DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Krueger-HVAC; Air Distribution Technologies, Inc.; a JCI Company.
  - 2. Nailor Industries, Inc.
  - 3. Price Industries.
  - 4. Titus; Air Distribution Technologies, Inc.; a JCI Company.

5. Tuttle & Bailey; Air Distribution Technologies, Inc.; a JCI Company.
- B. Terminal air diffusion devices have been chosen in terms of specific air distribution requirements, spacing, and sound characteristics.
- C. Provide plaster frames for units installed in plaster ceilings.
- D. Provide gaskets for supply terminal air devices mounted in finished surfaces.
- E. Finish:
  1. Device Face and Visible Trim: Standard off white baked enamel finish unless noted otherwise.
  2. Device Interior Surfaces, Including Blank-Offs and Boots: Black matte finish.
- F. Air pattern adjustments shall be made from the face of the device.
- G. Refer to drawings and schedules for quantities, types, and finishes.
- H. Coordinate frame types with Architectural Reflected Ceiling Plan.

## **2.2 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."
- B. Acoustical Applications and Sound Evaluation: Based on ARI Standard 885-98, "Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets."

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 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 practicable. 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. Wall-Mounted Supply Registers: Install 6 inches below finished ceiling unless otherwise indicated.



- D. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### **3.3 ADJUSTING**

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

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## SECTION 260010 - ELECTRICAL GENERAL REQUIREMENTS

### 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 work of this section.

#### 1.2 SUMMARY

- A. This Section includes electrical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 1 Specification Sections.

#### 1.3 REFERENCES

- A. All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
  1. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  2. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
  3. CSI - Construction Specifications Institute (The); [www.csiresources.org](http://www.csiresources.org).
  4. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
  5. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
  6. NEC - National Electrical Code
  7. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
    - a. NECA 1-2000, "Practices for Good Workmanship in Electrical Contracting (ANSI)."
  8. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
  9. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
  10. UL - Underwriters Laboratories Inc.; [www.ul.com](http://www.ul.com).

#### 1.4 QUALITY ASSURANCE

- A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the electrical systems as specified in the Division 26 Sections and as indicated on Drawings.
  1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.
  2. The Contractor understands that the work herein described shall be complete in every detail.

- B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of NFPA, NECA, and UL, unless otherwise indicated.
  - 1. Notify the Architect/Engineer before submitting a proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations. After entering into Contract, make all changes required to conform to above ordinances, rules and regulations without additional expense to the Owner.
- C. Source Limitations: All equipment of the same or similar systems shall be by the same manufacturer.
- D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.
- E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.
- F. Sequence and Schedule: Work so as to avoid interference with the work of other trades. Be responsible for removing and relocating any work which in the opinion of the Owner's Representatives causes interference.

### **1.5 CODES, PERMITS AND FEES**

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the Contractor. All work shall conform to all applicable codes, rules and regulations.
- B. Rules of local utility companies shall be complied with. Coordinate with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets and meters which will be required and include the cost of all such items and all utilities costs in proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed Drawings or diagrams which may be required by the governing authorities. Where the Drawings and/or Specifications indicate materials or construction in excess of code requirements, the Drawings and/or Specifications shall govern.

### **1.6 DRAWINGS**

- A. The Drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the Drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.
- C. Deviations from the Drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The architectural and structural Drawings take precedence in all matters pertaining to the building structure, mechanical Drawings in all matters pertaining to mechanical trades and electrical Drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

- E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

#### **1.7 MATERIAL AND EQUIPMENT MANUFACTURERS**

- A. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of electrical equipment and shall be of the manufacturer's latest design.
- B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, electrical work, and building alterations shall be included in the original Bid. Similar equipment shall be by one manufacturer.

#### **1.8 INSPECTION OF SITE**

- A. Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.

#### **1.9 ITEMS REQUIRING PRIOR APPROVAL**

- A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 1 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.
  - 1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.
  - 2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, electrical, replacement of other components, and building alterations shall be included in the original bid.
- B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid.

#### **1.10 SHOP DRAWINGS/SUBMITTALS**

- A. Submit project-specific submittals for review in compliance with Division 1.

- B. All shop Drawings shall be submitted in groupings of similar and/or related items (lighting fixtures, switchgear, etc.). Incomplete submittal groupings will be returned unchecked.
- C. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of the project and the reasons therefore, shall be submitted with the submittal for approval.
- D. Submit for approval shop drawings for electrical systems or equipment indicated in other sections of electrical specs. Where items are referred to by symbolic designation on the Drawings and Specifications, all submittals shall bear the same designation (light fixtures).

#### **1.11 COORDINATION DRAWINGS**

- A. Submit project specific coordination drawings for review in compliance with Division 1 Specification Sections.

#### **1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS**

- A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 01 Specification Sections.
- B. Provide complete operation and maintenance instructional manuals covering all electrical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Manual shall be provided on electronic media. All literature shall be combined in one document and shall be properly bookmarked with all applicable sections. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.
- C. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:
  - 1. Routine maintenance procedures.
  - 2. Trouble-shooting procedures.
  - 3. Contractor's telephone numbers for warranty repair service.
  - 4. Submittals.
  - 5. Recommended spare parts list.
  - 6. Names and telephone numbers of major material suppliers and subcontractors.
  - 7. System schematic drawings on 8-1/2" x 11" sheets.

#### **1.13 RECORD DRAWINGS**

- A. Submit record drawings in compliance with Division 01.
- B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media which have been neatly marked to represent as-built conditions for all new electrical work. Modifications to original drawings shall be clearly marked with a contrasting color so the marks are readily apparent.
- C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request during the course of construction.

**1.14 INSTRUCTION OF OWNER PERSONNEL**

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of electrical equipment and systems at agreed upon times. A minimum of 8 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. In addition to individual equipment training provide overview of each electrical system. Utilize the as-built documents for this overview.
- D. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction, or as requested by Owner.

**1.15 WARRANTY**

- A. Warranty: Comply with the requirements in Division 01 Specification Sections. Contractor shall warranty that the electrical installation is free from defects and agrees to replace or repair, to the Owner's satisfaction, any part of this electrical installation which becomes defective within a period of one year (unless specified otherwise in other Division 26 sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.
- B. Contractor shall be responsible for any temporary services including equipment and installation required to maintain operation as a result of any equipment failure or defect during warranty period.
- C. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

**1.16 USE OF EQUIPMENT**

- A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.
- B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

**1.17 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. To ensure that connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions; and to maintain 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 8 Section "Access Doors and Frames."
- D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

## **PART 2 - PRODUCTS (NOT APPLICABLE)**

## **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 raceways and piping systems installed at a required slope.

### **3.2 INSTALLATION OF EQUIPMENT**

- A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the Drawings and Specifications, report such conflicts to the Architect/Engineer for resolution.
- B. Device Location:
  - 1. Allow for relocation prior to installation of wiring devices and other control devices, for example, receptacles, switches, fire alarm devices, and access control devices, within a 10-foot radius of indicated location without additional cost.

### **3.3 TEMPORARY SERVICES**

- A. Provide and remove upon completion of the project, in accordance with the general conditions and as described in Division 01, a complete temporary electrical and telephone service during construction.



**3.4 CHASES AND RECESSES**

- A. Provided by the architectural trades, but the Contractor shall be responsible for their accurate location and size.

**3.5 CUTTING, PATCHING AND DAMAGE TO OTHER WORK**

- A. Refer to General Conditions for requirements.
- B. All cutting, patching and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

**3.6 EXCAVATION AND BACKFILLING**

- A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.
- B. Where conduit is installed less than 2'6" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical Drawings.
- C. Backfill all excavations with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
- D. Backfill all excavations inside building, under drives and parking areas with well-tamped granular material. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
- E. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen, excavated material in such a way to prevent settling.

**3.7 EQUIPMENT CONNECTIONS**

- A. Make connections to equipment and other items included in the work in accordance with the approved shop Drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. All additional connections not shown on the Drawings, but called out by the equipment manufacturer's shop Drawings shall be provided.

**3.8 CLEANING**

- A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.
- B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

**3.9 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS**

- A. Equipment and materials shall be protected from theft, injury or damage.
- B. Protect conduit openings with temporary plugs or caps.
- C. Provide adequate storage for all equipment and materials delivered to the job site. Location of the space will be designated by the Owner's representative or Architect/Engineer. Equipment set in place in unprotected areas must be provided with temporary protection.

**3.10 EXTRA WORK**

- A. For any extra electrical work which may be proposed, this Contractor shall furnish to the General Contractor, an itemized breakdown of the estimated cost of the materials and labor required to complete this work. The Contractor shall proceed only after receiving a written order from the General Contractor establishing the agreed price and describing the work to be done. Prior to any extra work which may be proposed, the Electrical Contractor shall submit unit prices (same prices for increase/decrease of work) for the following items: 1/2", 3/4", 1", 1-1/2" conduit; #12, #10, #8, #6, #2 wire; receptacle, I.G. receptacle, data box, fire alarm combination visual/audible notification appliance, fire alarm visual notification appliance, clock, or other devices which may be required for any proposed extra work.

**3.11 DRAWINGS AND MEASUREMENTS**

- A. The Drawings are not intended to be scaled for rough-in measurements nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement are the Contractor's responsibility. The Contractor shall check latest Architectural Drawings and locate light switches from same where door swings are different from Electrical Drawings.

END OF SECTION 260010

## SECTION 260519 - 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. Section includes:
  - 1. Building wires and cables rated 600V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

#### 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 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- D. Conductor Insulation:
  - 1. Type THHN/THWN-2: Comply with UL 83.
  - 2. Type THW/THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
  - 3. Type XHHW-2: Comply with UL 44.

## 2.2 ALUMINUM BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
  - 1. Allowed only for conductors used in feeders 100A and larger.
- B. Manufacturers:
  - 1. General Cable
  - 2. Southwire
- C. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Aluminum, complying with ASTM B 800 and ASTM B 801.
- E. Conductor Insulation:
  - 1. Type XHHW-2: Comply with UL 44.

## 2.3 Power Cable for Variable Frequency Controlled Motors

- A. Description: A factory assembly of three conductor cable with three symmetrical ground conductors, a continuous shield and overall PVC jacket.
- B. Manufacturers:
  - 1. Southwire Armor-x
  - 2. Belden
  - 3. Draka
- C. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. Comply with UL 1277
  - 3. Comply with ICEA S-95-658/NEMA WC 70 for Type TC-ER Power Cable (for VFD application)
  - 4. Comply with NEMA WC 61
  - 5. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
  - 1. Single circuit feeder.
- E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- F. Ground Conductor: Bare copper.

- G. Conductor Insulation: Type XLPE. Comply with UL 83. 600V and 2000V as required by the application.
- H. Shield: dual spiral copper tape shields for 100% coverage or braided shield.
  - 1. Shield transfer impedance shall be less than 10 ohms per meter up to 30 MHZ when tested in accordance with NEMA WC 61
- I. Armor: Steel interlocked.
- J. Jacket: Oil resistant PVC

#### **2.4 CONNECTORS AND SPLICES**

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

### **PART 3 - EXECUTION**

#### **3.1 CONDUCTOR MATERIAL APPLICATIONS**

- A. Refer to application schedule on the drawings
- B. If providing aluminum feeders, contractor is responsible for providing correct feeder, equipment ground and conduit size based on voltage drop and any de-rating required.
- C. Feeders and Branch Circuits: Solid or stranded for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- D. Each feeder shall be of the same conductor and insulation material (phase, neutral, and parallel).
- E. Use conductor not smaller than 14 AWG for control circuits,
- F. Where equipment is listed for use with copper conductors only, use copper conductors for the entire length of feeder.

#### **3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Refer to application schedule on the drawings
- B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel wire-mesh strain relief device at terminations to suit application.
- C. Fire Alarm Circuits: Power-limited, fire-protective, signaling circuit cable.
- D. Class 1 Control Circuits: Type THHN/THWN-2, in raceway.
- E. Class 2 Control Circuits: Power-limited cable, concealed in building finishes and Power-limited tray cable, in cable tray.

- F. Connection between Variable Frequency Controllers and Motors: Use 600V rated VFC power cable for circuit lengths less than 50 feet and 2000V rated VFC power cable for circuit lengths 50 feet and greater. Support 5' on center, minimum. Terminate according to cable manufacturer's recommendations.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. 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.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.
- H. Support communication cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
- I. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- J. Provide a separate neutral conductor for each circuit unless multi-wire branch circuits are specifically indicated on the drawings.
- K. Electrical Contractor shall be responsible for de-rating of conductors as required by N.E.C. when more than three current carrying conductors are installed in a single raceway or cable. Neutral conductors shall be considered current carrying conductors.
- L. Between support, hangers and termination no more than 3" deflection from the bottom of the cable to a horizontal line between the support/hanger or termination.
- M. Do not route conductors across roof without prior approval from engineer.

### 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.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

- D. Clean conductor surfaces before installing lugs and connectors.
- E. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- F. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
- G. Use Sta-Kon connectors to terminate stranded conductors #10 AWG and smaller to screw terminals.
- H. Use insulated spring wire connectors with plastic caps (wire nuts) for copper conductor splices and taps, 10 AWG and smaller. Push-in style connectors are not permitted.
- I. Provide lugs suitable for bussing and conductor material used.

### **3.5 IDENTIFICATION**

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### **3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260533 "Raceways and Boxes."

### **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. Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  - 1. Description: Test all feeders rated 100 A and above.
  - 2. Visual and Mechanical Inspection
    - a. Inspect cables for physical damage and proper connection in accordance with the one line diagram.
    - b. Test cable mechanical connections with an infrared survey.
    - c. Check cable color-coding against project Specifications and N.E.C. requirements.
  - 3. Electrical Tests
    - a. Perform insulation resistance test on each conductor with respect to ground and adjacent conductors. Applied potential to be 1000 volts dc for 1 minute.
    - b. Perform continuity test to insure proper cable connection.

4. Test Values
  - a. Minimum insulation resistance values shall be not less than fifty mega-ohms.
- B. 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.

END OF SECTION 260519



## SECTION 260526 - GROUNDING AND BONDING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. Related Sections include the following:
  - 1. Division 26 Section "Underground Ducts and Utility Structures" for ground test wells.
  - 2. Division 26 Section "Electrical General Requirements".
  - 3. Division 26 Section "Conductors and Cables".

#### 1.3 REFERENCES

- A. ASTM B 3: Specification for Soft or Annealed Copper Wire.
- B. ASTM B 8: Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
- C. ASTM B 33: Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
- D. ASTM B 187: Specification for Copper, Bus Bar, Rod, and Shapes and General Purpose Rod, Bar, and Shapes.
- E. IEEE 81: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
- F. IEEE 142: Grounding of Industrial and Commercial Power Systems.
- G. IEEE 1100 – 1992: Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.
- H. IEEE C2: National Electrical Safety Code.
- I. NETA MTS – 2001: Maintenance Testing Specifications.
- J. NFPA 70: National Electrical Code.
- K. NFPA 70B: Recommended Practice for Electrical Equipment Maintenance.
- L. TIA/EIA 607: Commercial Building Grounding and Bonding Requirements Standard.
- M. UL 467: Grounding and Bonding Equipment.

- N. UL 486 A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- O. UL 486B: Wire Connectors for Use with Aluminum Conductors.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Product Data: For the following:
  - 1. Ground rods.
  - 2. Compression-type connectors.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test Reports: Submit written test reports to include the following:
  - 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.
  - 4. Indicate overall system resistance to ground.
  - 5. Indicate overall Telecommunications system resistance to ground.

#### **1.5 PROJECT RECORD DOCUMENTS**

- A. Submit under provisions of Division 26 "Electrical General Requirements".
- B. Accurately record actual locations of grounding electrodes and connections to building steel.

#### **1.6 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Refer to specification section "Electrical Testing."
- 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.
  - 1. Comply with UL 467.
- C. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
- D. Comply with ANSI/TIA/EIA-607 "Standard for Commercial Building Grounding and Bonding Requirements for Telecommunications".
- E. Comply with ANSI/IEEE 1100 -1992 "Powering and Grounding Sensitive Electronic Equipment".

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductors and Cables:
  - a. Refer to Division 26 Section "Conductors and Cables".
2. Grounding Rods:
  - a. American Electric-Blackburn.
  - b. Apache Grounding/Erico Inc.
  - c. Chance/Hubbell.
3. Mechanical Connectors:
  - a. American Electric-Blackburn.
  - b. Burndy.
  - c. Chance/Hubbell.
4. Exothermic Connections:
  - a. Cadweld.
5. Compression-type Connectors:
  - a. Burndy HyGround
  - b. Blackburn EZ Ground.
  - c. Panduit.

### 2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."
- B. Equipment Grounding Conductors: Insulated with green-colored insulation.
- C. Grounding Electrode Conductors: Stranded cable.
- D. Underground Conductors: Bare, tinned, stranded, copper unless otherwise indicated.
- E. Bare Copper Conductors: Comply with the following:
  1. Solid Conductors: ASTM B 3.
  2. Assembly of Stranded Conductors: ASTM B 8.
  3. Tinned Conductors: ASTM B 33.
- F. Copper Bonding Conductors: As follows:
  1. Bonding Conductor: Stranded copper conductor; size per the NEC.
  2. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; size per the NEC.

3. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; size per the NEC.
- G. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.
- H. Telecommunications Main Grounding Busbar (TMGB)
  1. 48" (min) x 4" x 1/4" tin plated, copper busbar with three rows of 1/4 x 20 tapped holes 3" on center.
- I. Telecommunications Grounding Busbar (TGB)
  1. 12" (min) x 2" x 1/4" tin plated, copper busbar with two rows of 1/4 x 20 tapped holes 3" on center.
- J. Telecommunications Bonding Backbone (TBB)
  1. Minimum No. 2 AWG insulated stranded copper.
- K. Telecommunications Bonding Conductors
  1. Minimum No. 6 AWG insulated stranded copper.

## 2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected for the specific application per manufacturer's written instructions.
- D. Compression-Type Connectors: Pure, wrought copper, per ASTM B187.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
  1. Size: 5/8 in diameter.
  2. Length: 120 inches.
- B. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Provide handholes as specified in Division 2 Section "Underground Ducts and Utility Structures."

# PART 3 - EXECUTION

## 3.1 EQUIPMENT GROUNDING

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

- B. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- C. Underground Grounding Conductors: No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.
- D. In raceways, use insulated equipment grounding conductors.
- E. Install equipment grounding conductors in all feeders and circuits. Terminate each end on suitable lugs, bus or bushing.
- F. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- G. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- H. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- I. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a separate equipment grounding conductor with supply branch-circuit conductors. Bond pole and foundation reinforcing steel to equipment ground conductor.
- J. Verify specific equipment grounding requirements with the manufacturer's recommendations.

### **3.2 CONNECTIONS**

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations
  - 1. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
  - 2. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.
- F. Tighten screws and bolts for grounding and bonding 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 or UL 486B as applicable.
- G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Connections shall be non-reversible. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.3 INSTALLATION

- A. Equipotential Ground: Interconnect grounding electrodes to form one, electrically continuous, equipotential grounding electrode system. Grounding electrodes to be interconnected include:
  - 1. Ground rods.
  - 2. Metal water service pipe.
- B. Ground Rods: 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.
  - 1. Verify that final backfill and compaction has been complete before driving ground rods.
  - 2. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  - 3. Interconnect ground rods with grounding electrode conductors. Use exothermic welds or non-reversing compression-type connectors, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- C. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Install in conduit where routed above grade.
  - 1. Aluminum and copper-clad aluminum conductors shall not be used in direct contact with masonry, within 18 inches of the earth, or where subject to corrosive conditions.
- D. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors or non-reversing compression-type connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- E. Metal Water Service Pipes in direct contact with the earth for 10 feet: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to all metal water service

entrances to building including fire protection water service entrance. Connect grounding conductors to metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

- F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
- H. Separately Derived AC Power Systems: Ground separately-derived ac power system neutrals to grounding electrodes per NFPA 70.
- I. Packaged Engine Generator: Solidly ground the packaged engine generator neutral to the normal power source neutral. Do not ground the generator neutral to a separate grounding electrode.
- J. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.
- K. Grounding Bus:
  - 1. Install grounding bus in the locations listed below and elsewhere as indicated:
    - a. Electrical equipment rooms.
    - b. Telephone equipment rooms.
    - c. Rooms housing service equipment.
  - 2. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
- L. Equipment Grounding: Provide a permanent and continuous bonding of conductor enclosures, equipment frames, power distribution equipment ground busses, cable trays, metallic raceways, and other non-current carrying metallic parts of the electrical system.
- M. Provide a flexible braid bonding jumper at each set of columns at expansion joints.

### 3.4 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Manholes and Handholes: Install a driven ground rod close to wall, inside manhole, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG 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 tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- B. Connections to Manhole Components: Connect all 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 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.
- C. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with transformers/substations by connecting them to underground cable and grounding electrodes. Use not less than a No. 2 AWG conductor

for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade and 6 inches from the foundation.

### 3.5 TELECOMMUNICATIONS GROUNDING

- A. Telecommunications Grounding System: The telecommunications grounding system shall consist of:
1. Telecommunications Main Grounding Busbar (TMGB) located in the main telecommunications room near the telecommunications service entrance. Bond to the main building electrical grounding electrode system via a No. 3/0 AWG copper ground conductor.
  2. Bonding of all equipment racks, raceways, non-current carrying metallic equipment and surge protection devices within the telecommunications room to the TGB's or TMGB using approved bonding conductors. Each piece of equipment shall be bonded individually directly to the ground bus.
- B. All bonding connections shall be installed at an accessible location for inspection and maintenance.
- C. All telecommunications bonding connections shall be of an approved mechanical type connection. Do not use exothermic welds unless specifically indicated on the Drawings.
- D. The physical routing shall, in general, follow the same path as the backbone cable system.
- E. Bond each TGB directly to the building steel with a No. 6 AWG conductor.
- F. Do not use TGB's as a power system ground connection unless specifically noted on the Drawings.
- G. All bonding connectors and conductors shall be UL listed for the purpose intended.
- H. Mount TMGB and TGB bus to backboard or wall using 2" standoff insulators.
- I. Individually bond each piece of non-current carrying metallic equipment in the Telecommunications Room to the TGB.
- J. Install continuous cable from the TMGB to the furthest TGB. Bond all TGB's to TBB with bare No. 3/0 AWG copper ground conductor and T-tap grounding hardware.

### 3.6 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
    - a. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
    - b. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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.
    - c. Perform tests, by the fall-of-potential method according to IEEE 81. Instrumentation utilized shall be as defined in Section 12 of IEEE 81 and shall be specifically designed for ground impedance testing. Provide sufficient spacing so that curves flatten in the 62% area of the distance between the item under test and the current electrode.



2. Provide drawings locating each 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.
  - a. Equipment Rated 500 kVA and Less: 10 ohms.
  - b. Manhole Grounds: 10 ohms.
  - c. The telecommunications grounding system shall have a maximum resistance of 1 ohm as measured from the TMGB ground to earth ground.
3. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

### **3.7 GRADING AND PLANTING**

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 260526

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## 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.

#### 1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.

#### 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 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit; a part of Atkore International..
    - b. B-Line, by Eaton..
    - c. GS Metals Corp.
    - d. Pentair Electrical & Fastening Solutions.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; a part of Atkore International.
    - g. Wesanco, Inc.
  - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 4. Channel Dimensions: Selected for applicable load criteria.
  - 5. Rated Strength: Selected to suit applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. 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.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless] 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) B-Line by Eaton.
      - 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.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. 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.

## **2.3 ROOF MOUNTED CONDUIT AND EQUIPMENT SUPPORTS**

- A. General: Shop- or field- fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted conduit and equipment.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. B-Line by Eaton; Dura-Blok.
  2. MIRO Industries.
  3. Pentair Electrical & Fastening Solutions; Caddy Pyramid.
  4. Pipe Pier Support Systems; Pipe Piers.
- C. Adjustable Compact Stand: Recycled rubber base unit with integral threaded coupling capable of accepting 3/8-16 threaded rod, or 1-5/8 inch by 1-5/8 inch metal strut and various supporting elements.
- D. Multiple-Conduit and Equipment Stand: Assembly of bases, vertical and horizontal members, and conduit supports, for roof installation without membrane penetration.
  1. Bases: One or more adjustable compact stand bases.
  2. Vertical Members: Two or more protective-coated-steel channels.
  3. Horizontal Member: Protective-coated-steel channel.
  4. Supports: Standard strut clamps, hangers, and accessories.

## **2.4 BACKBOARDS**

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 6 Section "Rough Carpentry." Plywood sheets shall be free of all voids. Plywood shall have a minimum of two coats of fire-resistant, non-conducting paint applied to all sides of all sheets. Provide flush hardware and supports to mount plywood to wall. The provided hardware shall have sufficient strength to carry all anticipated loads including, but not limited to cabling, cable management and equipment racks.

## 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 in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted 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:
    - a. Two-bolt conduit clamps
    - b. Single-bolt conduit clamps
    - c. Single-bolt conduit clamps using spring friction action for retention in support channel.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- 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.
- C. 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. To Steel:
    - a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
    - b. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
    - c. Spring-tension clamps.
  - 6. To Light Steel: Sheet metal screws.
  - 7. 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 support systems attached to substrate.
- D. Slotted support systems applications:
  - 1. Indoor dry and damp Locations: Painted Steel
  - 2. Outdoors and interior wet locations: Galvanized Steel
  - 3. Corrosive Environments, including pool equipment rooms: Nonmetallic

- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- F. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- G. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- H. Obtain permission from Architect/Engineer before drilling or cutting structural members.
- I. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- J. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- K. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.
- L. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- M. The Contractor shall replace all supports and channels that sag, twist, and/or show signs of not providing proper structural support, to the equipment, it is intended for, as determined by the Owner and Architect/Engineer. All costs associated with replacing supports and steel channels shall be incurred by the Contractor.

### **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 INSTALLATION OF ROOF MOUNTED SUPPORTS**

- A. Install in accordance with manufacturer's instructions.
- B. If gravel top roof, gravel must be removed around and under support.
- C. Consult roofing manufacturer for roof membrane compression capacities. If required, a compatible sheet of roofing material (rubber pad) may be required under rooftop support to disperse concentrated loads and add further membrane protection.
- D. Utilize properly sized clamps and accessories to suit conduit sizes.
- E. Provide vertical steel channel members as required for elevated conduit supports where required for clearances, coordination with other roof mounted systems or derating.

### **3.5 CONCRETE BASES**

- A. Provide concrete bases for all floor mounted electrical equipment.

- B. Provide concrete bases for all exterior, grade level electrical equipment, and where indicated.
- C. Base/Pad Construction:
  - 1. Construct per manufacturer's recommendations for particular equipment, including suggested piers and dowel rods.
  - 2. Interior concrete bases shall have a minimum depth of 4" unless other indicated or recommended by the manufacturer.
  - 3. Exterior concrete bases shall have a minimum depth of 8" unless other indicated or recommended by the manufacturer.
  - 4. Construct concrete bases for primary and secondary power distribution equipment per requirements of the electrical utility, where submitted for its review.
- D. Anchor equipment to base per both supports and equipment manufacturer's instructions.
- E. Coordinate conduit openings and sleeve locations in base with requirements of equipment to be supported.

### 3.6 BACKBOARDS

- A. A minimum of two walls (or as indicated on drawings) shall be covered with plywood backboards to a minimum 8'-6" above finished floor in all Telecommunication Rooms and similar spaces and as indicated on Drawings.
- B. Securely fasten backboard to wall using appropriate hardware and mount at all four corners, minimum. Securely fasten backboard to wall-framing members (studs).
- C. Provide adequate backboard space to allow a clean and workable arrangement for telephone and data connections.

### 3.7 PAINTING

- A. 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.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529



## SECTION 260533 - RACEWAYS AND BOXES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 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 duct banks, manholes and underground utility construction.
  - 2. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings, and for access floor boxes and service poles.
  - 3. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.
- H. PVC: Polyvinyl Chloride.
- I. HDPE: High Density Polyethylene.
- J. RTRC: Reinforced Thermosetting Resin Conduit

#### 1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

## 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.

## 1.6 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Alflex Inc.
  - 3. Allied Tube Triangle Century.
  - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 5. International Metal Hose.
  - 6. Electri-Flex Co
  - 7. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
  - 8. LTV Steel Tubular Products Company – Manhattan/CDT/Cole-Flex.
  - 9. Maverick.
  - 10. O-Z Gedney; unit of General Signal.
  - 11. Wheatland.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. EMT: ANSI C80.3.
- E. FMC: Zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket.
- G. 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: Steel, compression type.
  - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

## 2.2 FIRE ALARM EMT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Allied Tube Triangle Century.
- B. EMT conduit with bright red topcoat; Fire Alarm EMT.
- C. EMT and Fittings: ANSI C80.3.

## 2.3 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American International.
  - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 3. Arco Corp.
  - 4. Cantex Inc.
  - 5. Certainteed Corp.; Pipe and Plastics Group.
  - 6. Condux International.
  - 7. ElecSys, Inc.
  - 8. Electri-Flex Co.
  - 9. Integral.
  - 10. Kor-Kap.
  - 11. Lamson and Sessions: Carlon Electrical Products.
  - 12. Manhattan/CDT/Cole-Flex.
  - 13. RACO; Division of Hubbell, Inc.
  - 14. Scepter.
  - 15. Spiralduct, Inc./AFC Cable Systems, Inc.
  - 16. Thomas & Betts Corporation.
- B. ENT: NEMA TC 13.
- C. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
- D. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.
- E. LFNC: UL 1660.
- F. HDPE: UL 651, ASTM D 3350, ASTM D 1248 Schedule 40.
- G. RTRC: Comply with UL 2515A and NEMA TC 14.

## 2.4 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hoffman.
  - 2. Square D.
- B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1.

- 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. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- E. Wireway Covers: Screw-cover type.
- F. Finish: Manufacturer's standard enamel finish.

## **2.5 NONMETALLIC WIREWAYS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of 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. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- D. 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.
- E. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

## **2.6 SURFACE RACEWAYS**

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Airey-Thompson Sentinel Lighting; Wiremold Company (The).
    - b. Thomas & Betts Corporation.
    - c. Walker Systems, Inc.; Wiremold Company (The).
    - d. Wiremold Company (The); Electrical Sales Division.
    - e. Mono-Systems, Inc.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell, Inc.; Wiring Device Division.
    - b. Carlon Electric Products.
    - c. Panduit Corporation.
    - d. Walker Systems, Inc.; Wiremold Company (The).
    - e. Wiremold Company (The); Electrical Sales Division.

f. Mono-Systems, Inc.

- C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

## 2.7 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Shall be used within walls or ceiling.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Shall be used in all exposed, non-recessed, locations.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2. Shall be used in corrosive areas.
- D. Floor Boxes: Cast metal, fully adjustable, rectangular.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover. Shall be used in areas exposed to water.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

## 2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Description: Comply with ANSI/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, "ELECTRIC", "COMMUNICATIONS" or as indicated for each system 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 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:

- a. Hubbell: Quazite
- b. Armorcast Products Company.
- c. Carson Industries LLC.
- d. CDR Systems Corporation.
- e. NewBasis.
- f. Christy Concrete Products.

## 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 thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

## 2.10 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of 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: Plastic. Include two for each sealing element.
  3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.11 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.

## 2.12 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. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

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. Provide raceways in interior and exterior locations in accordance with the "Raceway Application Matrix" included on the drawings.
- B. Boxes and Enclosures, Exterior Aboveground: NEMA 250, Type 3R.
- C. Boxes, Enclosures, and Handholes:
  1. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
  2. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
- D. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- E. Minimum Raceway Size: 3/4-inch trade size.
- F. 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.
  3. EMT: Use compression, steel fittings. Comply with NECA FB 2.10.
  4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F

#### **3.2 INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches 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. Install temporary closures to prevent foreign matter from entering raceways.
- F. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- G. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
  - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Raceways Embedded in Slabs:
  - 1. Raceways embedded in slabs shall be limited to above grade concrete decks. Embedded conduit shall be limited to servicing floor boxes and equipment located in open spaces away from accessible walls.
  - 2. Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover.
  - 3. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  - 4. Space raceways laterally to prevent voids in concrete.
  - 5. Run conduit larger than 1-inch trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - 6. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 7. Conduits shall run flat. Do not allow conduits to cross.
  - 8. Change from non-metallic raceway to rigid steel before turning up out of the concrete and rising above the floor.
- L. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
  - 1. Run parallel or banked raceways together on common supports.
  - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.



- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. 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.
- S. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- T. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- U. Communications and Signal Cabling Systems Raceways: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
1. Electrical conduit (LB's) are not permitted.
  2. Conduits shall have no more than two 90 degree bends between pull points or pull boxes.
  3. Conduits shall contain no continuous sections longer than 150 ft. without a pull point/box.
  4. Conduit for fiber cabling shall have a bend radius of at least 10 times the internal diameter.
  5. Conduit for copper cabling less than 2" shall have a bend radius of at least 6 times the internal diameter. Conduit for copper cabling 2" and larger shall have a bend radius of at least 10 times the internal diameter.
  6. All conduit ends shall have an insulated bushing.
- V. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-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 conduits route through, to, or from a hazardous classified space (Class I or II), provide proper seal offs when exiting or entering the hazardous classified space.
  3. Where conduits pass between spaces that are maintained at two different vapor pressures.
  4. Where otherwise required by NFPA 70.
- W. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- X. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC [ **and EMT**] conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.

- c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
  - d. Attics: 135 deg F temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  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 time of installation. Install conduit supports to allow for expansion movement.
- Y. Flexible Conduit Connections: Comply with NEMA RV3. Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
  - Z. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Provide cover clips to cover space between connecting pieces.
  - AA. 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.
  - BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
  - CC. Locate boxes so that cover or plate will not span different building finishes.
  - DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
  - EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
  - FF. Set floor boxes level and flush with finished floor surface. Trim non-metallic boxes after installation to fit flush with finished floor surface.
  - GG. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
  - HH. Do not route feeders across roof unless approved in writing by Engineer.
  - II. Provide a pull box (a handhole for outdoor applications) for each conduit run that exceeds 250 feet. Provide two pull boxes (handholes for outdoor applications) for runs that exceed 500 feet.
  - JJ. Outlet boxes within hazardous locations shall be of the proper class and division as noted in the N.E.C.

### 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 2 Section "Earthwork" for pipe less than 6 inches in nominal diameter.
  2. Install backfill as specified in Division 2 Section "Earthwork."

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 of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks 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 sieve to No. 4 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 above finished grade.
- D. Install handholes and boxes with bottom below the frost line, 42" 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 and communications PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Through-Penetration Firestop Systems."
- 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 and no side greater than 16 inches, thickness shall be 0.052 inch.
  2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- 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 above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch 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 7 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 7 Section "Through-Penetration Firestop Systems."
- 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 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 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 "Through-Penetration Firestop Systems."

**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.

**3.9 CLEANING**

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 260533

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## SECTION 260536 - CABLE TRAYS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes stainless-steel cable trays and accessories for telecommunication conductors and cables. Provide separate tray for fire alarm system cables.
- B. Related Sections include the following:
  - 1. Division 7 Section under "Through Penetration Firestop Materials" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.

#### 1.3 SUBMITTALS

- A. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.
- B. Shop Drawings: For each type of cable tray.
  - 1. Show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
  - 2. Vertical and horizontal offsets and transitions.
  - 3. Clearances for access above and to side of cable trays.
  - 4. Vertical elevation of cable trays above floor or bottom of ceiling structure.
- C. Qualification Data: For testing agency.
- D. Field Test Reports: Written reports for grounding of cable tray as specified in Part 3.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL), acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.
- B. Source Limitations: Obtain cable tray components through one source from a single manufacturer.
- 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 NEMA VE 1, "Metal Cable Tray Systems," if cable tray types specified are defined in the standard.
- E. Comply with NFPA 70.

## 1.5 COORDINATION

- A. Coordinate layout and installation of cable trays and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## PART 2 - PRODUCTS

### 2.1 WIRE BASKET support system

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. [B-Line](#) Flex-Tray.
  - 2. [Cablofil – EZ Tray](#) – Wire-mesh.
  - 3. [P-W Industries, Inc.](#) – Wire mesh.
  - 4. Wiremold.
  - 5. Mono-Systems, Inc.
- B. Description: Continuous, welded steel wire mesh construction, 2” x 4” longitudinal and lateral spacing orientation respectively, width and load depth as indicated with mounting hardware to secure in place.
- C. Material: ASTM A510 high strength steel wires.
- D. Finish: Natural electrostatic, powder-coat paint finish for tray and all fittings. Exact color to be determined by Architect at time of shop drawing submittal.
- E. Inside Width: as indicated on plan.
- F. Inside Depth: 4 inches.
- G. Inside Radius Fittings: 24 inches.
- H. Provide manufacturer’s standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, inside radius fittings, can grounding straps. All splicing connectors shall be UL listed for bonding or #6 AWG copper bonding conductors shall be installed at all splices of separate cable tray sections.
- I. Wall brackets shall be Cablofil CRP Reinforced Bracket, or equivalent, sized as required to bear full width of cable tray.
- J. Provide lay-in lugs for grounding and bonding cable tray.
- K. Provide cable roller kit, Cablofil FAS Roller, or equivalent, including all mounting hardware.



## 2.2 SOURCE QUALITY CONTROL

- A. Perform design and production tests according to NEMA VE 1.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 WIRE BASKET SUPPORT SYSTEMS INSTALLATION

- A. Install wire basket as indicated; in accordance with recognized industry practices (NEMA VE-2 2000), to ensure that the cable tray equipment complies with requirements of NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
- B. Coordinate wire basket with other electrical work as necessary to properly interface installation of wire basket runway with work of other trades.
- C. Provide sufficient space encompassing wire basket to permit access for installing and maintaining cables.
- D. Provide barriers between systems in basket as indicated.

### 3.3 CONNECTIONS

- A. Ground cable trays according to manufacturer's written instructions.
- B. 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.

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
  - 1. After installing wire basket support systems and after electrical circuitry has been energized, test for compliance with requirements.
  - 2. Perform the following electrical test and visual and mechanical inspections:
    - a. Visually inspect each cable tray joint and each ground connection for mechanical continuity.
    - b. Measure ground resistance of each system of cable tray from the most remote element to the point where connection is made to service disconnect enclosure grounding terminal. Record resistance in ohms.
  - 3. Report results in writing.

**3.5 PROTECTION**

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure wire basket support systems is without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 260536

## SECTION 260553 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Identification for raceway and metal-clad cable.
  - 2. Identification for conductors and communication and control cable.
  - 3. Underground-line warning tape.
  - 4. Warning labels and signs.
  - 5. Equipment identification labels.
  - 6. Miscellaneous identification products.

#### 1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

#### 1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

### PART 2 - PRODUCTS

## 2.1 RACEWAY 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. Color for Printed Legend:
  - 1. Power Circuits: Black letters on an orange field.
  - 2. Legend: Indicate system or service and voltage, if applicable.
- 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.

## 2.2 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

## 2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  - 1. Not less than 6 inches wide by 4 mils thick.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend shall indicate type of underground line.

## 2.4 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. 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."

## 2.5 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. Minimum letter height shall be 3/8 inch.
- B. Outdoor Equipment Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.
- C. 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 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service and Feeders More Than 400 A: Identify with orange self-adhesive vinyl label.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
  - 1. Fire Alarm System: Red.
  - 2. Security System: Blue and yellow.
  - 3. Telecommunication System: Green and yellow.
  - 4. Control Wiring: Green and red.
- C. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and marker tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use marker tape. Identify each ungrounded conductor according to source and circuit number as indicated on Drawings. Identify control circuits by control wire number as indicated on shop drawings.
- E. Branch-Circuit Conductor Identification: Mark junction box covers in indelible ink with the panel and breaker numbers of other circuits contained within.
- F. Conductor Identification: Locate at each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection or termination point.
- G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data 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 Operation and Maintenance Manual.
- H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  1. 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.
  2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and 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: Engraved, laminated acrylic or melamine label mechanically secured.
    - b. Outdoor Equipment: Stenciled.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  2. Equipment to Be Labeled: If included on project. All items may not be on project.
    - a. Panelboards, electrical cabinets, and enclosures.
    - b. Access doors and panels for concealed electrical items.
    - c. Electrical switchgear and switchboards.
    - d. Transformers.
    - e. Electrical substations.
    - f. Emergency system boxes and enclosures.
    - g. Motor-control centers.
    - h. Disconnect switches.
    - i. Enclosed circuit breakers.
    - j. Motor starters.
    - k. Push-button stations.
    - l. Power transfer equipment.
    - m. Contactors.
    - n. Remote-controlled switches, dimmer modules, and control devices.
    - o. Battery inverter units.
    - p. Battery racks.
    - q. Power-generating units.
    - r. Voice and data cable terminal equipment.
    - s. Master clock and program equipment.

- t. Intercommunication and call system master and staff stations.
- u. Television/audio components, racks, and controls.
- v. Fire-alarm control panel and annunciators.
- w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
- x. Monitoring and control equipment.
- y. Uninterruptible power supply equipment.
- z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
- aa. Breakers or switches at distribution panels.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location:
  - 1. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
  - 2. Conduit Markers: Provide identification for each power conduit containing conductors rated 400A or greater.
- C. Apply identification devices to surfaces after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color 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 maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
    - d. Grounded Conductor (Neutral): White.
  - 3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
    - d. Ground Conductor (Neutral): Grey.

- 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches 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.
  
- H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
  
- I. Label information arrangement for 3 lines of text.
  - 1. Line one shall describe the panel or equipment. Line one example: “DP-XX,” RP-XX,” “T-XX,” “EF-XX,” etc.
  - 2. Line two shall describe the first disconnecting means feeding this panel or equipment. Line two example: “Fed from DP-XX,” “Fed from RP-XX,” etc.
  - 3. Line three indicates that location of the disconnecting means as identified in line two. Line three example: “First Floor Elect. Rm #XXX.”
  - 4. Line four shall include “Via T-XX” when panel or equipment is fed from a transformer.
  
- J. Examples:

RP-1A FED FROM DP-1A ELECTRICAL ROOM A100 VIA T-1A	EF-1 FED FROM MCC-1A MECHANICAL ROOM F101	LP-1A LOCATED IN ELECTRICAL ROOM A100
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- K. Fusible Enclosed Switches and Distribution Equipment: Install self-adhesive vinyl label indicating fuse rating and type on the outside of door on each fused switch.
  
- L. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.
  
- M. Degrease and clean surface to receive nameplates.
  
- N. Install nameplate and labels parallel to equipment lines.
  
- O. Secure nameplate to equipment front using screws.
  
- P. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
  
- Q. Identify conduit using field painting where required.
  
- R. Paint red colored band on each fire alarm conduit and junction box.
  
- S. Paint bands 10 feet on center, and 4 inches minimum in width.

END OF SECTION 260553



## SECTION 260573 – OVERCURRENT DEVICE COORDINATION STUDY/ARC FLASH HAZARD ANALYSIS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E -Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D prepared by the electrical equipment manufacturer.
- C. The scope of the studies shall include all new distribution equipment supplied by the equipment Manufacturer under this contract.

#### 1.3 REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
  - 2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
  - 3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
  - 4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
  - 5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
  - 6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations
- B. American National Standards Institute (ANSI):
  - 1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
  - 2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
  - 3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
  - 4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
- C. The National Fire Protection Association (NFPA)

1. NFPA 70 -National Electrical Code, latest edition
2. NFPA 70E – Standard for Electrical Safety in the Workplace, latest edition.

#### **1.4 SUBMITTALS FOR REVIEW/APPROVAL**

- A. The short-circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

#### **1.5 SUBMITTALS FOR CONSTRUCTION**

- A. The results of the short-circuit, protective device coordination, and arc flash hazard analysis studies shall be summarized in a final report. Report shall be provided on electronic media. All literature shall be combined in one document and shall be properly bookmarked with all applicable sections.
- B. The report shall include the following sections:
1. Executive Summary.
  2. Descriptions, purpose, basis and scope of the study.
  3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties.
  4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection.
  5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout.
  6. Details of the incident energy and flash protection boundary calculations.
  7. Recommendations for system improvements, where needed.
  8. One-line diagram.
- C. Arc flash labels shall be provided in hard copy and a copy of the computer analysis software viewer program is required to provide arc flash labels in electronic format.

#### **1.6 QUALIFICATIONS**

- A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.
- B. The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer.
- C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.
- D. The equipment manufacturer shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

## 1.7 COMPUTER SOFTWARE PROGRAMS

- A. Computer Software Programs: Subject to compliance with requirements, provide products by one of the following:
  - 1. EDSA Micro Corporation.
  - 2. SKM Systems Analysis, Inc.
  - 3. ESA Inc.
  - 4. CGI CYME.
  - 5. Operation Technology, Inc.

## PART 2 - PRODUCTS

### 2.1 STUDIES

- A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E -Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D prepared by the equipment manufacturer.

### 2.2 DATA COLLECTION

- A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
- B. Source combination may include present and future motors and generators.
- C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner.
- D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data to satisfy the study requirements.

### 2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

- A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141-1993.
- B. Transformer design impedances shall be used when test impedances are not available.
- C. Provide the following:
  - 1. Calculation methods and assumptions
  - 2. Selected base per unit quantities
  - 3. One-line diagram of the system being evaluated
  - 4. Source impedance data, including electric utility system and motor fault contribution characteristics
  - 5. Tabulations of calculated quantities

6. Results, conclusions, and recommendations.
- D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
1. Electric utility's supply termination point
  2. Incoming switchgear
  3. Unit substation primary and secondary terminals
  4. Low voltage switchgear
  5. Motor control centers
  6. Standby generators and automatic transfer switches
  7. Branch circuit panelboards
  8. Other significant locations throughout the system.
- E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.
- F. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short circuit ratings
  2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
  3. Notify design engineer in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

#### 2.4 PROTECTIVE DEVICE COORDINATION STUDY

- A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.
- B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
- D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the TCC graphs, where applicable:
1. Electric utility's overcurrent protective device
  2. Medium voltage equipment overcurrent relays
  3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
  4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
  5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
  6. Conductor damage curves
  7. Ground fault protective devices, as applicable
  8. Pertinent motor starting characteristics and motor damage points, where applicable
  9. Pertinent generator short-circuit decrement curve and generator damage point
  10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

## 2.5 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D.
- B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- C. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA where work could be performed on energized parts.
- D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm<sup>2</sup>.
- E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.
- F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.
- G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
  - 1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
  - 2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).
- H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.
- I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically

possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

## 2.6 REPORT SECTIONS

- A. Input data shall include, but not be limited to the following:
1. Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).
  2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.
  3. Generation contribution data, (synchronous generators and Utility), including short-circuit reactance ( $X''d$ ), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.
  4. Motor contribution data (induction motors and synchronous motors), including short-circuit reactance, rated horsepower or kVA, rated voltage, and X/R ratio.
- B. Short-Circuit Output Data shall include, but not be limited to the following reports:
1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. Equivalent impedance
  2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated symmetrical fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. Calculated asymmetrical fault currents
      - 1) Based on fault point X/R ratio
      - 2) Based on calculated symmetrical value multiplied by 1.6
      - 3) Based on calculated symmetrical value multiplied by 2.7
    - e. Equivalent impedance
  3. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated symmetrical fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. No AC Decrement (NACD) Ratio
    - e. Equivalent impedance
    - f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis
    - g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis
- C. Recommended Protective Device Settings:

1. Phase and Ground Relays:
    - a. Current transformer ratio
    - b. Current setting
    - c. Time setting
    - d. Instantaneous setting
    - e. Recommendations on improved relaying systems, if applicable.
  2. Circuit Breakers:
    - a. Adjustable pickups and time delays (long time, short time, ground)
    - b. Adjustable time-current characteristic
    - c. Adjustable instantaneous pickup
    - d. Recommendations on improved trip systems, if applicable.
- D. Incident energy and flash protection boundary calculations
1. Arcing fault magnitude
  2. Protective device clearing time
  3. Duration of arc
  4. Arc flash boundary
  5. Working distance
  6. Incident energy
  7. Hazard Risk Category
  8. Recommendations for arc flash energy reduction

## PART 3 - EXECUTION

### 3.1 FIELD ADJUSTMENT

- A. The contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.
- B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- C. Notify design engineer in writing of any required major equipment modifications.

### 3.2 ARC FLASH WARNING LABELS

- A. The contractor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.
- C. The label for equipment where arc incident energy is calculated shall include the following, at a minimum:
  1. Location designation
  2. Nominal system voltage
  3. Arc flash boundary

4. Incident energy
  5. Working distance
  6. Engineering report number, revision number and issue date.
- D. The label for equipment where arc incident energy is not calculated shall include the following, at a minimum:
1. Location designation
  2. Nominal system voltage
  3. Arc flash boundary from NFPA 70E 2018 Table 130.7(C) 15(a)
  4. Arc flash PPE category from NFPA 70E 2018 Table 130.7(C) 15(a)
  5. Engineering report number, revision number and issue date.
- E. Labels shall be machine printed, with no field markings.
- F. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
1. For each 208 volt panelboard, one arc flash label shall be provided.
  2. For each motor control center, one arc flash label shall be provided.
  3. For each low voltage switchboard, one arc flash label shall be provided.
  4. For each switchgear, one flash label shall be provided.
  5. For medium voltage switches one arc flash label shall be provided
- G. Labels shall be field installed by the contractor.

END OF SECTION 260573



## 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 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following lighting control devices:
  - 1. Time controllers.
  - 2. Outdoor and indoor photoelectric control.
  - 3. Occupancy sensors.
  - 4. Outdoor motion sensors.
  - 5. Lighting contactors.
  - 6. Wall digital time switches.
- B. Related Sections include the following:
  - 1. Division 26 Section "Electrical General Requirements".
  - 2. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.
  - 3. Division 26 Section "Lighting Control Systems" for programmable lighting systems.

#### 1.3 REFERENCES

- A. IEEE C62.41: Guide for Surge Voltages in Low-Voltage AC Power Circuits.
- B. IEEE C136.10: Standard for Roadway Lighting Equipment Locking-Type Photocontrol Devices and Mating Receptacle Physical and Electrical Interchangeability and Testing.
- C. NEMA ICS 2: Industrial Control and Systems Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC Part 8: Disconnect Devices for Use in Industrial Control Equipment.
- D. NFPA 70: National Electrical Code.
- E. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- F. UL 486B: Wire Connectors for Use with Aluminum Conductors.
- G. UL 773: Plug-in, Locking Photocontrols for Use with Area Lighting.
- H. UL 773A: Nonindustrial Photoelectric Switches for Lighting Control.
- I. UL 917: Clock Operated Switches.

- J. UL 1449: Surge Protective Devices.
- K. UL 1598: Luminaires.
- L. NECA 130-2010: Installing and Maintaining Wiring Devices.

#### **1.4 DEFINITIONS**

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.
- C. ULTRASONIC: Active emission of at least 35 kHz sound waves, using Doppler reflectance to detect motion.
- D. MICROPHONIC: Passive reception to listen for continued occupancy, with circuitry to filter out white noise.
- E. MULTI-Tech: Using PIR and ultrasonic or microphonic technologies in one sensor.

#### **1.5 SUBMITTALS**

- A. Product Data: For each type of product indicated including physical data and electrical performance.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
  - 1. Lighting plan showing location, orientation, and coverage area of each sensor.
  - 2. 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. Include the following:
  - 1. Description of operation and servicing procedures.
  - 2. List of major components.
  - 3. Recommended spare parts.
  - 4. Programming instructions and system operation procedures.

#### **1.6 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.

#### **1.7 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, fire-suppression system, and partition assemblies.
- B. Coordinate interface of lighting control devices with temperature controls specified in Division 23.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the site under provisions of Division 26 Section "Electrical General Requirements".
- B. Store and protect products under provisions of Division 26 Section "Electrical General Requirements".

## PART 2 - PRODUCTS

### 2.1 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

- A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

### 2.2 OUTDOOR PHOTOELECTRIC CONTROL

- A. Manufacturers:
  - 1. Intermatic, Inc.
  - 2. Square D.
  - 3. TORK.
- B. General
  - 1. Provide fully-gasketed, weathertight enclosure constructed of die cast zinc, with one-half inch conduit nipple for mounting purposes, and with positioning lug to permit full 360-degree adjustable orientation of photocell.
  - 2. Provide hermetically-sealed, one-inch-diameter, cadmium sulphide photoelectric cell with manual, light level selector.
  - 3. Provide photoelectric control suitable for an operating temperature range of minus 40 degrees F to plus 140 degrees F .
- C. Description: Solid state, with SPST dry contacts rated for 1800 VA ballasted load, to operate connected load, relay, contactor coils, or microprocessor input, and complying with UL 773A.
  - 1. Light-Level Monitoring Range: Adjustable turn-on range of 1 to 5 footcandle and adjustable turn-off range of 3 to 15 footcandle [, **and a directional lens in front of photocell to prevent fixed light sources from causing turn-off**].
  - 2. Time Delay: Adjustable delay up to two minutes to prevent false operation.
  - 3. Contacts: Normally closed, fail on.
  - 4. Electrical: Provide photocell with operating voltage rated to switch the load directly unless otherwise indicated.
  - 5. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.
  - 6. 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.
  - 7. Provide hermetically-sealed, one inch diameter, cadmium sulphide photoelectric cell with manual, 2 to 50 footcandle , light level selector.

### 2.3 INDOOR PHOTOELECTRIC CONTROL

- A. Manufacturers:
1. Wattstopper LS-101.
  2. Sensorswitch CM-PC.
- B. Photoelectric Sensor: Solid-state, light-level sensor unit utilizing an internal photoconductive cell to detect changes in lighting levels and capable of controlling any lighting source.
1. Housing: White, thermoplastic, tamper resistant, ceiling mount.
  2. Sensor shall operate on 24V DC power through a control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
  3. Light-Level Monitoring Range: 10 to 200 footcandle with an adjustment for turn-on and turn-off levels within that range.
  4. Deadband: Adjustable range of 10 to 300%.
  5. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
  6. Indicator: Two LEDs to indicate the beginning of on and off cycles.
  7. Manual override function.
  8. Provide indoor photoelectric switches and control units from single manufacturer.
  9. Provide indoor photoelectric switches from same manufacturer as occupancy sensors.
  10. Provide all control units and relays required to interface with occupancy sensors as required.
- C. Indoor Photoelectric Sensor Control Units:
1. Description: Transformer and relay combined in single unit to provide 24DC power to sensors and provide 20A contact(s) for control of lighting loads at 120 or 277V. Control unit input power shall be from unswitched leg of lighting circuit it is controlling.
    - a. Control units shall be provided as required to power indoor photoelectric sensor, control lighting loads and provide a minimum of one auxiliary contact.
    - b. Sensor control units shall mount external to 4" sq junction box in the ceiling space. Wiring between control unit and photoelectric switch shall be plenum rated.
    - c. Locate control unit in accessible location in gyp-board ceilings, adjacent to return air grilles, or provide access panel.
    - d. Additional auxiliary relay modules shall be provided as required to provide control of all lighting circuits and additional auxiliary contacts as required.
    - e. It is acceptable to provide controls and auxiliary contacts as required integral to the sensor, provided all required contacts are provided.
    - f. Maximum of 3 sensors per power pack. Verify exact quantities required with manufacturer.

### 2.4 OCCUPANCY SENSORS

- A. General
1. Coordinate occupancy sensor locations, coverages and required quantities with manufacturer's recommendations. Coverage areas indicated on the Drawings are for minor motion (6 to 8 inches of hand movement). Provide additional occupancy sensors and control units as required to achieve complete minor motion coverage of the space indicated.
  2. Adjust occupancy sensors and test that complete minor motion coverage is obtained in accordance with Part 3. Provide written confirmation of testing to owner, architect and engineer.
  3. Provide occupancy sensors with a bypass switch to override the "ON" function in the event of sensor failure.

4. Provide occupancy sensors with an LED indicator indicating when motion is being detected during testing and normal operation of the sensor.
  5. Provide occupancy sensors and occupancy sensor control units from single manufacturer.
- B. 360° Ceiling Mounted Dual Technology Occupancy Sensor
1. Manufacturers:
    - a. Perfect Sense CDS.
    - b. Wattstopper DT 300
    - c. Hubbell Building Automation “OMNI-DT” Series.
    - d. Greengate OMC-DT-2000-R.
    - e. Sensorswitch CM-PDT-R.
    - f. Philips LRM2255.
    - g. Leviton OSC10-M0W.
  2. Description: Ceiling mounted, 360° coverage, multi-tech sensing occupancy sensor.
    - a. Housing: White, thermoplastic, tamper resistant ceiling mount.
    - b. Functions: Automatic ON must sense motion from both ultrasonic and infrared sensing elements. Either technology shall maintain ON, with adjustable time delays.
    - c. Adjustments: User adjustable sensitivity adjustment shall be provided for each sensing technology. Time delay shall be adjustable from 30 seconds to 30 minutes.
    - d. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
    - e. Manual override function.
- C. 110° Wall Mounted Dual Technology Occupancy Sensor
1. Manufacturers:
    - a. Perfect Sense DTC.
    - a. Wattstopper DT-200
    - b. Hubbell Building Automation “LO-DT” Series.
    - c. Sensorswitch WV-PDT-R/WV-BR.
    - d. Philips LRM2265.
    - e. Leviton OSW12-M0W.
  2. Description: Wall mounted, 110° coverage, multi-tech occupancy sensor.
    - a. Housing: White, thermoplastic, tamper resistant with swivel bracket for wall or ceiling mounting.
    - b. Functions: Automatic ON must sense motion from both sensing elements. Either technology shall maintain ON, with adjustable time delays.
    - c. Adjustments: User adjustable sensitivity adjustment shall be provided for each sensing technology. Time delay shall be adjustable from 30 seconds to 15 minutes.
    - d. Sensor Orientation: Orient sensor in room such that sensor will not detect motion through open door which could cause false activation.
    - e. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
    - f. Manual override function.
- D. Occupancy Sensor Control Units:

1. Description: Transformer and relay combined in single unit to provide 24DC power to sensors and provide 20A contact(s) for control of lighting loads at 120 or 277V. Control unit input power shall be from unswitched leg of lighting circuit it is controlling.
  - a. Control units shall be provided as required to power ceiling mounted occupancy sensors, control lighting loads and provide a minimum of one auxiliary contact.
  - b. Occupancy sensor control units shall mount external to 4" sq junction box in the ceiling space. Wiring between control unit and occupancy sensor shall be plenum rated.
  - c. Locate control unit in accessible location in gyp-board ceilings, adjacent to return air grilles, or provide access panel.
  - d. Additional auxiliary relay modules shall be provided as required to provide control of all lighting circuits and additional auxiliary contacts as required.
  - e. It is acceptable to provide controls and auxiliary contacts as required integral to the ceiling sensor, provided all required contacts are provided.
  - f. Maximum of 3 sensors per power pack. Verify exact quantities required with manufacturer.

## 2.5 LIGHTING CONTACTORS

### A. Manufacturers:

1. Cutler-Hammer; Eaton Corporation.
2. Square D Co.
3. General Electric.
4. Siemens.
5. Square D Co; class 8903.

### B. Contactor

1. Electrically-operated mechanically-held contactor, per NEMA ICS2, with 120 volt, 60 hertz coil and 240 volt, 60 hertz, 20 ampere contacts.
2. Provide contacts to be 100 percent, continuously rated for all types of ballast and tungsten lighting and resistance loads without the need for in-rush current derating.
3. Provide NEMA type 1 enclosure unless otherwise indicated.
4. Provide solderless pressure wire terminals.
5. Provide corrosion-resistant primer treatment with light gray baked acrylic enamel finish.
6. Provide the following control and indicating devices:
  - a. Auxiliary contacts: One field convertible.
  - b. Auxiliary relay to convert maintained-contact type control circuit to momentary-contact type control circuit necessary for contactor control.
  - c. Hand-off-auto selector switch, of the heavy-duty "oil-tight", maintained-contact type, mounted on the front cover with legend plate.
  - d. Green pilot light to indicate "power on" condition. Mount on front cover with legend plate.

## PART 3 - EXECUTION

### 3.1 LIGHTING CONTACTOR INSTALLATION

- A. Install lighting contactors as indicated on plan. Install at accessible locations. Switch controls where provided shall be no higher than 54" or lower than 48".
- B. Demonstrate proper operation of all lighting control functions to the Owner and Engineer.

### **3.2 OUTDOOR PHOTOELECTRIC CONTROL INSTALLATION**

- A. Mount photocell on roof or parapet to ½" GRS conduit, supported to building structure below. Coordinate roof penetration with roofing contractor.
- B. Install photoelectric control oriented in the northeast direction and not within any potential shadows.
- C. Adjust photocell sensitivity and delay to meet owner's requirements. Multiple adjustments may be required, as needed.

### **3.3 OCCUPANCY SENSOR INSTALLATION**

- A. Install wall mounted occupancy sensors as noted on plan. Arrange occupancy sensors with adjacent switch devices so that device plates line-up and are equally spaced.
- B. Install ceiling mounted sensors at approximate locations as indicated on plan. Sensor manufacturer shall provide quantity of sensors as required to provide complete coverage for rooms.
- C. Locate sensors such that motion through open doors will not falsely activate sensors.
- D. Do not locate ultrasonic sensors within six feet of supply air diffusers.
- E. Locate infrared sensors to avoid obstructions.
- F. Provide the services of a manufacturer's representative for commissioning of occupancy sensor installation. This shall include consultation on layout and location prior to installing sensors, testing of each sensor for compliance with Contract Documents and field adjustment and fine tuning after installation is complete. Provide written confirmation of testing to the Owner, Architect and Engineer.
- G. Field adjustments shall take place in the presence of the owner and the engineer. This shall include owner training on adjustment techniques for the occupancy sensors.

### **3.4 WIRING INSTALLATION**

- A. Wiring Method: Comply with Division 26 Section "Conductors and Cables".
- B. 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.
- 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.
- E. 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.

### **3.5 IDENTIFICATION**

- A. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."

- B. Label time switches and contactors with a unique designation.

### **3.6 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 actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### **3.7 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION 260923



## SECTION 260943 - LIGHTING CONTROL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the design and installation of programmable automatic lighting controls with all input and control devices necessary to meet the performance indicated on the contract drawings and this specification.
- B. Related Sections include the following:
  - 1. Division 16 Section "Lighting Control Devices" for standalone lighting control devices not included in the programmable lighting control system.
  - 2. Division 16 Section "LED Interior Lighting" and "Exterior Lighting" for luminaire specifications and accessories.

#### 1.3 DEFINITIONS

- A. BACnet: A networking communication protocol that complies with ASHRAE 135.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.
- C. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A.

#### 1.4 SUBMITTALS

- A. Product Data: Indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature for all sensors, relays, dimming modules, control stations and other devices necessary for complete operation of the system
- B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.
  - 1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements for all system components requiring field installation.
  - 2. Riser Diagram: Show interconnection between all system components.
    - a. Identify complete data communication backbone and interconnection between sensors, relays, dimming modules control stations and other components.
    - b. Identify typical room/area type configurations.

- c. Indicate interconnections with emergency egress lighting relays and transfer devices required.
  3. Information Technology (IT) connection: Provide information pertaining to interconnection with facility IT networking equipment and third-party systems.
  4. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
  5. Contractor startup and commissioning worksheet.
- C. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
  2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
  3. Device address list.
  4. Printout of software application and graphic screens.
- D. Submit qualifications of commissioning agent and draft functional test plans for review and approval.
- E. Field quality-control test reports and commissioning worksheets
- F. Software licenses and upgrades required by and installed for operation and programming of digital devices.
- G. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals. Include the following:
1. Software manuals.
  2. Operation of adjustable zone controls.
  3. Description of operation and servicing procedures.
  4. List of major components and recommended parts.
  5. System operation and integration instructions.
- H. Warranty: Special warranty specified in this Section.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain lighting control system components through one source from a single manufacturer with total responsibility for compatibility of lighting control system components required to meet the performance of the system specified in this section and as indicated on the drawings.
- 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 47 CFR, Subparts A and B, for Class A digital devices.
- D. Comply with NFPA 70.
- E. Listed as qualified under Design Lights Consortium (DLC) Networked Lighting Control System Specification V2.0.
- F. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
- G. Comply with ASHRAE 90.1 - 2013

## 1.6 COORDINATION

- A. Coordinate lighting control components specified in this Section and with systems and components specified in other Sections to form an integrated interconnection of compatible components.
- B. Match components and interconnections for optimum performance of lighting control functions.
- C. Provide open protocol interface for Interoperability with building automation system including status of occupancy/vacancy sensors, control stations, time schedules, display graphics and status of lighting controls in each area.
- D. Coordinate lighting controls with devices specified in Division 16 Section "Lighting Control Devices".

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship within five years from date of Substantial Completion.

## 1.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for five years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within five years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revise licenses for use of the software.
  - 1. Provide 30-day notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment, if necessary.

## 1.9 SYSTEM COMMISSIONING

- A. Provide the services of a third party, independent agent to perform functional testing and verification of the lighting control system to comply with the requirements of ASHRAE 90.1 – 2013.
- B. Perform functional testing of all lighting control system operations.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acuity nLight
  - 2. Lutron
  - 3. Touche'

## 2.2 SYSTEM PERFORMANCE REQUIREMENTS

### A. System Architecture

1. System shall have an architecture that is based upon three main concepts: (a) networkable intelligent lighting control devices, (b) standalone lighting control zones using distributed intelligence, (c) system backbone for remote, time based and global operation between control zones.
  - a. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
  - b. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher level system backbone; this capability is referred to as “distributed intelligence.”
  - c. System must be capable of interfacing directly with networked luminaires such that low voltage network cabling is used to interconnect networked luminaires with control components such as sensors, switches and system backbone.
2. The system shall be provide individually addressable switching and dimming control of the following: networked luminaires, control zones to include multiple switch legs or circuits, and relay and dimming outputs from centralized panels to provide design flexibility appropriate with sequence of operations required in each project area or typical space type. A single platform shall be used for both indoor and outdoor lighting controls.
3. Lighting control zones shall be networked with a higher level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software.
4. All system devices shall support remote firmware update, such that physical access to each device is not necessary, for purposes of upgrading functionality at a later date.
5. System shall be capable of “out of box” sequence of operation for each control zone. Standard sequence is:
  - a. All switches control all fixtures in a zone
  - b. All occupancy sensors automatically control all fixtures in the control zone with a default timeout.

### B. Wired Networked Control Zone Characteristics

1. All networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g., software application, handheld remote, pushbutton). The “out of box” default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
2. System shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
3. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
  - a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.

- b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay(s) and provide 100% light output upon detection of loss of power sensed via line voltage connections.
- c. Emergency egress devices shall be provided and UL labeled by the lighting control manufacturer.

C. System Integration Capabilities

1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet/MSTP protocols.

## 2.3 SYSTEM SOFTWARE INTERFACES

A. Management Interface

1. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.
2. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.
3. All system software updates must be available for automatic download and installation via the internet.

B. Historical Database and Analytics Interface

1. System shall provide a browser-based trending and monitoring interface that stores historical data for all occupancy/daylight sensors and lighting loads. Additionally, the system shall optionally upload that data to a cloud based server.

C. Visualization Interfaces

1. System shall provide an optional web-based visualization interface that displays a graphical floorplan. System data, to include status of occupancy sensors, daylight sensors and light output shall be overlaid to the floorplan to provide a graphical status page.

D. Portable Programming Interface for Standalone Control Zones

1. Portable handheld application interface for standalone control zones shall be provided for systems that allows configuration of lighting control settings.
2. Programming capabilities through the application shall include, but not be limited to, the following:
  - a. Switch, occupancy and photo sensor group configuration
  - b. Manual/automatic on modes
  - c. Turn-on dim level
  - d. Occupancy sensor time delays
  - e. Dual technology occupancy sensors sensitivity
  - f. Photo-sensor calibration adjustment and auto-setpoint
  - g. Trim level settings

## 2.4 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

### A. System Controller

1. System Controller shall be a multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
2. System Controller shall perform the following functions:
  - a. Facilitation of global network communication between different areas and control zones.
  - b. Time-based control of downstream wired network devices.
  - c. Linking into an Ethernet network.
  - d. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
  - e. Connection to various software interfaces, including management interface, historical database and analytics interface, visualization interface, and personal control applications.
3. System Controller shall not require a dedicated PC or a dedicated cloud connection.
4. Device shall automatically detect all networked devices connected to it, including those connected to wired and wireless communication bridges.
5. Device shall have a standard and astronomical internal time clock.
6. Shall be capable of connecting to the customers Local Area Network (LAN) via IEEE 802.11.x Wireless and IEEE 802.3 Wired connection.
7. System Controller shall support BACnet/IP and BACnet/MSTP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.
  - a. BACnet/MSTP shall support a minimum of 50 additional BACnet MS/TP controllers in addition to the Expansion I/O modules.
  - b. BACnet/MSTP shall support 9600 to 115200 baud.
  - c. System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
  - d. System controller must support BACnet/IP Broadcast Management Device (BBMD) and Foreign Device Registration (FDR).

### B. OpenADR Interface

1. System shall provide an interface to OpenADR protocol Demand Response Automation Servers (DRAS) typically provided by local electrical utility.
2. OpenADR interface shall meet all of the requirements of Open ADR 2.0a Virtual End Nodes (VEN), including:
  - a. Programmable with the account information of the end-user's electrical utility DRAS account credentials.

## 2.5 WIRED NETWORKED DEVICES

### A. Wired Networked Wall Switches, Dimmers, Scene Controllers

1. Wall switches & dimmers shall support the following device options:
  - a. Number of control zones: 1, 2 or 4. Gang multiple switches where more than 4 control zones are required in a single location under a single faceplate.
  - b. Control Types Supported: On/Off or On/Off/Dimming

2. Scene controllers shall support the following device options:
  - a. Number of scenes: 1, 2 or 4
  - b. Control Types Supported:
    - 1) On/Off or On/Off/Dimming
    - 2) Preset Level Scene Type
    - 3) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene
    - 4) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones
3. Match color specified in Division 16 Section "Wiring Devices."
4. Integral green LED pilot light to indicate when circuit is on.
5. Internal white LED locator light to illuminate when circuit is off.
6. Networked switch stations shall have backlit buttons.
7. Wall Plates:
  - a. Single and multigang plates as specified in Division 16 Section "Wiring Devices."
  - b. Where multiple switches and/or dimmers are adjacent to each other, install a single cover plate. Provide separate boxes or barriers as required for the application.
  - c. Provide cover plates that are identical in material and dimension to standard single and double gang switch plates.
  - d. Verify back box requirements for multiple control points with manufacturer.
8. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

B. Wired Networked Graphic Wall Stations

1. Device shall have a full color touch screen.
2. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
3. Graphic wall stations shall support the following device options:
  - a. Number of control zones: Minimum of 16
  - b. Number of scenes: Minimum of 16
  - c. Optional password protection for setup screens.

C. Wired Networked Auxiliary Input / Output (I/O) Devices

1. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
  - a. Contact closure input: Programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, ramp light level up or down, or toggle lights on/off.
  - b. 0-10V analog input: Programmable to function as a daylight sensor.
  - c. RS-232/RS-485 digital input: Supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
  - d. 0-10V dimming control output, capable of sinking a minimum of 20mA of current programmable to support all standard sequence of operations supported by system.

D. Wired Networked Occupancy and Photosensors

1. Sensors shall utilize passive infrared (PIR) or passive dual technology (PDT) to detect both major and minor motion as defined by NEMA WD-7 standard.
  2. Sensing technologies that are acoustically passive, meaning they do not transmit sound waves of any frequency do not require additional commissioning. Ultrasonic or Microwave based sensing technologies may require commissioning due to the active nature of their technology, if factory required.
  3. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device.
  4. Sensor mounting type shall match project design requirements as shown on plans.
    - a. Sensors shall have optional features for photosensor/daylight override, dimming control, and low temperature/high humidity operation.
  5. The system shall support the following types of photocell-based control:
    - a. On/Off: The control zone is automatically turned off if the photocell reading exceeds the defined setpoint and automatically turned on if the photocell reading is below the defined setpoint. A time delay or adaptive setpoint adjustable behavior may be used to prevent the system from exhibiting nuisance on/off switching.
    - b. Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.
- E. Wired Networked Wall Switch Sensors
1. Wall switches sensors shall support the following device options:
    - a. User Input Control Types Supported: On/Off or On/Off/Dimming
    - b. Occupancy Sensing Technology: PIR only or Dual Tech
    - c. Daylight Sensing Option: Inhibit Photosensor
- F. Wired Networked Embedded Sensors
1. Embedded sensors shall support the following device options:
    - a. Occupancy Sensing technology: PIR only or Dual Tech
    - b. Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor
- G. Distributed System Power, Switching and Dimming Controls
1. Devices shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
  2. Device programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
  3. Device shall be plenum rated.
  4. Devices shall be UL Listed for load and load type as specified on the plans.
- H. Wired Networked Luminaires
1. Networked luminaire shall have a factory installed mechanically integrated control device and carry a UL Listing as required.
  2. Networked LED luminaire shall provide low voltage power to other networked control devices.



3. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by automatically varying the dimming control signal to account for lumen depreciation.
4. System shall be able to provide control of network luminaire intensity, in addition to correlated color temperature of specific LED luminaires.
5. Controls manufacturer is responsible for primary troubleshooting and tech support of complete fixture.

I. Wired Networked Relay and Dimming Panel

1. Relay and dimming panel(s) shall be capable of providing the required amount of relay capacity, as required per panel schedules shown on drawings, with an equal number of individual 0-10V dimming outputs.
2. Standard relays used shall have the following required properties:
  - a. Configurable in the field to operate with normally closed or normally open behavior.
  - b. Provides visual status of current state and manual override control of each relay.
  - c. Be individually programmable
3. 0-10 dimming outputs shall support a minimum of 100mA sink current per output.
4. Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205)
5. Cabinet: Steel with hinged, locking door or flush, surface mounted cover attached with screws.
  - a. Barriers separate low-voltage and line-voltage components.
  - b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device, if any.
  - c. User interface panel: Accessible without removing cover.
6. Relays: Mechanically held; split-coil, momentary-pulsed type.
  - a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
  - b. Rated Capacity (Mounted in Relay Panel): 20 A for any load type at 277V or 120V.
  - c. Endurance: 1,000,000 cycles at rated capacity.
  - d. Mounting: Provision for easy removal and installation in relay cabinet.
7. Panel shall be UL924 listed for control of emergency lighting circuits.
8. Panel shall provide a contact closure input that acts as a panel override to activate the normally configured state of all relays (i.e., normally open or normally closed) in the panel.

**2.6 CONDUCTORS AND CABLES**

- A. General: All conductors and cables shall comply with the requirements of Division 16 Section "Conductors and Cables." Where cable is permitted to be installed exposed in ceiling space, provide plenum rated cable.
- B. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG.
- C. Classes 2 and 3 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 22 AWG.
- D. Class 1 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 18 AWG.

- E. Digital and Multiplexed Signal Cables: As required by system manufacturer. Provide plenum rated cables where installed exposed in ceiling space.

### **PART 3 - EXECUTION**

#### **3.1 WIRING INSTALLATION**

- A. The lighting control system shall be installed and connected as shown on the plans and as directed by the manufacturer.
- B. Comply with NECA 1.
- C. Wiring Method: Install wiring in raceways except where installed in accessible ceilings. Comply with Division 16 Sections "Conductors and Cables" and "Raceways and Boxes".
- D. Where cables are installed in finished areas with exposed construction, conceal cables from view. Route at top of structural systems and conceal on top of structural members where possible. Where cable is exposed to view, provide raceway. As an alternative to raceway, provide cable that is factory colored to match exposed ceiling. Submit sample to Architect for approval.
- E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- F. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- G. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- H. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes as per manufacturers' recommendations.
- I. Identify components and power and control wiring according to Division 16 Section "Electrical Identification."
- J. Label each relay with a unique designation.

#### **3.2 INSTALLATION REQUIREMENTS**

- A. Review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
- B. Install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals, plans and specifications.
- C. Coordination with Owner's IT Network Infrastructure to secure all required network connections to the owner's IT network infrastructure. Provide the owner's representative with all network infrastructure requirements of the networked lighting control system. Provide the manufacturer's representative with all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

- D. Verify integration and interoperability scope with the Mechanical Contractor prior to submittal phase and provide all necessary schedules to the Lighting Control manufacturer.

### **3.3 SYSTEM STARTUP**

- A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed by an authorized representative of the manufacturer.
  - 1. Low voltage network cable testing shall be performed prior to system startup at the discretion of the manufacturer.
- B. System start-up and programming shall include:
  - 1. Verifying operational communication to all system devices.
  - 2. Programming the network devices into functional control zones to meet the required sequence of operation.
  - 3. Programming and verifying all sequence of operations.
  - 4. Customization of owner's software interfaces and applications.
- C. Initial start-up and programming is to occur on-site. Additional programming may occur on-site or remotely over the Internet as necessary.

### **3.4 DOCUMENTATION**

- A. Submit software database file with desired device labels and notes completed.
- B. Document the installed location of all networked devices, including networked luminaires. Provide as-built plan drawing showing device addresses corresponding to locations of installed equipment.

### **3.5 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components and equipment installation, including connections and assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Test for circuit continuity.
  - 2. Verify that the control module features are operational.
  - 3. Check operation of local override controls.
  - 4. Test system diagnostics by simulating improper operation of several components selected by Architect.

### **3.6 SOFTWARE INSTALLATION**

- A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

**3.7 SYSTEM COMMISSIONING**

- A. Facilitate the functional testing and verification of the lighting control system by an independent, third party commissioning agent.
- B. Perform commissioning in the presence of the Owner's representative.
- C. Submit functional test plan checklist signed by the commissioning agent.

**3.8 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting programming functions and other system parameters and to assist Owner's personnel in making program changes to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

**3.9 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to program, adjust, operate, and maintain lighting controls.
- B. Demonstration shall be done only after initial system start-up setup has occurred and system is functioning properly.
- C. Demonstration shall consist of a four hour minimum session.

**3.10 MANUFACTURER SUPPORT**

- A. Manufacturer telephone support shall be available at no cost to the Owner during the warranty period and shall include the following:
  - 1. Assistance in solving programming or other application issues pertaining to the control equipment.
  - 2. The manufacturer shall provide a toll-free number for direct technical support available 7 days a week, 24 hours a day.
  - 3. A factory authorized technician shall be located within a 100 mile radius of the project site.

END OF SECTION 260943

## SECTION 260999 - ELECTRICAL TESTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Related Sections include the following:
  - 1. Division 26 Section "Electrical General Requirements."
  - 2. Division 26 Section "Conductors and Cables."
  - 3. Division 26 Section "Grounding and Bonding."
  - 4. Division 26 Section "Packaged Engine Generators."
  - 5. Division 26 Section "Enclosed Switches."
  - 6. Division 26 Section "Transfer Switch."
  - 7. Division 26 Section "Enclosed Controllers."
  - 8. Division 26 Section "Surge Protective Devices"
  - 9. Division 26 Section "Switchboards."
  - 10. Division 26 Section "Panelboards."
  - 11. Division 26 Section "Fuses."

#### 1.2 SECTION INCLUDES

- A. The Electrical Contractor shall engage the services of a recognized corporately independent N.E.T.A. certified testing firm for the purpose of performing inspections and tests as herein specified
- B. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
- C. It is the intent of these tests to assure that all tested electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design Specifications.
- D. The test and inspections shall determine suitability for energization.
- E. Equipment to be tested and inspected shall be the equipment shown on the one line diagram and schedules as required by part three of each individual Specification Section. In addition, all equipment that is part of an emergency distribution system shall be tested.

#### 1.3 REFERENCES

- A. All inspections and tests shall be in accordance with the latest version of the following codes and standards except as provided otherwise herein.
  - 1. National Electrical Manufacturer's Association - NEMA
  - 2. American Society for Testing and Materials - ASTM
  - 3. Institute of Electrical and Electronic Engineers - IEEE

4. InterNational Electrical Testing Association - NETA Acceptance Testing Specifications - ATS-2017
5. InterNational Electrical Testing Association - NETA Maintenance Testing Specifications- MTS-2015
6. American National Standards Institute - ANSI C2: National Electrical Safety Code
7. State and Local Codes and Ordinances
8. Insulated Cable Engineers Association - ICEA
9. Association of Edison Illuminating Companies - AEIC
10. Occupational Safety and Health Administration
11. National Fire Protection Association - NFPA
  - a. ANSI/NFPA 70: National Electrical Code
  - b. ANSI/NFPA 70B: Electrical Equipment Maintenance
  - c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
  - d. ANSI/NFPA 101: Life Safety Code

#### **1.4 QUALIFICATIONS**

- A. The testing firm shall be a corporately independent testing organization, which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.
- B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- C. The lead, on site, technical person and at least 50% of the on site crew shall be currently certified by the InterNational Electrical Testing Association (NETA) or National Institute for Certification in Engineering Technologies in Electrical Power Distribution System Testing.
- D. The testing firm shall only utilize technicians who are regularly employed by the firm on a full-time basis for testing services.
- E. The Contractor shall submit proof of the above qualifications with bid proposal.
- F. The terms used herewithin such as Test Agency, Test Contractor, Testing Laboratory, or Contractor Test Company, shall be construed to mean the testing organization.
- G. Acceptable Testing Firms:
  1. Northern Electrical Testing; Phone (248) 689-8980.
  2. Utilities Instrumentation Services; Phone (734) 424-1200.
  3. High Voltage Maintenance Corporation; Phone (248) 305-5596.
  4. Powertech Services, Inc.; Phone (810) 720-2280.
  5. Power Plus Engineering, Inc.; Phone (800) 765-3120.
  6. Premier Power Maintenance, Inc.; (517) 230-6629

#### **1.5 PERFORMANCE REQUIREMENTS**

- A. The Electrical Contractor shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the power requirements.
- B. The Electrical Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

- C. The testing firm shall notify the Owner's Representative prior to commencement of any testing.
- D. Any system, material or workmanship, which is found defective on the basis of acceptance tests, shall be reported to the Engineer. The Electrical Contractor shall correct all defects.
- E. The testing organization shall maintain a written record of all tests and shall assemble and certify a final test report.
- F. Safety and Precautions
  - 1. Safety practices shall include, but are not limited to, the following requirements:
    - a. Occupational Safety and Health Act.
    - b. Accident Prevention Manual for Industrial Operations, National Safety Council.
    - c. Applicable state and local safety operating procedures.
    - d. NETA Safety/Accident Prevention Program.
    - e. Owner's safety practices.
    - f. National Fire Protection Association - NFPA 70E.
    - g. American National Standards for Personnel Protection.
  - 2. All tests shall be performed with apparatus de-energized except where otherwise specifically required.
  - 3. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety.

#### 1.6 TEST INSTRUMENT CALIBRATION

- A. Test Instrument Calibration
  - 1. The testing firm shall have a calibration program, which assures that all applicable test instruments are maintained within rated accuracy.
  - 2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.
  - 3. Instruments shall be calibrated in accordance with the following frequency schedule:
    - a. Field instruments: Analog - 6 months maximum Digital - 12 months maximum
    - b. Laboratory instruments: 12 months
    - c. Leased specialty equipment: 12 months  
(Where accuracy is guaranteed by Lessor)
  - 4. Dated calibration labels shall be visible on all test equipment.
  - 5. Records must be kept up-to-date which show date and results of instruments calibrated or tested.
  - 6. An up-to-date instrument calibration instruction and procedures shall be maintained for each test instrument.
  - 7. Calibrating standard shall be of higher accuracy than that of the instrument tested.
- B. Field Test Instrument Standards
  - 1. All equipment used for testing and calibration procedures shall exhibit the following characteristics:
    - a. Maintained in good visual and mechanical condition.
    - b. Maintained in safe, operating condition.
- C. Suitability of Test Equipment

1. All test equipment shall be in good mechanical and electrical condition.
2. Selection of metering equipment should be based on knowledge of the waveform of the variable being measured. Digital multi-meters may be average of RMS sensing and may include or exclude the dc component. When the variable contains harmonics of dc offset and, in general, any deviation from a pure sine wave, average sensing, average measuring RMS scaled meters may be misleading. Use of RMS measuring meters is recommended.
3. Field test metering used to check power system meter calibration must have any accuracy higher than that of the instrument being checked.
4. Accuracy of metering in test equipment shall be appropriate for the test being performed.
5. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and tested equipment.

## **1.7 TEST REPORTS**

- A. A test report shall be generated for each piece of major equipment or groups of equipment and shall include the following:
  1. A list of visual and mechanical inspections required by Division 26 Specification Sections in a checklist or similar format.
  2. Test reports, including test values where applicable, for all required electrical tests. Clearly indicate where test values fall outside of the limits of recommended values.
  3. Summary and interpretation of test results detailing problems located and recommended corrective measures.
  4. Record of infrared scan and photos showing potential problem locations.
  5. Signed and dated by the testing firm field superintendent stating that all required tests have been completed.
- B. Test reports shall be furnished to the Architect/Engineer within 14 days of the completion each test on an ongoing basis. Original copies of the reports shall be furnished directly to the Architect/Engineer by the testing company prior to formal submittal via the Contractors.

## **PART 2 - PRODUCTS**

Not Applicable

## **PART 3 - EXECUTION**

### **3.1 THERMOGRAPHIC SURVEY**

- A. Visual and Mechanical Inspection
  1. Remove all necessary covers prior to scanning.
  2. Inspect for physical, electrical, and mechanical condition.
- B. Equipment to be Scanned
  1. All components of the distribution system down to and including branch circuit panelboards and motor control centers. Return 3 months after equipment has been energized and loaded to do a final scan of all equipment.
- C. Provide report indicating the following:



1. Problem area (location of "hot spot").
2. Temperature rise between "hot spot" and normal or reference area.
3. Cause of heat rise.
4. Phase unbalance, if present.
5. Areas scanned.

D. Test Parameters

1. Scanning distribution system with ability to detect 1°C between subject area and reference at 30°C.
2. Equipment shall detect emitted radiation and convert detected radiation to visual signal.
3. Infrared surveys should be performed during periods of maximum possible loading but not less than twenty percent (20%) of rated load of the electrical equipment being inspected.

E. Test Results

1. Interpretation of temperature gradients requires an experienced technician. Some general guidelines are:
  - a. Temperature gradients of 37°F to 44.6°F indicate possible deficiency and warrant investigation.
  - b. Temperature gradients of 44.6°F to 59°F indicate deficiency; repair as time permits.
  - c. Temperature gradients of 61°F and above indicate major deficiency; repair immediately.

END OF SECTION 260999

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## 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 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Single and duplex receptacles
  - 2. Ground-fault circuit interrupter receptacles
  - 3. Surge protective receptacles
  - 4. Single- and double-pole snap switches.
  - 5. Device wall plates.
  - 6. Pin and sleeve connectors and receptacles.
  - 7. Floor service fittings
  - 8. Poke-through assemblies

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. AFCI: Arc-fault circuit interrupter.
- D. PVC: Polyvinyl chloride.
- E. RFI: Radio-frequency interference.
- F. SPD: Surge protective devices.
- G. UTP: Unshielded twisted pair.
- H. USB: Universal serial bus.

#### 1.4 REFERENCES

- A. DSCC W-C-596G: Federal Specification Connector, Electrical, Power, General Specification.
- B. DSCC W-C-896F: Federal Specification Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification).
- C. IEC 309-1, Part 1: General Requirements: Plugs, Socket-Outlets and Couplers for Industrial Purposes

- D. NEMA FB 11: Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations.
- E. NEMA WD 1: General Requirements for Wiring Devices.
- F. NEMA WD 6: Wiring Device – Dimensional Requirements.
- G. UL 20: General-Use Snap Switches.
- H. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- I. UL 486B: Wire Connectors for Use with Aluminum Conductors.
- J. UL 498: Electrical Attachment Plugs and Receptacles.
- K. UL 943: Ground Fault Circuit Interrupters.
- L. NECA 130-2010: Installing and Maintaining Wiring Devices.

### **1.5 SUBMITTALS**

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations for each type of product indicated.

### **1.6 QUALITY ASSURANCE**

- A. Source Limitations: Obtain each type of wiring device 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 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.

### **1.7 COORDINATION**

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL WIRING DEVICE REQUIREMENTS**

- A. Comply with NFPA 70, NEMA WD 1, NEMA WD 6, and UL498.
- B. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.

2. Cord and Plug Sets: Match equipment requirements.

C. 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. Delete subparagraphs below as required if surge protective and IG receptacles are not specified.
2. Surge Protective Devices: Blue.
3. Wall Switches: As selected by Architect, unless otherwise indicated.

## 2.2 STANDARD GRADE RECEPTACLES

A. Duplex Receptacle, NEMA 5-20R:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hubbell Wiring Device-Kellems: BR20
  - b. Eaton/Arrow Hart Wiring Devices: BR20
  - c. Leviton: BR 20
  - d. Legrand, Pass & Seymour: CRB5362

B. Tamper-Resistant Duplex Receptacle, NEMA 5-20R:

1. Safety mechanism to energize contacts only when both openings are simultaneously engaged.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hubbell Wiring Device-Kellems: BR20TR
  - b. Eaton/Arrow Hart Wiring Devices: TRBR20
  - c. Leviton: TBR20
  - d. Legrand, Pass & Seymour: TR5352

C. Weather-Resistant Duplex Receptacle, NEMA 5-20R:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hubbell Wire Device-Kellems: BR20WR
  - b. Eaton/Arrow Hart Wiring Devices: WRBR20
  - c. Leviton: WBR20
  - d. Legrand, Pass & Seymour: WR20TR

D. Weather- and Tamper-Resistant Duplex Receptacle, NEMA 5-20R:

1. Safety mechanism to energize contacts only when both openings are simultaneously engaged.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hubbell Wire Device-Kellems: BR20WRTR
  - b. Eaton/Arrow Hart Wiring Devices: TWRBR20
  - c. Leviton: TWR20
  - d. Legrand, Pass & Seymour: WR5352TR

## 2.3 GFCI RECEPTACLES

A. Comply with UL 943

- B. Duplex GFCI Receptacle, NEMA 5-20R:
  - 1. Manufacturers: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell Wiring Device-Kellems: GFRST20
    - b. Eaton/Arrow Hart Wiring Devices: SGF20
    - c. Leviton: GFNT2
    - d. Legrand, Pass & Seymour: 2097
  
- C. Tamper-Resistant Duplex GFCI Receptacle, NEMA 5-20R:
  - 1. Safety mechanism to energize contacts only when both openings are simultaneously engaged.
  - 2. Manufacturers: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell Wiring Device-Kellems: GFTRST20
    - b. Eaton/Arrow Hart Wiring Devices: TRSGF20
    - c. Leviton: GFTR2
    - d. Legrand, Pass & Seymour: 2097TR
  
- D. Tamper- and Weather-Resistant Duplex GFCI Receptacle, NEMA 5-20R:
  - 1. Safety mechanism to energize contacts only when both openings are simultaneously engaged.
  - 2. Manufacturers: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell Wiring Device-Kellems: GFTWRST20
    - b. Eaton/Arrow Hart Wiring Devices: TWRSGF20
    - c. Leviton: GFWT2
    - d. Legrand, Pass & Seymour: 2097TRWR
  
- E. Weather-Resistant Duplex GFCI Receptacle, NEMA 5-20R:
  - 1. Comply with UL 943.
  - 2. Manufacturers: Subject to compliance with requirements, provide one of the following:
    - a. Eaton/Arrow Hart Wiring Devices WRS GF20
    - b. Leviton: GFWR2
    - c. Legrand, Pass & Seymour: 2097TRWR

## **2.4 SURGE PROTECTION DEVICE RECEPTACLES**

- A. Duplex Surge Protective Receptacle, NEMA 5-20R:
  - 1. Integral surge protection in line to ground, line to neutral, and neutral to ground.

## **2.5 STRAIGHT BLADE AND TWIST-LOCK RECEPTACLES, OTHER THAN NEMA 5-20R**

- A. Provide commercial specification grade straight blade and twist-lock receptacles with standard NEMA configurations in accordance with the "Special Receptacles" schedule included on the drawings.
  
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Wiring Device-Kellems
  - 2. Eaton/Arrow Hart Wiring Devices

3. Leviton
4. Legrand, Pass & Seymour

## **2.6 PENDANT CORD-CONNECTOR DEVICES**

- A. Description: Matching, locking type plug and receptacle body connector, NEMA WD 6, device configurations as indicated on drawings, heavy-duty grade.
- B. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
- C. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

## **2.7 CORD AND PLUG SETS**

- A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
- B. 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.
- C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## **2.8 CORD REELS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Reelcraft L4500 Series
- B. Description: Portable cord reel with portable outlet box and receptacle; steel construction NEMA 1 enclosure; adjustable cord stop; spring retractable with latch; 115V, 20A. rated and capable of being ceiling, wall or bench mounted.
- C. Cord: 45 feet of 3 no. 12 SJO cord with strain relief.
- D. Wiring device: Portable outlet box with liquidtight cord connector and one NEMA 5-20R duplex GFCI receptacle, outlet box and flip-top cover attached to end of cable reel.
- E. Electrical Connection: Provide 48 inch (1220 mm) pigtail with NEMA 5-20P plug.

## **2.9 WALL SWITCHES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Legrand, Pass & Seymour: PS20AC Series
  2. Hubbell Wiring Device-Kellems: 2100 Series
  3. Eaton/Arrow Hart Wiring Devices: 7630
  4. Leviton: 5621 Series
  5. Legrand, Pass & Seymour: 2624
- B. Device body: Plastic handle.

- C. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
- D. Snap Switches: Heavy Duty specification grade, quiet type; rated 20A., 120-277 V AC.
- E. Provide single-pole, two-pole, three-way and four-way switches as indicated.
- F. Provide pilot light where indicated. Switch shall be illuminated when the switch is [on] [off].
- G. Provide key type where indicated. Furnish four keys to Owner.
- H. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.
  - 1. Switch: 20 A, 120/277-V ac.
  - 2. Receptacle: NEMA WD 6, Configuration 5-20R.

## **2.10 WALL PLATES**

- A. Manufacturers:
  - 1. Provide wall plates and corresponding wiring devices from same manufacturer.
- B. 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:
    - a. Steel with white baked enamel, suitable for field painting
  - 3. Material for Unfinished Spaces:
    - a. Galvanized steel
  - 4. Material for Wet Locations: Gasketed Cast aluminum with hinged cover and listed and labeled as Extra Duty Weatherproof While-In-Use.
    - a. Manufacturers:
      - 1) Red Dot Model: CKLSVU, Thomas & Betts
      - 2) Intermatic: WP3110MXD
      - 3) Leviton: IUM1V
  - 5. Material for Damp Locations: Gasketed Cast aluminum with hinged cover and listed and labeled as Weatherproof.
    - a. Manufacturers:
      - 1) Red Dot Model CCGV, ABB Installation Products
      - 2) Eaton/Arrow Hart WLRD1
      - 3) Legrand, Pass & Seymour
      - 4) Intermatic: WP3110MXD

## **2.11 FLOOR SERVICE FITTINGS**



- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Wiring Device-Kellems
  - 2. Legrand, Wiremold
  - 3. Steel City
- B. Refer to Floor Service Fitting Schedule on Plan.
- C. Compartments: Provide barrier separating power from telecommunications cabling. Provide recessed-type floor service fittings with independent compartments and feed through wiring capability.
- D. Provide a blank bracket for any unused gangs.

## **2.12 POKE-THROUGH ASSEMBLIES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Wiring Device-Kellems
  - 2. Legrand, Wiremold
  - 3. Steel City
- B. Refer to Poke-Through Assembly Schedule on Plan.
- C. Description: Factory-fabricated and -wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
  - 1. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly; minimum 2-hour rating.
  - 2. Comply with UL514A scrub water exclusion requirement.
- D. Compartments: Provide barrier separating power from telecommunications cabling.
- E. Provide a blank bracket for any unused gangs.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Prior to installation of devices, verify wall openings are neatly cut and will be completely covered by wall plates, clean debris from outlet boxes and provide extension rings to bring outlet boxes flush with finished surface.
- C. Install devices and assemblies level, plumb, and square with building lines.
- D. Arrangement of Devices:
  - 1. Coordinate locations of outlet boxes provided under Division 26 Section "Raceways and Boxes" to obtain mounting heights indicated on Drawings.
  - 2. Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top.

3. Where multiple switches, dimmers, and/or occupancy sensors are adjacent to each other, provide a single cover plate. Custom fabricate, if required, for all combinations. Provide separate boxes or barriers as required for the application.
  4. Install horizontally mounted receptacles with grounding pole on the left.
  5. Install GFCI receptacles so that the "Push To Test" and "Reset" designations can be read correctly. If printed in both directions, install with ground pole on top.
  6. Install switches with OFF position down.
- E. Install cover plates on switch, receptacle, and blank outlets in finished areas.
- F. Install weather-resistant type receptacles in all damp and wet locations, including pool environments.
- G. Install weatherproof cover plates on receptacles in damp locations.
- H. Install weatherproof While-In-Use cover plates on receptacles in wet locations.
- I. Install tamper-resistant type receptacles in all locations as required by the NEC (406.12) and as indicated on plan.
- J. Provide hospital-grade tamper-resistant receptacles in all areas where identified in the National Electrical Code (406.12(s) and 517.18(c)) (i.e., business offices, corridors, waiting areas, lobbies, exam rooms, pediatric patient rooms, etc.).
- K. Use oversized plates for outlets installed in masonry walls.
- L. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- M. Remove wall plates and protect devices and assemblies during painting.
- N. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- O. Adjust devices and wall plates to be flush and level. Three corners of wall plates must be in contact with wall surfaces. Devices shall be solidly mounted against the box.

### 3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Electrical Identification."
1. Receptacles: Identify panelboard and circuit number from which served. Use adhesive label as specified in Division 26 Section "Electrical Identification" with black on back side of wall plate, and durable wire markers or tags inside outlet boxes.
  2. Wall Switches: Identify panelboard and circuit number from which served. Use adhesive label as specified in Division 26 Section "Electrical Identification" with black-filled lettering back side of wall plate, and durable wire markers or tags inside outlet boxes.

### 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding." Connect wiring device grounding terminal to outlet box with bonding jumper. Use of quick ground strap or screw is not acceptable.

- B. Connect wiring according to Division 26 Section "Conductors and Cables." Connect wiring devices by wrapping conductor around screw terminal or by using back wiring and tightening the screw securely.
- C. 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.

### **3.4 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Inspect each wiring device for defects.
  - 2. Operate each wall switch with circuit energized and verify proper operation.
  - 3. After installing wiring devices and after electrical circuitry has been energized, test each receptacle for proper polarity, ground continuity, and compliance with requirements.
  - 4. Test each GFCI receptacle for proper operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 262726

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## SECTION 262813 - FUSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Cartridge fuses rated 600 V and less for use in switches and controllers.
  - 2. Spare-fuse cabinets.

#### 1.3 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
  - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings. Retain first paragraph and subparagraphs below if variations in fuse performance due to ambient temperature extremes can affect system performance.
- B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
  - 1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
  - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- 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:
  - 1. NEMA FU 1 – Low Voltage Cartridge Fuses.
  - 2. NFPA 70 – National Electrical Code.
  - 3. UL 198C – High-Interrupting-Capacity Fuses, Current-Limiting Types.
  - 4. UL 198E – Class R Fuses.
  - 5. UL 512 – Fuseholders.

## 1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

## 1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Quantity equal to 10% percent of each fuse type and size, but no fewer than three of each type and size.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. [Cooper Bussmann, Inc.](#)
  - 2. [Eagle Electric Mfg. Co., Inc.](#); Cooper Industries, Inc.
  - 3. [Ferraz Shawmut, Inc.](#)
  - 4. Tracor, Inc.; [Littelfuse, Inc.](#) Subsidiary.

### 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.
  - 1. Motor Branch Circuits: Class RK5, time delay.
  - 2. Other Branch Circuits: Class RK1, time delay.

### 2.3 SPARE-FUSE CABINET

- A. Cabinet: Wall-mounted, 0.05-inch- thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
  - 1. Size: 30 inches high by 24 inches wide by 12 inches deep.
  - 2. Finish: Gray, baked enamel.
  - 3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
  - 4. Fuse Pullers: For each size of fuse.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Fuses shall be shipped separately. Any fuses shipped installed in equipment, shall be replaced by the Electrical Contractor with new fuses as specified above prior to energization at no additional expense to Owner. All fuses shall be stored in moisture free packaging at job site and shall be installed immediately prior to energization of the circuit in which it is applied.
- B. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- C. Install spare-fuse cabinet(s).

### **3.3 IDENTIFICATION**

- A. Install labels indicating fuse rating and type on outside of the door on each fused switch.

END OF SECTION 262813

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## 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 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 26 Section "Fuses".

#### 1.2 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Molded-case circuit breakers.
  - 4. Molded-case switches.
  - 5. Enclosures.
- B. Related Sections:
  - 1. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

#### 1.3 DEFINITIONS

- A. GD: General duty.
- B. GFCI: Ground-fault circuit interrupter.
- C. HD: Heavy duty.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

#### 1.4 REFERENCES

- A. NECA 1: Practices for Good Workmanship in Electrical Contracting.
- B. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NEMA AB 1: Molded Case Circuit Breakers and Molded Case Switches.

- E. NEMA FU 1: Low Voltage Cartridge Fuses.
- F. NEMA KS 1: Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- G. NEMA PB1.1: General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
- H. NEMA PB2.1: General Instructions for Proper Installation, Operation, and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
- I. NFPA 70: National Electrical Code.

### **1.5 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, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current rating.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports including the following:
  - 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 1 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 curves, including selectable ranges for each type of circuit breaker.

### **1.6 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.
- D. 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.

## **1.7 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 and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.

## **1.8 COORDINATION**

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## **1.9 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Spares: For the following:
    - a. Potential Transformer Fuses: 2 of each size and type.
    - b. Control-Power Fuses: 2 of each size and type
    - c. Fuses for Fusible Switches: Equal to 10 percent of amount installed for each size and type, but no fewer than 3 of each size and type.
  - 2. Spare Indicating Lights: Six of each type installed.

## **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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:
1. Eaton Corporation; Cutler-Hammer Products.
  2. General Electric Co.; Electrical Distribution & Control Division.
  3. Siemens Industries, Inc.
  4. Square D/Group Schneider.
- B. Fusible Switch: NEMA KS 1, quick make, quick-break load interrupter enclosed knife switch Type HD, with clips or bolt pads to accommodate specified fuses, externally operable lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch: NEMA KS 1, quick make, quick-break load interrupter enclosed knife switch Type HD, externally operable lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Accessories:
1. Provide early break auxiliary contacts in motor disconnect switches for motors that are fed from variable frequency controllers.
  2. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  3. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
  4. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

## 2.3 TOGGLE DISCONNECT SWITCH

- A. Manufacturers:
1. Double Pole:
    - a. Hubbell 1372.
    - b. Leviton 6808G-DAC.
    - c. Pass & Seymour 7812.
    - d. Bryant 30102.
  2. Three Pole:
    - a. Hubbell 1379.
    - b. Leviton 7810GD.
    - c. Pass & Seymour 7813.
    - d. Bryant 30103.
- B. Description: Heavy duty, 30A, 600 volt, double or three pole as required, single throw, motor rated switch without overload protection. Provide NEMA 1 enclosure and padlock attachment.

## 2.4 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Manufacturers:
1. Eaton Corporation; Cutler-Hammer Products.

2. General Electric Co.; Electrical Distribution & Control Division.
  3. Siemens Industries, Inc.
  4. Square D/Group Schneider.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity 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. GFCI Circuit Breakers: Single- and two-pole configurations with 5 or 30-mA trip sensitivity as required.
- C. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
  2. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  3. Enclosure: Provide handle capable of being locked in the open position with padlock.
  4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  5. Communication Capability: Circuit-breaker-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: 120-V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage.
  7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
  8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
  9. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
  10. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage. Provide "dummy" trip unit where required for proper operation.
  11. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay. Provide "dummy" trip unit where required for proper operation.
  12. Key Interlock Kit: Externally mounted to prohibit operation; key shall be removable only when switch is in off position.
  13. Circuit breaker selection for primary
- D. Circuit Breaker Selection for Transformer Primary Protection: Provide circuit breakers with time-current characteristics to clear transformer inrush currents while still providing protection for the ANSI through-fault protection curve. Provide circuit breakers with adjustable magnetic trip or electronic trip units as necessary to provide time-current curve shaping to achieve long time trip indicated on drawings, inrush coordination and damage protection.

## 2.5 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
1. Indoor Dry Locations: NEMA 250, Type 1.

## 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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 3.

### 3.3 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Install switches with off position down.
- D. Install NEMA KS 1 enclosed switch where indicated for motor loads  $\frac{1}{2}$  HP and larger and equipment loads greater than 30A.
- E. Install toggle disconnect switch, surface mounted, where indicated for motor loads less than  $\frac{1}{2}$  HP and equipment loads 30A. and less.
- F. Install fuses in fusible disconnect switches.
- G. Install flexible liquid tight conduit from toggle disconnect switch to portable equipment. Leave a 6'-0" whip.
- H. Install flexible liquid tight conduit from toggle disconnect switch to stationary equipment.
- I. Install control wiring from early break contacts in motor disconnect switch to variable frequency controllers to shut down controller when switch is open.
- J. Install equipment on exterior foundation walls at least one inch from wall to permit vertical flow of air behind breaker and switch enclosures.
- K. Support enclosures independent of connecting conduit or raceway system.
- L. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

### 3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Electrical Identification."
- C. Provide adhesive label as specified in Division 26 Section "Electrical Identification" on inside door of each switch indicating UL fuse class and size for replacement.

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
  - 1. Inspect mechanical and electrical connections.
  - 2. Verify switch and relay type and labeling verification.
  - 3. Verify rating of installed fuses.
- B. Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- C. Perform the following field tests and inspections and prepare test reports:
  - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches. Certify compliance with test parameters.

Evaluate if testing of circuit breakers is appropriate for project and edit or delete paragraph and subparagraphs below to suit Project.

- 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.6 for molded-case circuit breakers. Test all NEMA AB1, molded case circuit breakers with thermal magnetic trip or auxiliary, solid-state trip units 100A and larger. Certify compliance with test parameters.
  - a. Visual and Mechanical Inspection
    - 1) Circuit breaker shall be checked for proper mounting and compare nameplate data to Drawings and Specifications.
    - 2) Operate circuit breaker to ensure smooth operation.
    - 3) Inspect case for cracks or other defects.
    - 4) Check internals on unsealed units.
  - b. Electrical Tests
    - 1) Perform a contact resistance test.
    - 2) Perform an insulation resistance test at 1000 volts dc from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase.
    - 3) Perform long time delay time-current characteristic tests by passing three hundred percent (300%) rated current through each pole separately. Record trip time. Make external adjustments as required to meet time current curves.
    - 4) Determine short time pickup and delay by primary current injection.
    - 5) Determine ground fault pickup and time delay by primary current injection.
    - 6) Determine instantaneous pickup current by primary injection using run-up or pulse method.

- 7) Perform adjustments for final settings in accordance with coordination study.
- 8) For circuit breakers 800A and larger, verify all functions of trip unit by means of secondary injection in lieu of primary injection.

c. Test Values

- 1) Compare contact resistance or millivolt drop values to adjacent poles and similar breakers. Investigate deviations of more than fifty percent (50%). Investigate any value exceeding manufacturer's recommendations.
  - 2) Insulation resistance shall not be less than 100 megohms.
  - 3) Trip characteristic of breakers shall fall within manufacturer's published time-current characteristic tolerance band, including adjustment factors.
  - 4) All trip times shall fall within N.E.T.A. Acceptance Testing Specifications, Table 10.7 Circuit breakers exceeding specified trip time at three hundred percent (300%) of pickup shall be tagged defective.
  - 5) Instantaneous pickup values shall be within values shown on N.E.T.A. Acceptance Testing Specifications, Table 10.8 or manufacturer's recommendations.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

**3.6 ADJUSTING**

- A. Set field-adjustable switches and circuit-breaker trip and time delay settings to values as determined by the protective device coordination study.

**3.7 CLEANING**

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816



## SECTION 262913 - ENCLOSED CONTROLLERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes ac, enclosed controllers rated 600 V and less, of the following types:
  - 1. Across-the-line, manual and magnetic controllers.
  - 2. Reduced-voltage controllers.
  - 3. Multispeed controllers.
- B. Related Sections include the following:
  - 1. Division 20 Section "Variable Frequency Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on constant torque loads in ranges up to 200 hp.
  - 2. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each enclosed controller.
  - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Each installed unit's type and details.
    - b. Nameplate legends.
    - c. Short-circuit current rating of integrated unit.
    - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Qualification Data: For manufacturer.
- D. Field quality-control test reports.

- E. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section Operation and Maintenance Data include the following:
  - 1. Routine maintenance requirements for enclosed controllers and all installed components.
  - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- F. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

#### **1.4 REFERENCES**

- A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- B. ANSI/UL 198C - High-Intensity Capacity Fuses; Current-Limiting Types.
- C. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
- D. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses).
- E. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted.
- F. NECA 402-2000 – Recommended Practice for Installing and Maintaining Motor Control Centers.
- G. NEMA AB 1 - Molded Case Circuit Breakers.
- H. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- I. NEMA KS 1 - Enclosed Switches.
- J. ANSI/NFPA 70 - National Electrical Code.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. 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.
- C. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.
- D. 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.
- E. Comply with NFPA 70.

- F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, minimum clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Prior to beginning work on any system, verify all existing conditions that affect the work and coordinate with all other trade Contractors. Determine that the work can be installed as indicated or immediately report to the Architect/Engineer errors, inconsistencies or ambiguities.
- B. Deliver products to site under provisions of Section 260010. Store and protect products under provisions of Section 260010.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle in accordance with manufacturer's written instructions. Lift large equipment only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.
- E. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

#### **1.7 PROJECT RECORD DOCUMENTS**

- A. Accurately record actual locations of each contactor and indicate circuits controlled. Submit under provisions of 26 0010.

#### **1.8 COORDINATION**

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."
- D. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- E. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

#### **1.9 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spare Fuses: Furnish one spare for every five installed, but no fewer than one set of three of each type and rating.
2. Indicating Lights: Two of each type installed.
3. Keys: Furnish 2 of each to Owner.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. [ABB Power Distribution, Inc.](#); ABB Control, Inc. Subsidiary.
2. [Danfoss Inc.](#); Danfoss Electronic Drives Div.
3. [Eaton Corporation; Cutler-Hammer Products.](#)
4. [General Electrical Company; GE Industrial Systems.](#)
5. [Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.](#)
6. [Siemens/Furnas Controls.](#)
7. [Square D.](#)

### 2.2 ACROSS-THE-LINE ENCLOSED CONTROLLERS

A. Manual Controller: NEMA ICS 2, general purpose, Class A, with "quick-make, quick-break" toggle or pushbutton action, and marked to show whether unit is "OFF," "ON," or "TRIPPED."

1. Overload Relay: Ambient-compensated type with inverse-time-current characteristics and NEMA ICS 2, Class 10 tripping characteristics. Relays shall have heaters and sensors in each phase, matched to nameplate, full-load current of specific motor to which they connect and shall have appropriate adjustment for duty cycle.

B. Magnetic Controller: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.

1. Control Circuit: 120 V; obtained from integral control power transformer with sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
2. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 20 tripping characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.
3. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 20 tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.

C. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.

1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL.
2. Nonfusible Disconnecting Means: NEMA KS 1, heavy-duty, nonfusible switch.
3. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

### 2.3 REDUCED-VOLTAGE ENCLOSED CONTROLLERS

- A. Star-Delta Controller: NEMA ICS 2, closed transition with adjustable time delay.
- B. Part-Winding Controller: NEMA ICS 2, closed transition with separate overload relays for starting and running sequences.
- C. Autotransformer Reduced-Voltage Controller: NEMA ICS 2, closed transition.
- D. Solid-State, Reduced-Voltage Controller: NEMA ICS 2, suitable for use with NEMA MG 1, Design B, polyphase, medium induction motors.
  - 1. Adjustable acceleration rate control utilizing voltage or current ramp, and adjustable starting torque control with up to 500 percent current limitation for 20 seconds.
  - 2. Surge suppressor in solid-state power circuits providing 3-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
  - 3. LED indicators showing motor and control status, including the following conditions:
    - a. Control power available.
    - b. Controller on.
    - c. Overload trip.
    - d. Loss of phase.
    - e. Shorted silicon-controlled rectifier.
  - 4. Motor running contactor operating automatically when full voltage is applied to motor.
  - 5. Coil operating voltage: 120 volts secondary, 60 hertz.

### 2.4 MULTISPEED ENCLOSED CONTROLLERS

- A. Multispeed Enclosed Controller: Match controller to motor type, application, and number of speeds; include the following accessories:
  - 1. Compelling relay to ensure that motor will start only at low speed.
  - 2. Accelerating relay to ensure properly timed acceleration through speeds lower than that selected.
  - 3. Decelerating relay to ensure automatically timed deceleration through each speed.

### 2.5 VARIABLE FREQUENCY CONTROLLERS

- A. Refer to Division 20 "Variable Frequency Controllers."
- B. Equipment furnished by mechanical trades and installed by electrical trades.

### 2.6 ENCLOSURES

- A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
  - 1. Outdoor Locations: NEMA 250, Type 3R.
  - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  - 4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

## **2.7 ACCESSORIES**

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights: NEMA ICS 2, heavy-duty type.
- C. Indicating Lights: Run (Red), off or ready (Green).
- D. Auxiliary Contacts: Provide two normally open (N.O.) and two normally closed (N.C.) contacts.
- E. Selector Switch: NEMA ISC 2, mounted in front cover to read "hand/off/auto," provide auxiliary contact for auto position monitoring.
- F. Control Relays: Auxiliary and adjustable time-delay relays.
- G. Elapsed Time Meters: Heavy duty with digital readout in hours.
- H. Manufacturer provided nameplate shall be provided on controller enclosure. Nameplate shall contain the following information:
  - 1. Manufacturer's name or identification.
  - 2. Voltage rating.
  - 3. Current and/or horsepower rating.
  - 4. Short-circuit current rating,

## **2.8 FACTORY FINISHES**

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosed controllers before shipping.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

## **3.2 APPLICATIONS**

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.

### **3.3 INSTALLATION**

- A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."
- B. Install freestanding equipment on concrete bases.
- C. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."
- D. Install motor control equipment and contactors in accordance with manufacturer's instructions.
- E. Select and install heater elements in motor starters to match installed motor characteristics.
- F. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

### **3.4 CONCRETE BASES**

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 3.

### **3.5 IDENTIFICATION**

- A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Electrical Identification."

### **3.6 CONTROL WIRING INSTALLATION**

- A. Install wiring between enclosed controllers according to Division 26 Section "Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
  - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
  - 2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

### **3.7 CONNECTIONS**

- A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."

**3.8 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
  
- B. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  - 1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in NETA ATS, Motor Control - Motor Starters, and Motor Control - Adjustable Speed Drive Systems" 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.

**3.9 ADJUSTING**

- A. Set field-adjustable switches and circuit-breaker trip ranges.

**3.10 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers. Refer to Division 1 Sections.

END OF SECTION 262913



## SECTION 265119 - LED 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. Section Includes:
  - 1. Interior solid-state luminaires that use LED technology.
  - 2. Lighting fixture supports.
- B. Related Requirements:
  - 1. Division 26 "Lighting Control Devices."

#### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lamp: LED and substrate as a replaceable assembly.
- F. LED: Light-emitting diode.
- G. Lumen: Measured output of lamp and luminaire, or both.
- H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units, including batteries and chargers.
  - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.

6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project per IES LM-79 and IES LM-80.
  - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products or certified by a qualified independent testing agency.
- B. Shop Drawings: For nonstandard or custom luminaires.
  1. Include plans, elevations, sections, and mounting and attachment details.
  2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include diagrams for power, signal, and control wiring.
- C. Qualification Data: For testing laboratory providing photometric data for luminaires.
  1. And locate and describe mounting and anchorage provisions.
- D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- F. Sample warranty.

## **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

## **1.6 MAINTENANCE MATERIAL SUBMITTALS**

- 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: 5% attic stock of each type and rating installed. Furnish at least one of each type.
  2. LED Drivers 5% attic stock of each type and rating installed. Furnish at least one of each type.
  3. Diffusers and Lenses: 1% attic stock of each type and rating installed. Furnish at least one of each type.
  4. Globes and Guards: 5% attic stock of each type and rating installed. Furnish at least one of each type.

## **1.7 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. 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.
- E. Comply with:
  - 1. NFPA 70 - National Electrical Code.
  - 2. NECA/IESNA 500-1998 – Recommended Practice for Installing Indoor Commercial Lighting Systems.
  - 3. NECA/IESNA 502-1999 – Recommended Practice for Installing Industrial Lighting Systems.
  - 4. Code of Federal Regulations (47 CFR 37342).
- F. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

## **1.9 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.

## **1.10 WARRANTY**

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) or manufacturer’s standard warranty length (whichever is longer) from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 LUMINAIRES (LIGHTING FIXTURES)**

- A. Provide Luminaires as included in specification 26 5700 “Luminaire Product Data.” This section contains product data sheets from the basis of design manufacturer with annotations.
- B. Acceptable alternate manufacturers are indicated on the product data sheets. Alternate manufacturer products shall be equal in all respects including materials, finishes, photometric performance and energy performance and shall include all options, features, and accessories identified.
- C. The Luminaire schedule shown on the drawings is supplemental provided for convenience and reference only. The requirements of this section and 26 5700 shall govern.

## 2.2 LUMINAIRE REQUIREMENTS

- 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. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. Unless otherwise specified in Luminaire product data, provide products with a minimum CRI 80.
- D. Unless otherwise specified in Luminaire product data, provide products with a CCT of 3500K.
- E. Unless otherwise specified in Luminaire product data, provide products with an IES LM-80 rated lamp life of 50,000 hours.
- F. Driver
  - 1. Provided as an integrated component of the luminaire or as an external component of an assembly of luminaries.
  - 2. Nominal Input Voltage: All drivers shall be rated for use on either 120V or 277V systems.

## 2.3 EXIT SIGNS

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 1. Lamps: Light-emitting diodes, 70,000 hours minimum of rated lamp life.
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
  - 1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
  - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  - 3. 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. Provide edge lit signs with a mirror plaque background.
- E. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- F. 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.
- G. Diffusers and Globes:

1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  2. Glass: Annealed crystal glass unless otherwise indicated.
  3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- H. Factory-Applied Labels: Comply with UL 1598 Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI for all luminaires.

## 2.4 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.5 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: Unless otherwise specified in Luminaire product data, provide products with a minimum 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: Unless otherwise specified in Luminaire product data, provide products with a minimum ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: Unless otherwise specified in Luminaire product data, provide products with a minimum 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 TEMPORARY LIGHTING

- A. Do not use permanent luminaires for temporary lighting.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and N.E.C.A./I.E.S.N.A. 500-2006 and 502-2006.
- B. Locate ceiling luminaires as indicated on reflected ceiling plan.
- C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
  - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.
  - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
- D. Support luminaires independent of ceiling framing. Support recessed grid luminaries from two opposite corners directly to structure. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- E. Install recessed luminaires to permit removal from below.
- F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- G. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- H. Install fixture with no gaps between adjacent fixtures or between fixtures and surrounding surfaces. Trims of fixtures shall be properly and uniformly aligned.
- I. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- J. Flush-Mounted Luminaire Support:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- K. Wall-Mounted Luminaire Support:
  - 1. Attached to a minimum 20 gauge backing plate attached to wall structural members.
  - 2. Do not attach luminaires directly to gypsum board.
- L. Ceiling-Mounted Luminaire Support:
  - 1. Ceiling mount with **two 5/32-inch-** <Insert value> diameter aircraft cable supports [**adjustable to**] [**120 inches in length**] <Insert length>.
- M. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- N. Comply with requirements in Section 260519 "Conductors and Cables" for wiring connections.
- O. Fixtures shall have their exterior labels removed and shall be thoroughly cleaned.
- P. Locate the remote test/monitor modules identically so that they are visible and they form a straight line when viewed from the end of the corridor or room. Where a suspended ceiling exists, center the modules in adjacent ceiling tiles.

### 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 wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- C. Bond products and metal accessories to branch circuit equipment grounding conductor.
- D. Connect luminaires to branch circuit outlet boxes provided under Division 26 Section "Raceways and Boxes" using 1/2" flexible conduit.

### 3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.
- D. A visual inspection shall be performed to verify cleanliness and alignment of the fixtures, misalignment and light leaks shall be corrected, and rattles due to ventilation system vibration shall be eliminated.

### 3.7 STARTUP SERVICE

- A. Comply with requirements for startup specified in **Section xxxxxx Lighting Control Systems.**

**3.8 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
  - 1. During adjustment visits, inspect all luminaires. Replace lamps, drivers, or luminaires that are defective.
  - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 3. Adjust the aim of luminaires in the presence of the Architect.
- B. Adjust exit sign directional arrows as indicated on Drawings.
- C. Adjust and calibrate all dimming system controls until the system works as designed. Contact the Architect/Engineer when dimming is complete and demonstrate operation to owner's representative and Architect/Engineer.

**3.9 CLEANING**

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures and lenses.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

END OF SECTION 265119



**LUMINAIRE SCHEDULE**

REFER TO LIGHTING SPECIFICATIONS DOCUMENT FOR LUMINAIRE DETAILS & ORDERING INFORMATION. DO NOT ATTEMPT TO QUOTE OR ORDER PRODUCTS USING THIS SCHEDULE.

TYPE	LOCATION	DESCRIPTION	MANUFACTURER(S)	LAMP TYPE	WATTAGE	VOLTAGE	LIGHT CHARACTERISTICS	CONTROLS	REMARKS
EM1	TOILETS THROUGHOUT	WALL-MOUNTED EMERGENCY LIGHT	LITHONIA: ELM SERIES	INTEGRAL LED	2.4W	120-277V	220L, 5000K CCT, 80 CRI	NON-DIM	WALL MOUNT OVER DOOR, AIM HEADS APPROPRIATELY TO COVER SPACE.
P1A	LOBBY 101	SUSPENDED DECORATIVE LUMINAIRE - CONVEX	PEERLESS: VENUE	INTEGRAL LED	54W	120-277V	1500L, INDIRECT, 4500L, DIRECT, 3500K CCT, 80 CRI	DIM 0-10V 100%-1%	LUMINAIRE TO BE CHOSEN BY ARCHITECT.
P1B	LOBBY 101	SUSPENDED DECORATIVE LUMINAIRE - CONCAVE	PEERLESS: VENUE	INTEGRAL LED	54W	120-277V	1500L, INDIRECT, 4500L, DIRECT, 3500K CCT, 80 CRI	DIM 0-10V 100%-1%	LUMINAIRE TO BE CHOSEN BY ARCHITECT.
R1	ALL BUNKS	RECESSED 6" DOWNLIGHT - RED LIGHT REQUIRED	LITHONIA: LCP	RETROFIT RED LED	75W MAX	120V	N/A	NON-DIM	UTILIZE THE EXISTING NOTIFICATION SYSTEM CONTROL CIRCUIT IN THE EXISTING BUNK ROOM TO FEED NEW RED DOWNLIGHTS.
R1-LAMP	ALL BUNKS	RED LED LAMP	PHILIPS	N/A	8.5W	120V	RED A-19 LED RETROFIT LAMP 16P BEAM SPREAD	NON-DIM	FOR USE WITH TYPE R1 DOWNLIGHT.
R2	RECEPTION 211	RECESSED PUCK LIGHT	FEELUX: DVS SPOT	INTEGRAL LED	4.3W	24V	344L, 3500K CCT, 85 CRI	DIM 0-10V	
S1A	TOILETS 204 & 215	SURFACE-MOUNTED LOW-PROFILE DOWNLIGHT - 7" DIAM	JUNO: SLIMFORM SERIES	INTEGRAL LED	12.8W	120-277V	1000L, 3500K CCT, 90 CRI	DIM 0-10V	
S1B	ELEVATOR VESTIBULE & JANITOR CLOSET 206	SURFACE-MOUNTED LOW-PROFILE DOWNLIGHT - 11" DIAM	JUNO: SLIMFORM SERIES	INTEGRAL LED	15W	120-277V	1300L, 3500K CCT, 82 CRI	DIM 0-10V	
S2	STAIR 203	SURFACE-MOUNTED STAIRWELL LIGHT	RAB: TSLED SERIES	INTEGRAL LED	36W	120-277V	4800L, 3500K CCT, 83 CRI	DIM 0-10V BI-LEVEL, 25%, 50%, 75%	SURFACE MOUNT TO THE UNDERSIDE OF LANDING.
S3	IT 206 & JC 205	SURFACE-MOUNTED STRIP LIGHT - 3'	LITHONIA: CLX SERIES	INTEGRAL LED	15.5W	120-277V	2250L, 3500K CCT, 80 CRI	DIM 0-10V	
T1A	THROUGHOUT	RECESSED 2X4 ARCHITECTURAL TROFFER	LITHONIA: BLT SERIES	INTEGRAL LED	22.98W	120-277V	3000L, 3500K CCT, 82 CRI	DIM 0-10V 100%-10%	EMERGENCY LIGHTING TO BE PROVIDED USING BATTERY PACKS AS NOTED ON PRODUCT DATA SHEET.
T1B	POLE #2 (238)	RECESSED 2X4 ARCHITECTURAL TROFFER	LITHONIA: BLT SERIES	INTEGRAL LED	29.48W	120-277V	4000L, 3500K CCT, 82 CRI	DIM 0-10V 100%-10%	EMERGENCY LIGHTING TO BE PROVIDED USING BATTERY PACKS AS NOTED ON PRODUCT DATA SHEET.
T1C	BUNK ROOM 231 & ALL BUNKS	RECESSED 2X4 ARCHITECTURAL TROFFER	LITHONIA: BLT SERIES	INTEGRAL LED	22.98W	120-277V	3000L, 3000K CCT, 82 CRI	DIM 0-10V 100%-10%	EMERGENCY LIGHTING TO BE PROVIDED USING BATTERY PACKS AS NOTED ON PRODUCT DATA SHEET.
T1D	POLE #1 (219) & STAIR 203	RECESSED 2X4 ARCHITECTURAL TROFFER	LITHONIA: BLT SERIES	INTEGRAL LED	43.61W	120-277V	6000L, 3500K CCT, 82 CRI	DIM 0-10V 100%-10%	EMERGENCY LIGHTING TO BE PROVIDED USING BATTERY PACKS AS NOTED ON PRODUCT DATA SHEET.
T2A	THROUGHOUT	RECESSED 2X2 ARCHITECTURAL TROFFER	LITHONIA: BLT SERIES	INTEGRAL LED	14.91W	120-277V	2000L, 3500K CCT, 82 CRI	DIM 0-10V 100%-10%	EMERGENCY LIGHTING TO BE PROVIDED USING BATTERY PACKS AS NOTED ON PRODUCT DATA SHEET.
T2B	CONFERENCE 212	RECESSED 2X2 ARCHITECTURAL TROFFER	LITHONIA: BLT SERIES	INTEGRAL LED	24.7W	120-277V	3300L, 3500K CCT, 82 CRI	DIM 0-10V 100%-10%	EMERGENCY LIGHTING TO BE PROVIDED USING BATTERY PACKS AS NOTED ON PRODUCT DATA SHEET.
T2C	BUNK ROOM 231	RECESSED 2X2 ARCHITECTURAL TROFFER	LITHONIA: BLT SERIES	INTEGRAL LED	14.91W	120-277V	2000L, 3000K CCT, 82 CRI	DIM 0-10V 100%-10%	EMERGENCY LIGHTING TO BE PROVIDED USING BATTERY PACKS AS NOTED ON PRODUCT DATA SHEET.
UC	KITCHEN #16 & WORKROOM 217	SURFACE-MOUNTED UNDERCABINET LIGHT - VARIOUS LENGTHS (1', 2', 3', 4')	LITHONIA: UCLD SERIES	INTEGRAL LED	7.29WIFT	120V	375L FT, 3000K CCT, 94 CRI	STANDARD INCANDESCENT DIMMING	SURFACE MOUNT TO THE UNDERSIDE OF UPPER CABINETS AT THE FRONT EDGE. JUST BEHIND THE REVEAL. VERIFY EXACT LENGTHS NEEDED PRIOR TO PLACING ORDER.
W1	TOILETS THROUGHOUT	28" LINEAR VANITY LIGHT	VISA: POSH SERIES	INTEGRAL LED	15W	120-277V	1700L, 3500K CCT, 83 CRI	DIM 0-10V 100%-1%	WALL MOUNT OVER MIRRORS AT VANITIES AT APPROX. 6'-8" AFF. VERIFY MOUNTING HEIGHT WITH ARCHITECT PRIOR TO INSTALLATION.
W2	BUNK ROOM 231	WALL-MOUNTED LOW OUTPUT NIGHT/PATH LIGHT	ACUTY: HMLS PATHFINDER SERIES	INTEGRAL LED	3W	120-277V	42L, 3000K CCT, 80+ CRI	DIM 0-10V 100%-10%	NIGHT/PATH LIGHTS TO BE WALL MOUNTED AT 18" AFF.

**GENERAL NOTES:**

- REFER TO SPECIFICATIONS FOR DETAILED LUMINAIRE PRODUCT DATA SHEETS. **DO NOT ORDER PRODUCT BASED ON LUMINAIRE SCHEDULE ONLY.** ADDITIONAL INFORMATION IS PROVIDED ON THE PRODUCT DATA SHEETS.
- WATTAGE, LIGHT CHARACTERISTICS, VOLTAGE, & CONTROL DETAILS LISTED ARE FROM THE BASIS OF DESIGN MANUFACTURER.
- FINISH TO BE APPROVED BY INTERIOR DESIGNER, ARCHITECT, AND/OR CLIENT PRIOR TO PLACING ORDER.
- ALL LUMINAIRES TO BE AS SPECIFIED OR EQUAL **APPROVED IN ADVANCE BY PBA.**
- ALL LUMINAIRES TO BE MANUFACTURED IN THE USA UNLESS OTHERWISE SPECIFIED IN DESIGN INFORMATION.
- ALL LUMINAIRES TO BE MADE IN THE USA UNLESS PRE-APPROVED BY THE OWNER AND PBA.**



**FEATURES & SPECIFICATIONS**

**INTENDED USE** — Provides a minimum of 90 minutes illumination for the rated wattage upon loss of AC power to meet and exceed code required emergency lighting. Ideal for applications requiring attractive LED unit equipment with quick installation and unparalleled performance for lower mounting heights.

**Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate.**  
[Click here for Acrylic-Polycarbonate Compatibility table for suitable uses.](#)

**CONSTRUCTION** — The housing is a standard white (black optional) thermoplastic with a compact and low-profile contemporary design. It is 5VA flame rated, impact-resistant, scratch-resistant and corrosion proof. The UV-stable resin resists discoloration from natural and man-made light sources. There is a low-profile, integrated and back-lit test switch with an easily visible multi-color LED status indicator. The back-plate contains a universal j-box mounting pattern to facilitate ease of installation on a wide variety of j-boxes and the front housing allows tool-less access for ease of maintenance.

**ELM2LF:** Fixed lamp head arrangement for ease of installation and maximum path of egress aiming coverage with no aiming required for wall mount applications.

**ELM2L:** Unique track and swivel arrangement permits full range of direction for lamp head adjustment.

**OPTICS** — Both the ELM2L and ELM2LF feature two, high performance LEDs with acrylic lens<sup>†</sup> rated at 1.2 watts each and delivering a total of 220 lumens in a linear pattern (LP220L). The typical life of an LED is 10 years. The LED light sources typically never need to be replaced under normal conditions for normal off applications.

CCT: 5000K.

**ELECTRICAL** — Orderable in multiple voltages (see ordering tree for specific voltages).

Current-limiting charger maximizes battery life and minimizes energy consumption and provides low operating costs. Small battery chargers Certified in the CA Title 20 Appliance Efficiency Database.

Short-circuit protection — current-limiting charger circuitry protects printed circuit board from shorts. Regulated charge voltage maintains constant-charge voltage over a wide range of line voltages.

Prevents over/undercharging that shortens battery life and reduces capacity. Filtered charger input minimizes charge voltage ripple and extends battery life.

**BATTERY:** Sealed, maintenance-free nickel-cadmium or Lithium Iron Phosphate.

Lithium Iron Phosphate battery powers both on board LEDs and up to 2.4W additional LED remote lamp heads simultaneously or offers extended run-time up to 3 hours.

**SELF-DIAGNOSTICS and REMOTE TEST (SDRT option):**

Automatic 24-hour recharge after a 90-minute discharge.

Advanced electrical design provides constant light output throughout the entire discharge period.

Brownout protection is automatically switched to emergency mode when supply voltage drops below approximately 80 percent nominal of 120, 220, 277 or 347. Other input voltages may vary.

AC/LVD reset allows battery connection before AC power is applied and prevents battery damage from deep discharge.

Self-Diagnostics: Continuously monitors AC functionality. Test switch and remote tester (RTKIT accessory) provide manual activation of 30-second diagnostic testing for on-demand visual inspection. Standard derangement monitoring will indicate disconnected battery, charger failure and displays green flashing indicator light while in emergency mode. Single multi-chromatic LED indicator to display two-state charging, test activation and three-state self-diagnostics.

Self-diagnostic testing: Five minutes every 30 days and 90 minutes annually. Diagnostic evaluation of lamps, AC to DC transfer, battery charging and condition of microprocessor. Automatic test is easily postponed for eight hours by activating manual test switch or use of remote tester (RTKIT accessory).

**INSTALLATION** — Wall mount and ceiling mount standard for ELM2L. Wall mount only for ELM2LF. Blind-mate connector ensures easy installation and safe maintenance. 7/8" entrance provision at top of unit for standard 1/2" conduit entry. Tool-less removal of front cover from back-plate for ease of installation and maintenance.

**LISTINGS** — UL damp location listed standard and wet location listed when used with the WPV5 accessory, all at 50-104°F (10-40°C). Meets or exceeds all applicable requirements for UL 924, NFPA 101 (current Life Safety Code), NFPA 70 (NEC), NOM (Norma Oficial Mexicana), California Energy Commission Title 20 section 1605.3 (W)(4), FCC Title 47, Part 15, Subpart B and OSHA. List and labeled to comply with Canadian Standards C22.2 No. 141-10.

**BUY AMERICAN** — Product with the BAA option is assembled in the USA and meets the Buy America (n) government procurement requirements under FAR, DFARS and DOT.

Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.

**WARRANTY** — 5-year limited warranty. Complete warranty terms located at:

[www.acuitybrands.com/support/customer-support/terms-and-conditions](http://www.acuitybrands.com/support/customer-support/terms-and-conditions)

**NOTE:** Actual performance may differ as a result of end-user environment and application.

All values are design or typical values, measured under laboratory conditions at 25 °C.

Specifications subject to change without notice.

† Small Battery Chargers Certified in the CA Title 20 Appliance Efficiency Database.



Catalog Number	<b>TYPE EM1</b>
Notes	
Type	



Contemporary Commercial LED Emergency Light



**ELM2L**  
Aimable Optics



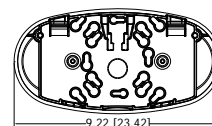
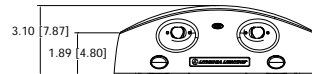
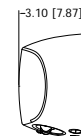
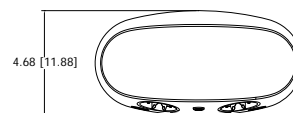
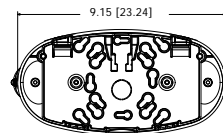
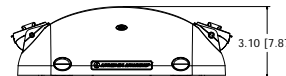
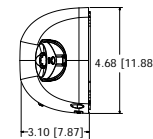
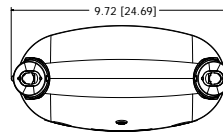
**ELM2LF**  
Fixed Optics

LITHIUM IRON PHOSPHATE  
Nickel Cadmium



**MOUNTING AND SPECIFICATIONS**

All dimensions are inches (centimeters) unless otherwise indicated.



*ELM2L Specifications*

- Length: 9.72 (24.69)
- Depth: 3.10 (7.87)
- Height: 4.68 (11.88)
- Weight: 1.31lbs (0.59kg)

*ELM2LF Specifications*

- Length: 9.22 (23.42)
- Depth: 3.10 (7.87)
- Height: 4.68 (11.88)
- Weight: 1.25lbs (0.57kg)

# ELM2L\_ELM2LF Quantum® Contemporary Commercial LED Emergency Light

**TYPE EM1**



Looking for Contractor Select readily available configurations? Click here to visit Contractor Select™ spec sheet or go to [www.contractorselect.com](http://www.contractorselect.com)

## NICKEL CADMIUM BATTERY MODELS

**ORDERING INFORMATION** For shortest lead times, configure product using **bolded options**.

**Example:** ELM2LF

Series <sup>1</sup>	Lamp type	Housing color	Voltage	Battery type	Automatic Testing	Options
<b>ELM2L</b> Aimable optics	<b>(blank)</b> LP220L 220 lumen, 2.4 watt, linear pattern, two lamps	<b>(blank)</b> White B Black	<b>(blank)</b> 120/277 VAC/60Hz 120/347 120/347 VAC/60Hz SVOLT 220-240/50-60 Hz UVOLT 120 - 347 VAC, 50/60hz	<b>(blank)</b> Nicad	<b>(blank)</b> None SDRT Self Diagnostics, Remote Test <sup>2</sup>	<b>(blank)</b> None WPVS Wet protective vandal shield <sup>3</sup> BAA BAA Buy America(n) Act Compliant

**Notes**

- 1 ELM2L and ELM2LF with Nicad battery type not available with remote capacity.
- 2 SDRT only available with UVOLT.
- 3 WPVS breaks out and ships separately and color will match (ex: WPVS SML B). Must be ordered when using for wet location applications. Decreases delivered lumens up to 20%. See spec sheet [WPVS](#) for more information.

## LITHIUM IRON PHOSPHATE BATTERY MODELS

**ORDERING INFORMATION** For shortest lead times, configure product using **bolded options**.

**Example:** ELM2LF UVOLT LTP

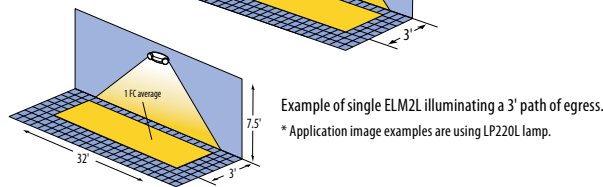
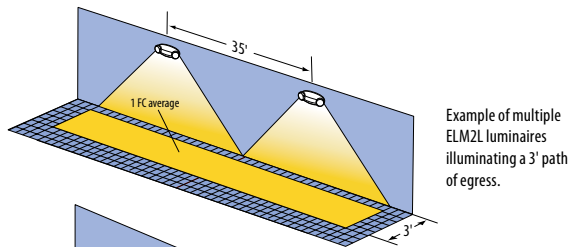
Series <sup>1</sup>	Lamp type	Housing color	Voltage	Battery type	Automatic Testing	Options
<b>ELM2L</b> Aimable Optics	<b>(blank)</b> LP220L 220 lumen, 2.4 Watt, Linear Pattern, two lamps	<b>(blank)</b> White B Black	UVOLT 120 - 347 VAC, 50/60hz	<b>LTP</b> Lithium Iron Phosphate <sup>1</sup>	<b>(blank)</b> None SDRT Self-diagnostics, remote test <sup>1</sup>	<b>(blank)</b> None WPVS Wet protective vandal shield <sup>2</sup> BAA BAA Buy America(n) Act Compliant

**Notes**

- 1 Extended run-time or remote capacity is standard. New ELMRE and ELMRW style remotes are compatible with both SDRT and non-SDRT versions (see page 3).
- 2 WPVS breaks out and ships separately and color will match (ex: WPVS SML B). Must be ordered when using for wet location applications. Decreases delivered lumens up to 20%. See spec sheet [WPVS](#) for more information.

## SPACING GUIDELINES

\*Note: To see complete photometric report or download the .ies file for this product, visit Lithonia Lighting ELM2L or ELM2LF home page.



**Other Accessories:** Order as separate catalog number.

WPVS SML W	Wet protective vandal shield (must be used for wet location applications)
WPVS SML B	Wet protective vandal shield, black (must be used for wet location applications)
ELA WG1	Wireguard, 15" W x 13-1/2" H x 6" D (see spec sheet <a href="#">ELA-WG</a> )
RTKIT	Remote test kit, up to 40' away (includes goggles, laser and battery)

### Maximum Spacing Guidelines — ELM2LF

Mounting Height	Illumination Level	Single Luminaire Coverage		Multiple Luminaire Spacing		Application Notes
		3' Path of Egress	6' Path of Egress	3' Path of Egress	6' Path of Egress	
7.5'	1FC Avg <sup>1</sup>	32'	20'	35'	28'	100' Corridor, 8' wide, and 12' high with 80/50/20 reflectances
10'	1FC Avg <sup>1</sup>	20'	NA	27'	24'	

**Notes:**

1. Also meets the additional illumination requirements of NFPA 101: .1FC minimum and max/min ratio of 40:1.

### Maximum Spacing Guidelines — ELM2L

Mounting Height	Illumination Level	Single Luminaire Coverage		Multiple Luminaire Spacing		Application Notes
		3' Path of Egress	6' Path of Egress	3' Path of Egress	6' Path of Egress	
7.5'	1FC Avg <sup>1</sup>	32'	24'	35'	28'	100' Corridor, 8' wide, and 12' high with 80/50/20 reflectances
10'	1FC Avg <sup>1</sup>	20'	14'	27'	23'	

**Notes:**

1. Also meets the additional illumination requirements of NFPA 101: .1FC minimum and max/min ratio of 40:1.



ELM2L mounted inside the WPVS (white)



ELM2LF mounted inside WPVS (white)



ELM2LF\_ELM2L

ELM2L\_ELM2LF Quantum® Contemporary Commercial LED Emergency Light

TYPE EM1

INDOOR/ DAMP LOCATION REMOTES

ELMRE Compatible Remotes<sup>1,2,3</sup>

LTP Compatible Remote Accessories: Order as separate catalog number.	
ELMRE LP220L SGL	Single LED Indoor remote head, white, 110 lumens
ELMRE LP220L T	Twin LED Indoor remote heads, white, 110 lumens
ELMRE LP220L FXO	Twin LED Indoor remote heads, fixed lamps, white, 220 lumens

Notes

- 1 Compatible with SDRT and non-SDRT versions.
- 2 Order the WPVS accessory for wet location listing and vandal protection.
- 3 See spec sheet [ELMRE](#). Also available in black.

BATTERY CAPACITY AND LOADING - ELMRE REMOTES		
Battery Option	Total Capacity	Maximum # of Remote Lamp heads
LTP	4.8W	2- ELMRE LP220L SGL M12
		1 - ELMRE LP220L T M12
		1 - ELMRE LP220L FXO

\* In addition to the lamp heads on the product.



ELMRE LP220L SGL



ELMRE LP220L T



ELMRE LP220L FXO

OUTDOOR / WET LOCATION REMOTES

ELMRW Compatible Remotes

LTP Compatible Remote Accessories: Order as separate catalog number.	
ELMRW LP220L DDBTXD SGL	Single LED Wet Location remote head, dark bronze, 110 lumens
ELMRW LP220L DDBTXD T	Twin LED Wet Location remote heads, dark bronze, 220 lumens

BATTERY CAPACITY AND LOADING		
Battery Option	Total Capacity	Maximum# Remote lamp heads*
LTP	4.8W	2- ELMRW LP220L SGL
		1 - ELMRW LP220L T

\* These are in addition to the lamp heads on the product.



ELMRW LP220L DDBTXD SGL



ELMRW LP220L DDBTXD T

SPECIFICATIONS

ELECTRICAL			
Primary Circuit			
Type	Volts	Input amps	Watts
Nicad	120	0.018	1.09
	347	0.012	1.34
Lithium Iron Phosphate	120	0.022	1.35
	347	0.014	1.64

LTP EXTENDED RUN-TIMES	
Products	Total Run-time with no remotes
ELM2L LTP	3 hours
ELM2LF LTP	3 hours

BATTERY			
UVOLT Nicad ( 6V), All Other Nicad ( 3.6V)			
Typical Shelf life <sup>1</sup>	Typical life <sup>1</sup>	Maintenance <sup>2</sup>	Temperature Range <sup>3,4</sup>
3 years	7-9 years	none	50°-104°F (10-40°C)
Lithium Iron Phosphate (9.6V)			
Typical Shelf life <sup>1</sup>	Typical life <sup>1</sup>	Maintenance <sup>2</sup>	Temperature Range <sup>3,4</sup>
1 years	7-9 years	none	50°-104°F (10-40°C)

Notes

- 1 At 77°F (25°C) ambient temperature, charge/discharge cycles and prolonged full discharge may reduce useful life.
- 2 All life safety equipment, including emergency lighting for path of egress must be tested in accordance with all National Fire Protection Association (NFPA) and local codes. Failure to perform the required testing could jeopardize the safety of occupants and will void all warranties.
- 3 Ambient temperature range where unit will provide capacity for 90 minutes. Higher and lower temperatures affect life and capacity.
- 4 Battery life is negatively impacted by many variables including temperature, charging rates, number of cycles and deep discharges due to long periods of time without AC power.

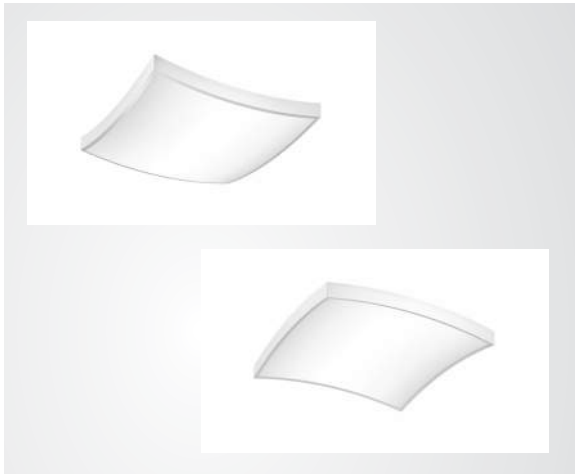
**Peerless®**  
Lighting for People®

Venue Square  
VNU4 | LED | 1/D or Direct | Suspended

**TYPE P1A**

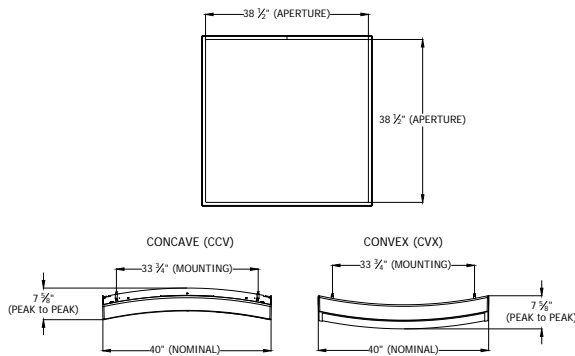
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**DIMENSIONS**

**VNU4**



**COMPANION LUMINAIRE(S)**



Venue Rectangle

**VENUE LUMINANCE COMPANION CHART**

Lumen Value	
Square	Rectangle
3300	5800
4500	7800
6600	11600
8600	15000

\* If trying to match brightness of different shapes please use the recommended pairings shown above

**CUSTOMIZATION**

Ask us about the following possibilities: Higher lumen outputs, alternate voltages, custom colors.

**HIGHLIGHTS**

- Total System Integration features 5-year limited warranty by Acuity Brands covering all components and construction
- Up to 119 lm/W
- Square dimensions are 40" x 40"
- Offered in Convex or Concave
- Flicker-free dimming to dark powered by eldoLED® driver
- Integrated nLight® control module for system networking (optional)
- White, black, painted aluminum or custom color



eldoLED



Buy American

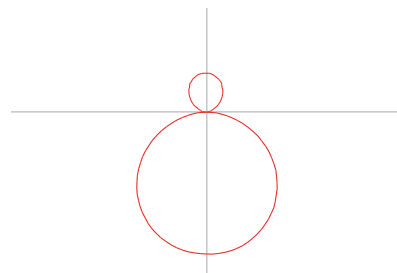
**LUMEN PACKAGES** The table values are based on the 3 available Indirect outputs combined with a range of downlight nominal outputs. Additional outputs and color temperatures available (Indirect in bold)

@ 35K & 80CRI - CCV	11500 + (4500 / 6600 / 8600)			12500 + (4500 / 6600 / 8600)			13500 + (4500 / 6600 / 8600)		
Direct Delivered Lumens	4346	6764	8408	4347	6765	8410	4349	6767	8411
Total Delivered Lumens	5849	8267	9911	7011	9429	11074	7910	10328	11972
Input Watts	54	78	96	67	91	109	78	102	120
Lumens Per Watt	108	105	103	104	103	101	101	101	99

Please pull the appropriate IES file for the hard data number for your luminaire selection

**DISTRIBUTION**

Based on CCV - 80CRI 35K 12500LM 12500LM. Additional color temperatures available



AcuityBrands

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PeerlessLighting.com

1-800-705-SERV (7378) | TechSupport-Peerless@AcuityBrands.com

Rev. 06/21/21



TYPE P1A

**Peerless**<sup>®</sup>  
Lighting for People<sup>®</sup>

Venue Square  
VNU4 | LED | I/D or Direct | Suspended

Type:

Project:

## SPECIFICATIONS

### Housing

The housing is a one-piece thermoformed automotive grade polymer casing that is cut into two pieces. The back panel that holds the electricals, while the second piece is a seamless fascia that holds our optical grade acrylic lens.

### Color

Color for housing is white, black or painted aluminum. Consult factory for custom colors.

### Source

Five available color temperature options (2700K, 3000K, 3500K, 4000K and 5000K) — all within 2.5 MacAdam ellipse.

### Optics

Direct optics are maintained through a dual optical system that creates superior uniformity across the lens. Indirect optics are recessed along the upper boundary of the luminaire to distribute light evenly across the ceiling plane.

### Remote Dimming Driver

eldoLED driver provides "natural dimming" with smooth, continuous and flicker-free operation to 0.1% dim levels. Acuity luminaires incorporating eldoLED LED drivers perform within the recommended operating areas for flicker as a function of frequency and modulation (%) outlined in IEEE Standard 1789-2015 (IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers), in typical operating conditions at representative dimming levels. Syncing for controls: 2mA max. THD: < 20%. Insignificant inrush current at 120 and 277VAC. FCC Class A and B tested for EMI and RFI. When control input of 0-10V is specified driver will be set for linear dimming curve, if nLIGHT is specified driver will be set for logarithmic dimming curve.

For 0-10V driver details go to: [PeerlessLighting.com/S66L](http://PeerlessLighting.com/S66L)

For DALI driver details go to: [PeerlessLighting.com/S60L](http://PeerlessLighting.com/S60L)

### Controls and System Networking Options

For wired network via Cat-5e, choose an integrated nLight<sup>®</sup> module with nLIGHT.

### Electrical

LED light engine -- consisting of LED arrays and eldoLED<sup>®</sup> dimming driver -- is rated for 60,000 hours (L90) at 25° C ambient temperature. Specify 120V, 277V or 347V\*. Pre-wired with 18AWG fixture wire. For special circuiting or wire gauge, consult factory. Plug-in electrical connectors included.

### Electrical Connection

Peerless will provide a quick connect cord solution from the Venue luminaire to the remote driver/control box. The cord length is determined by the overall suspension length of the luminaire plus the remote box distance. Class one connections to remote box provided by others.

### Environment

Suitable for damp location.

### Validation

CSA/CSAus listed, CSA tested to UL 2108 standards, LM-79 tested\*. Individual luminaires meet FCC Part 15 requirements.

### Buy American

This product is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.

### US PATENT

US Patent No. 10,253,944

### Packaging

Venue and assorted components are packaged in 4 mil polyethylene and nylon bags. Protection is provided with cross linked polyethylene foam inserts and a double walled telescoping corrugated carton. All packaging materials are readily recyclable.

### Warranty

5-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

Note: Actual performance may differ as a result of end-user environment and application.

All values are design or typical values, measured under laboratory conditions at 25°C.

The product images shown are for illustration purposes only and may not be an exact representation of the product.

### A+ Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight<sup>®</sup> control networks when ordered with drivers marked by a shaded background\*
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a shaded background\*

To learn more about A+, visit [www.acuitybrands.com/aplus](http://www.acuitybrands.com/aplus).

\*See ordering tree for details

AcuityBrands

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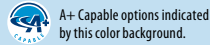
TYPE P1A



Venue Square  
VNU4 | LED | 1/D or Direct | Suspended

Type:

Project:



MODEL NUMBER Example: VNU4 SQ CCV 40IN 80CRI 35K I3500LM 3300LM DARK ZT 120 SCT F2/48A 8FTC C041 DBC041

Luminaire	Shape	Curvature	Size	LED Color Rendering	LED Color Temperature	Indirect LED Output
VNU4	SQ Square	CCV Concave CVX Convex	40IN	80CRI 80+ CRI 90CRI* 90+ CRI <i>*Longer lead times—consult factory</i>	27K* 2700K 30K 3000K 35K 3500K 40K 4000K 50K** 5000K <i>*90CRI Only **80CRI Only</i>	(blank) I1500LM 1500 Nominal lumens I2500LM 2500 Nominal lumens I3500LM 3500 Nominal lumens

Direct LED Output	Minimum Dimming Level	Control Input	Voltage	Wiring Options
3300LM 3300 Nominal lumens 4500LM 4500 Nominal lumens 6600LM 6600 Nominal lumens 8600LM 8600 Nominal lumens 12500LM 12500 Nominal lumens	DARK Constant current, dimming to <1% MINI Constant current, dimming to 1% MINIO Constant current, dimming to 10%	ZT* 0-10V NLIGHT** nLight enabled DALI*** DALI NLTAIR2* NLight AIR (wireless) enabled ECO* Lutron EcoSystem Interface <i>*0-10V will use linear dimming curve **Will use logarithmic dimming curve ***Will use logarithmic dimming curve</i>	120 120V 277 277V 347 347V MVOLT* 120-277V <i>*Not available with NLIGHT</i>	SCT Single Circuit DCT* Dual Circuit <i>*Not available with ECO</i>

Emergency Options	Mounting Type/	Overall Suspension	Luminaire to Remote Driver Box
EC* (1) emergency circuit module E10WLCP ...10 Watt battery pack, constant power with self diagnostics. CEC Certified <i>*Not available with 347, MVOLT, ZT, DALI or ECO</i>	F1/* T-bar ceiling (universal mounting bracket) F2/** Hard ceiling (horizontal J-box) F5/** Open Ceiling Closed Loop AC Cable F5A/** Open Ceiling Bolt to Ceiling AC Cable <i>*F1 Mount uses standard 3 1/2" canopy on feed and 2" canopy on support **F2 &amp; F5A Mount uses standard 5" canopy on feed and 2" canopy on support ***F5 Mount has no canopies on feed or support **** All feed cords, cord managers &amp; canopies are standard white. They are not painted to match fixture color</i>	48A 48" adjustable suspension 96A* 96" adjustable suspension 144A** 144" adjustable suspension 240A*** 240" adjustable suspension <i>Measured from ceiling to bottom of luminaire. *96A Not available with 8FTC **144A Not available with 8FTC &amp; 12FTC ***240A Not available with 8FTC, 12FTC, 16FTC or 20FTC</i>	8FTC 8FT Feed Cord 12FTC 12FT Feed Cord 16FTC 16FT Feed Cord 20FTC 20FT Feed Cord 30FTC 30FT Feed Cord 40FTC 40FT Feed Cord 50FTC 50FT Feed Cord

ELECTRICAL CONTRACTOR TO DETERMINE MOUNTING TYPE

ELECTRICAL CONTRACTOR TO DETERMINE

Luminaire Color	Driverbox Color	Options
C041 White (low gloss) C110 Painted aluminum (low gloss) C201 Black (low gloss) C099** Custom color RALTBDD* Ral Paint finishes <i>*RALTBDD for pricing only, replace with applicable RAL call out when ready to order. See the RAL BROCHURE for available options **C099 for pricing only, Custom color chip needs to be sent in to Customer Care and matched up with our paint department and customer approved before order is entered.</i>	DBC041 White (low gloss) DBC110 Painted Aluminum (low gloss) DBC201 Black (low gloss) DBC099** Custom Color DBRALTBDD* Ral Color <i>*DBRALTBDD for pricing only, Replace with applicable RAL call out when ready to order. See the RAL BROCHURE for available options **C099 for pricing only, Custom color chip needs to be sent in to Customer Care and matched up with our paint department and customer approved before order is entered</i>	CP* Chicago Plenum MCS** Matching Canopy at support for aesthetics OJB Offset J-box at feed SLP*** Sloped Ceiling <i>*Available with F1, F5 or F5A mounting only with control input limited to ZT, DALI &amp; ECO. Luminaire to driver box must be &gt;=20FT **MCS not available with F5 mount ***When SLP is chosen need to choose F2 mount and OJB</i>

ARCHITECT TO DETERMINE

ARCHITECT/OWNER TO CHOOSE LUMINAIRE & DRIVERBOX COLOR(S)

ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES



TYPE P1A

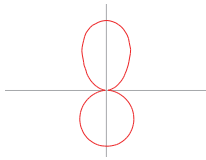
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Lighting for People<sup>®</sup>

Venue Square  
VNU4 | LED | 1/D or Direct | Suspended

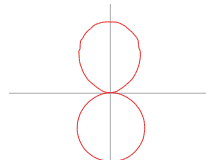
Type:

Project:

FIXTURE PERFORMANCE DATA



CCV - 30K 13500LM/4500LM  
7728 Delivered Lumens



CVX - 30K 13500LM/4500LM  
8241 Delivered Lumens

EXPECTED LIFE L90@60,000 HOURS

CCT SCALING CHART

Direct			Indirect		
CCT	CRI	MULTIPLIER	CCT	CRI	MULTIPLIER
27K	80CRI	0.9	27K	80CRI	0.96
30K	80CRI	0.93	30K	80CRI	0.99
35K	80CRI	0.96	35K	80CRI	1
40K	80CRI	1	40K	80CRI	1
50K	80CRI	0.98	50K	80CRI	1.1
27K	90CRI	0.76	27K	90CRI	0.81
30K	90CRI	0.79	30K	90CRI	0.83
35K	90CRI	0.81	35K	90CRI	0.85
40K	90CRI	0.84	40K	90CRI	0.86
50K	90CRI	0.83	50K	90CRI	0.92

COMPATIBLE nLIGHT COMPONENTS



nPODMA DX WH



nPODMA 2P DX WH



nPODMA 4P DX WH



nPODMA 2L WH



nPOD UNITOUCH WH

[SensorSwitch.com/DataSheets/nPODMA.PDF](http://SensorSwitch.com/DataSheets/nPODMA.PDF)

[Switch.com/DataSheets/nPOD Unitouch.PDF](http://Switch.com/DataSheets/nPOD Unitouch.PDF)

**eldoLED COMPATIBILITY** For compatible dimmers & switches please see the EldoLED compatibility document

[PeerlessLighting.com/eldoLED-compatibility](http://PeerlessLighting.com/eldoLED-compatibility)

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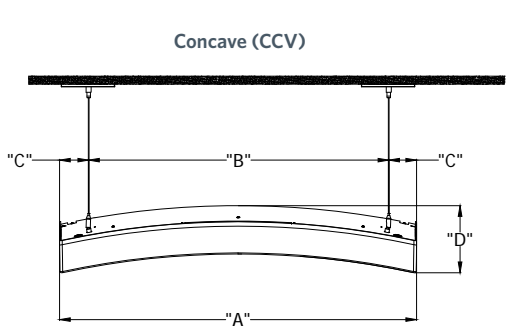
TYPE P1A

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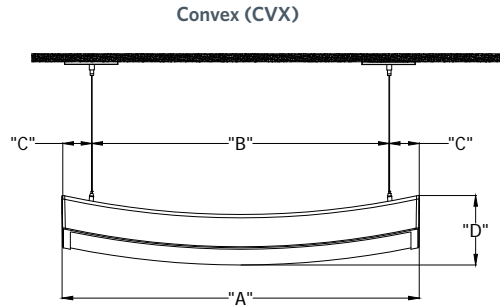
Venue Square  
VNU4 | LED | 1/D or Direct | Suspended

Type:  
Project:

WEIGHTS



SQUARE



INDIVIDUAL FIXTURES					
ORDERED	"A" O.A.L.	"B" O.C.	"C" FROM END	"D" PEAK TO PEAK	APPROX. WEIGHT
CCV	3'- 4"	2'- 9 3/4"	3 1/8"	7 5/8"	46LB

INDIVIDUAL FIXTURES					
ORDERED	"A" O.A.L.	"B" O.C.	"C" FROM END	"D" PEAK TO PEAK	APPROX. WEIGHT
CVX	3'- 4"	2'- 9 3/4"	3 1/8"	7 5/8"	46LB

VENUE INTELLIGENT LUMINAIRE CHART

Choose nomenclature from these columns							
Driver Configurations	Minimum Dimming Level	Control Input	Driver	Dimming Range	Notes		
	DARK	+	ZT	=	eldoLED SoloDrive	100% to .1%	Linear Dimming, supplied with leads for 0-10V control
	DARK	+	NLIGHT	=	eldoLED SoloDrive	100% to .1%	Logarithmic Dimming, NPS80 included with driver box
	DARK	+	DALI	=	eldoLED SoloDrive	100% to .1%	Logarithmic Dimming, DALI controls and power supply by others
	DARK	+	NLTAIR2	=	eldoLED SoloDrive	100% to .1%	Logarithmic Dimming, RPP20 included with driver box
	DARK	+	ECO	=	eldoLED SoloDrive	100% to .1%	Logarithmic Dimming, Lutron TVI-LMF-2A Ecosystem to 0-10V converter in driver box
	MIN1	+	ZT	=	eldoLED EcoDrive	100% to 1%	Linear Dimming, supplied with leads for 0-10V control
	MIN1	+	NLIGHT	=	eldoLED EcoDrive	100% to 1%	Logarithmic Dimming, NPS80 included with driver box
	MIN1	+	DALI	=	eldoLED SoloDrive	100% to 1%	Logarithmic Dimming, DALI controls and power supply by others
	MIN1	+	NLTAIR2	=	eldoLED EcoDrive	100% to 1%	Logarithmic Dimming, RPP20 included with driver box
	MIN1	+	ECO	=	eldoLED EcoDrive	100% to 1%	Logarithmic Dimming, Lutron TVI-LMF-2A Ecosystem to 0-10V converter in driver box
	MIN10	+	ZT	=	eldoLED EcoDrive	100% to 10%	Linear Dimming, supplied with leads for 0-10V control
	MIN10	+	NLIGHT	=	eldoLED EcoDrive	100% to 10%	Logarithmic Dimming, NPS80 included with driver box
	MIN10	+	DALI	=	eldoLED SoloDrive	100% to 10%	Logarithmic Dimming, DALI controls and power supply by others
	MIN10	+	NLTAIR2	=	eldoLED EcoDrive	100% to 10%	Logarithmic Dimming, RPP20 included with driver box
MIN10	+	ECO	=	eldoLED EcoDrive	100% to 10%	Logarithmic Dimming, Lutron TVI-LMF-2A Ecosystem to 0-10V converter in driver box	

**TYPE P1A**

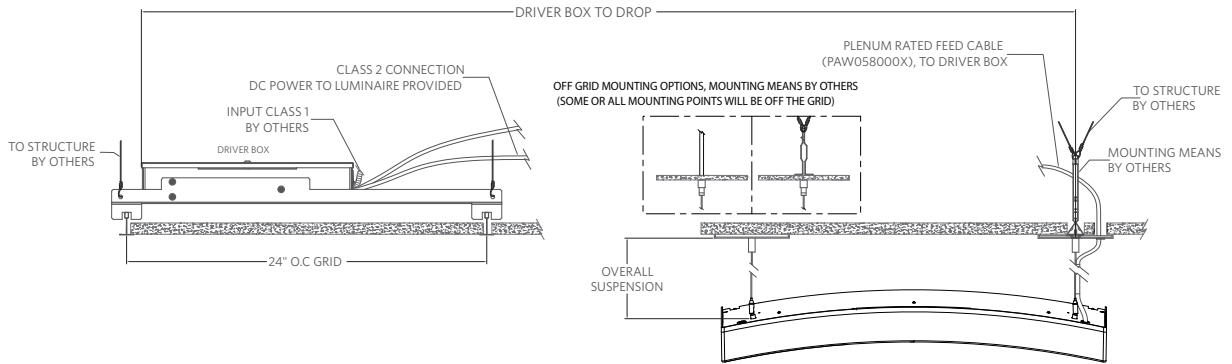
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Venue Square  
VNU4 | LED | 1/D or Direct | Suspended

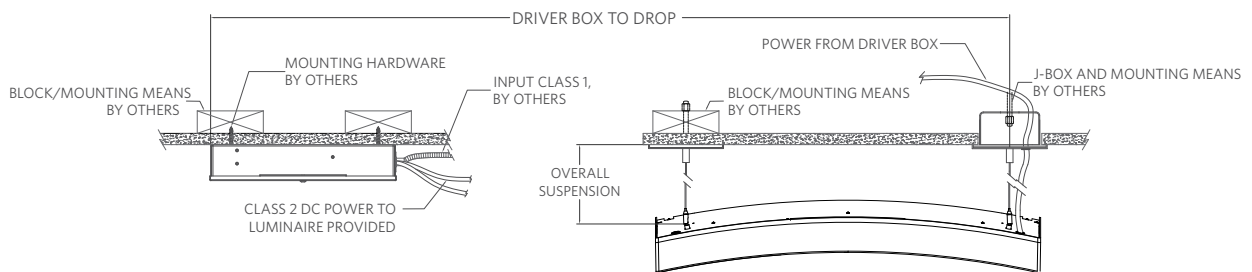
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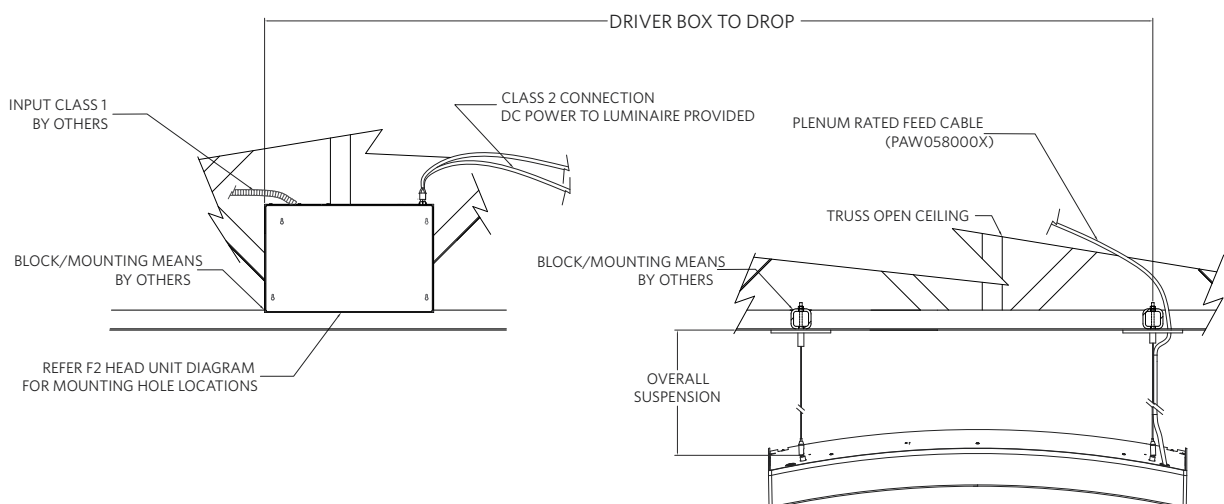
**F1 MOUNTING DETAILS**



**F2 MOUNTING DETAILS**



**F5A MOUNTING DETAILS**



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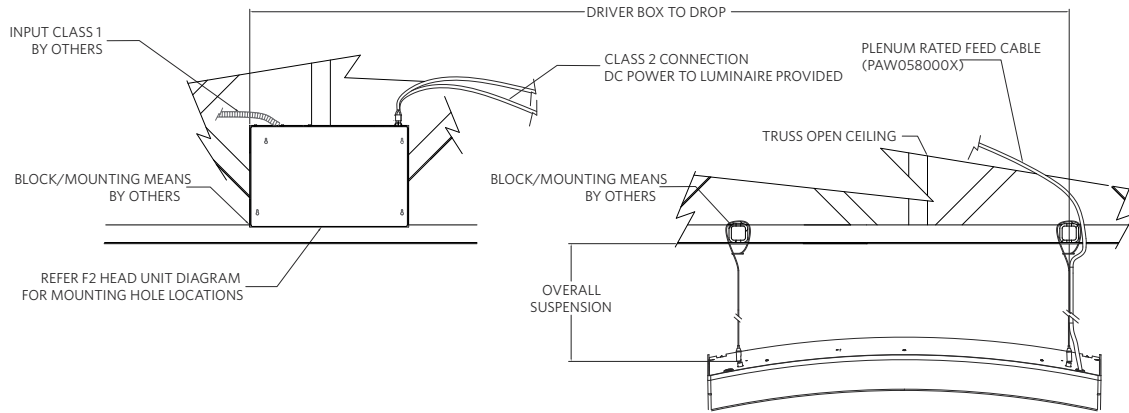
6

**TYPE P1A**

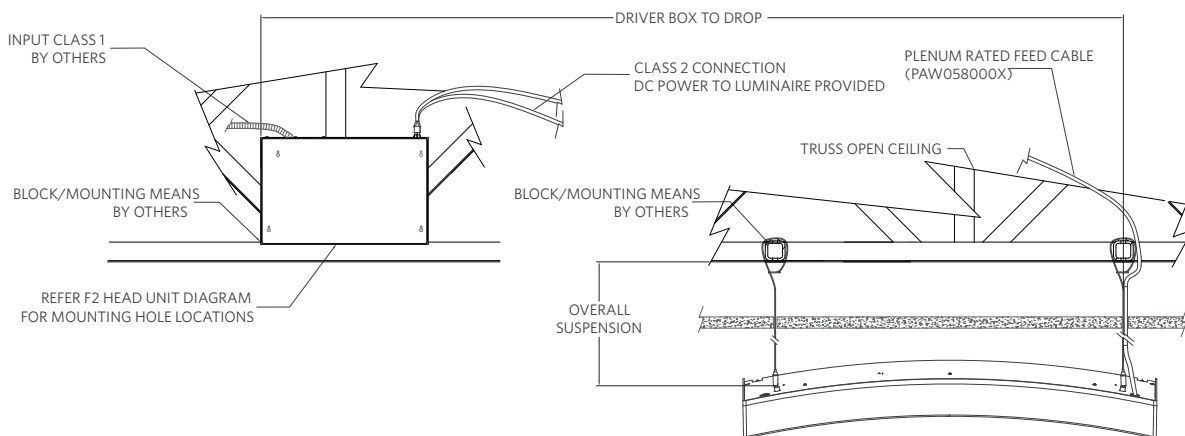
**Peerless**<sup>®</sup> | Venue Square  
Lighting for People<sup>®</sup> | VNU4 | LED | I/D or Direct | Suspended

Type:  
Project:

**F5 MOUNTING DETAILS OPEN CEILING**



**F5 MOUNTING DETAILS CLOSED CEILING**



OVERALL SUSPENSION	
OPTION VALUE	OPTIONAL VALUE DESCRIPTION
48A	Adjustable 48 inch
96A	Adjustable 96 inch
144A	Adjustable 144 inch
240A	Adjustable 240 inch

DRIVER BOX TO LUMINAIRE	
OPTION VALUE	OPTIONAL VALUE DESCRIPTION
8 FTC	8 FT Feed Cable
12 FTC	12 FT Feed Cable
16 FTC	16 FT Feed Cable
20 FTC	20 FT Feed Cable
30 FTC	30 FT Feed Cable
40 FTC	40 FT Feed Cable
50 FTC	50 FT Feed Cable

DRIVER BOX TO LUMINAIRE = DRIVER BOX TO DROP + OVERALL SUSPENSION

TYPE P1A

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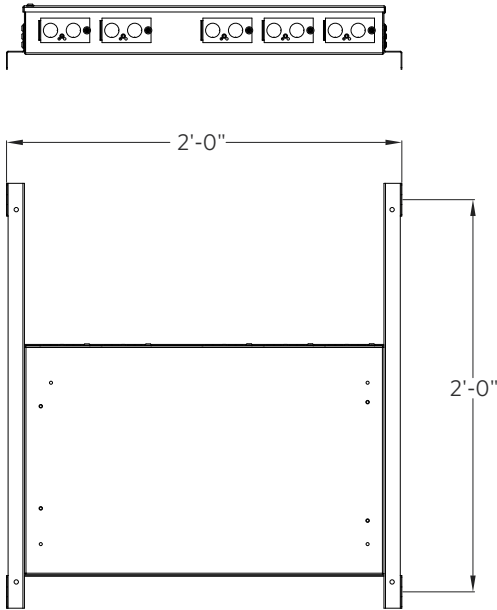
Venue Square  
VNU4 | LED | I/D or Direct | Suspended

Type:

Project:

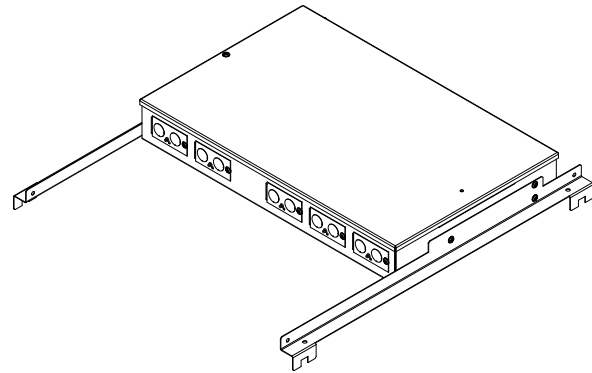
REMOTE DRIVER BOX

F1 MOUNTING LOCATIONS

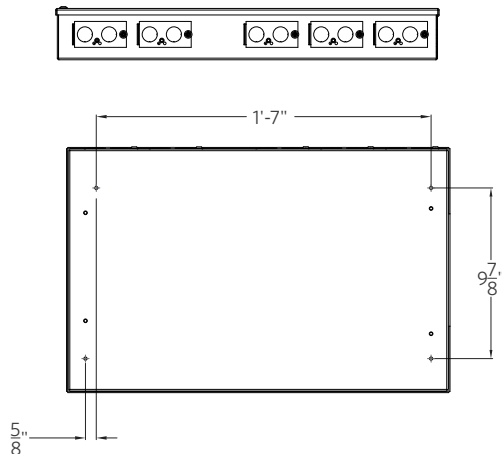


OVERALL DIMENSIONS

2'-1/4" X 2'-2" X 3 7/8"

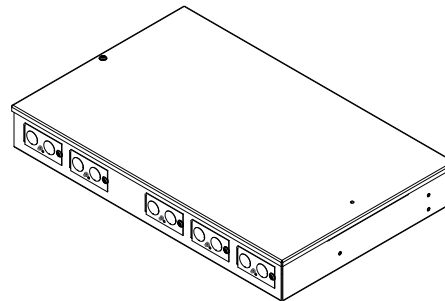


F2/F5/F5A MOUNTING LOCATIONS



OVERALL DIMENSIONS

1'-10 1/4" X 1'-2 1/4" X 3"



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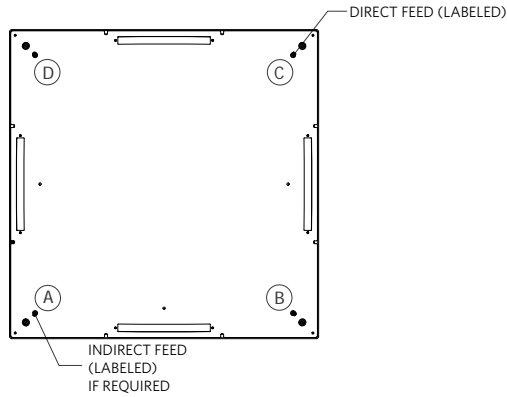
**TYPE P1A**

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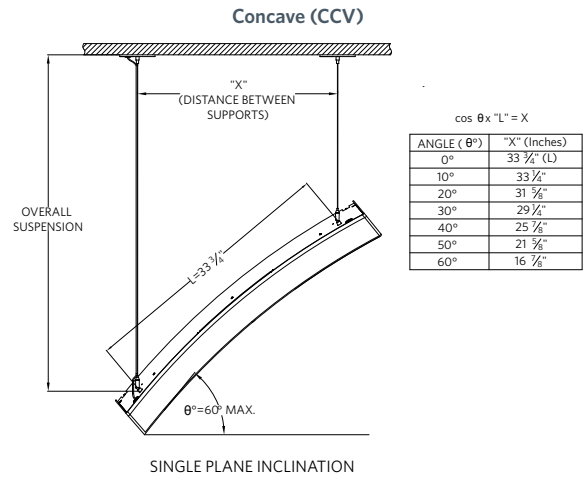
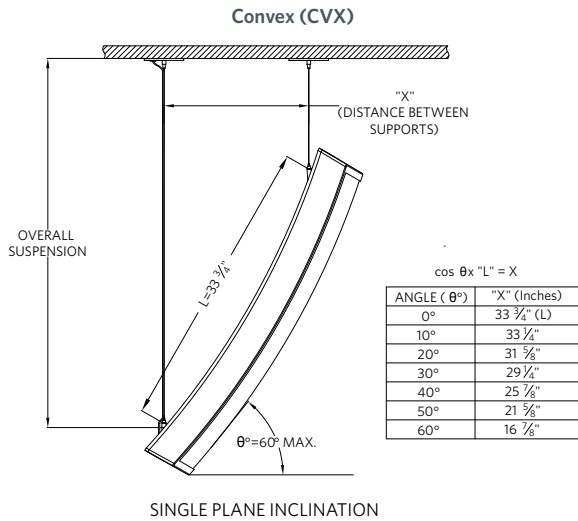
Venue Square  
VNU4 | LED | I/D or Direct | Suspended

Type:  
Project:

**LUMINAIRE SUSPENSION DETAILS**



**MOUNTING ANGLE VIEW SQUARE**



\*When suspending the luminaire at an angle please use the above tables for guidance to ensure your cables hang straight.

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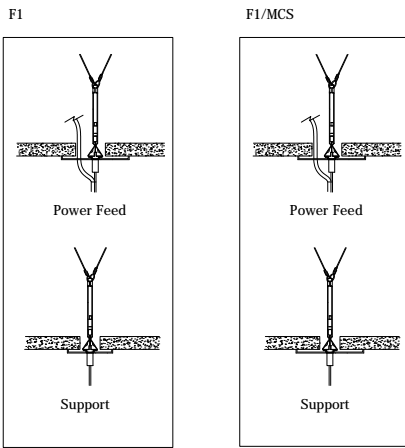
Type:  
Project:

**MOST COMMON MOUNTING TYPES AND OPTIONS** Options available for this specific luminaire are checked in the boxes below.

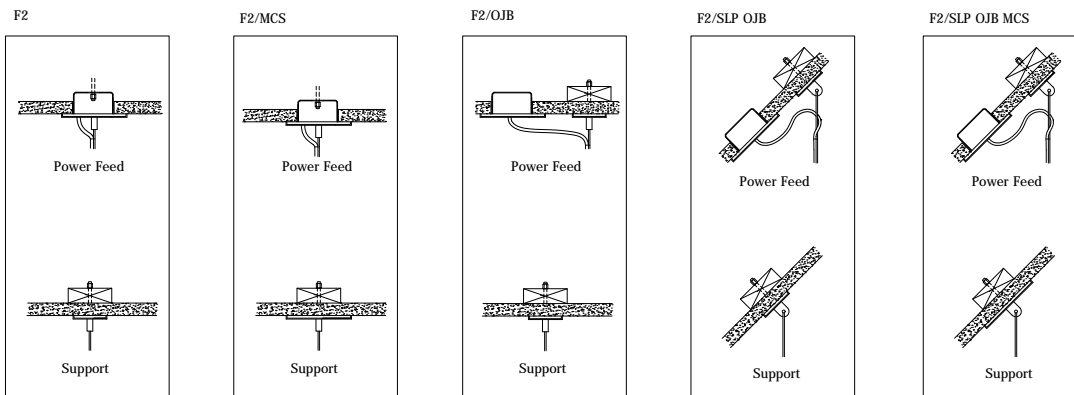
**Mounting Type**

- F1/ For use with most T-Bar and screw slot grid ceilings. Designed for on-grid and off-grid applications.
- F2/ For use with recessed or surface mount horizontal J-box applications.
- F5/ Open Ceiling Closed Loop AC Cable
- F5A/ Open Ceiling Bolt to Ceiling AC Cable

**F1 - T-BAR CEILING (UNIVERSAL MOUNTING BRACKET)**



**F2 - HARD CEILING (HORIZONTAL J-BOX)**



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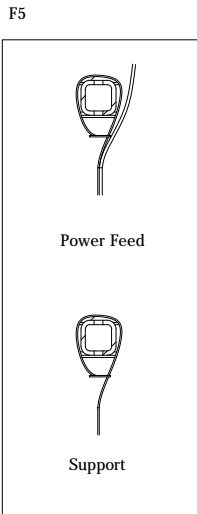
Venue Square  
VNU4 | LED | I/D or Direct | Suspended

TYPE P1A

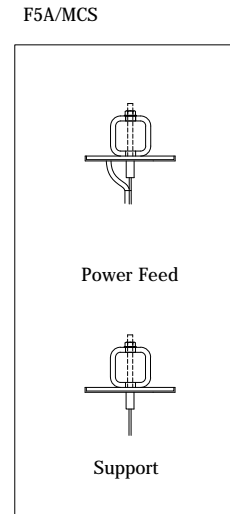
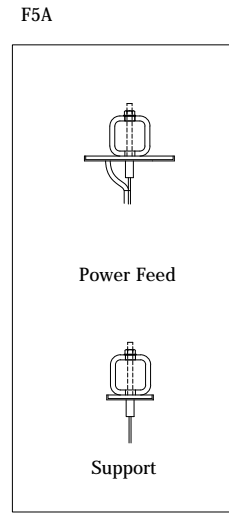
Type:

Project:

F5 - OPEN CEILING CLOSED LOOP AIRCRAFT CABLE



F5A - OPEN CEILING 'BOLT TO CEILING SYSTEM' AIRCRAFT CABLE



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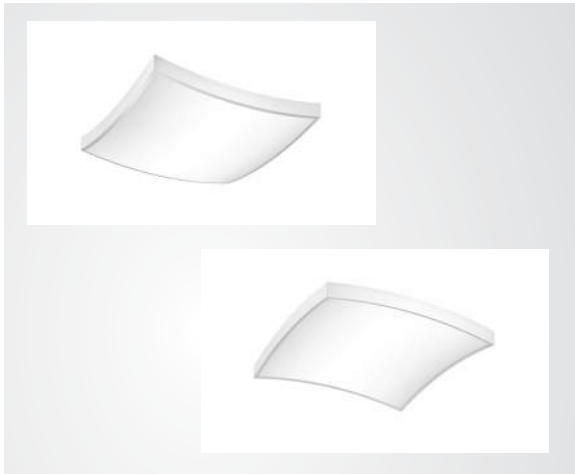
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**TYPE P1B**

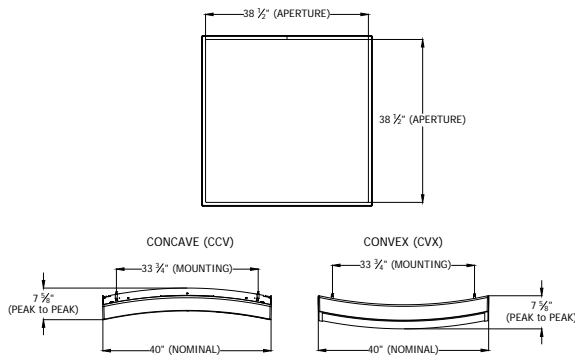
Type:

Project:



**DIMENSIONS**

**VNU4**



**COMPANION LUMINAIRE(S)**



Venue Rectangle

**VENUE LUMINANCE COMPANION CHART**

Lumen Value	
Square	Rectangle
3300	5800
4500	7800
6600	11600
8600	15000

\* If trying to match brightness of different shapes please use the recommended pairings shown above

**CUSTOMIZATION**

Ask us about the following possibilities: Higher lumen outputs, alternate voltages, custom colors.

**HIGHLIGHTS**

- Total System Integration features 5-year limited warranty by Acuity Brands covering all components and construction
- Up to 119 lm/W
- Square dimensions are 40" x 40"
- Offered in Convex or Concave
- Flicker-free dimming to dark powered by eldoLED® driver
- Integrated nLight® control module for system networking (optional)
- White, black, painted aluminum or custom color



eldoLED

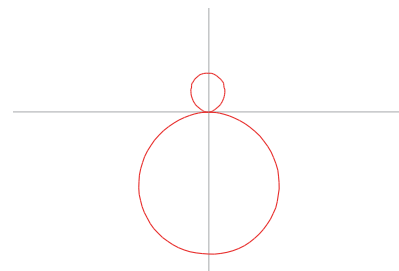


**LUMEN PACKAGES** The table values are based on the 3 available Indirect outputs combined with a range of downlight nominal outputs. Additional outputs and color temperatures available (Indirect in bold)

@ 35K & 80CRI - CCV	11500 + (4500 / 6600 / 8600)			12500 + (4500 / 6600 / 8600)			13500 + (4500 / 6600 / 8600)		
Direct Delivered Lumens	4346	6764	8408	4347	6765	8410	4349	6767	8411
Total Delivered Lumens	5849	8267	9911	7011	9429	11074	7910	10328	11972
Input Watts	54	78	96	67	91	109	78	102	120
Lumens Per Watt	108	105	103	104	103	101	101	101	99

Please pull the appropriate IES file for the hard data number for your luminaire selection

**DISTRIBUTION** Based on CCV - 80CRI 35K 12500LM 12500LM. Additional color temperatures available



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TYPE P1B

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Venue Square  
VNU4 | LED | I/D or Direct | Suspended

Type:

Project:

## SPECIFICATIONS

### Housing

The housing is a one-piece thermoformed automotive grade polymer casing that is cut into two piece. The back panel that holds the electricals, while second piece is a seamless fascia that holds our optical grade acrylic lens.

### Color

Color for housing is white, black or painted aluminum. Consult factory for custom colors.

### Source

Five available color temperature options (2700K, 3000K, 3500K, 4000K and 5000K) — all within 2.5 MacAdam ellipse.

### Optics

Direct optics are maintained through a dual optical system that creates superior uniformity across the lens. Indirect optics are recessed along the upper boundary of the luminaire to distribute light evenly across the ceiling plane.

### Remote Dimming Driver

eldoLED driver provides "natural dimming" with smooth, continuous and flicker-free operation to 0.1% dim levels. Acuity luminaires incorporating eldoLED LED drivers perform within the recommended operating areas for flicker as a function of frequency and modulation (%) outlined in IEEE Standard 1789-2015 (IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers), in typical operating conditions at representative dimming levels. Syncing for controls: 2mA max. THD: < 20%. Insignificant inrush current at 120 and 277VAC. FCC Class A and B tested for EMI and RFI. When control input of 0-10V is specified driver will be set for linear dimming curve, if NLIGHT is specified driver will be set for logarithmic dimming curve.

For 0-10V driver details go to: [PeerlessLighting.com/S66L](http://PeerlessLighting.com/S66L)

For DALI driver details go to: [PeerlessLighting.com/S60L](http://PeerlessLighting.com/S60L)

### Controls and System Networking Options

For wired network via Cat-5e, chose an integrated nLight<sup>®</sup> module with NLIGHT.

### Electrical

LED light engine -- consisting of LED arrays and eldoLED<sup>®</sup> dimming driver -- is rated for 60,000 hours (L90) at 25° C ambient temperature. Specify 120V, 277V or 347V\*. Pre-wired with 18AWG fixture wire. For special circuiting or wire gauge, consult factory. Plug-in electrical connectors included.

### Electrical Connection

Peerless will provide a quick connect cord solution from the Venue luminaire to the remote driver/control box. The cord length is determined by the overall suspension length of the luminaire plus the remote box distance. Class one connections to remote box provided by others.

### Environment

Suitable for damp location.

### Validation

CSA/CSAus listed, CSA tested to UL 2108 standards, LM-79 tested\*. Individual luminaires meet FCC Part 15 requirements.

### Buy American

This product is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.

### US PATENT

US Patent No. 10,253,944

### Packaging

Venue and assorted components are packaged in 4 mil polyethylene and nylon bags. Protection is provided with cross linked polyethylene foam inserts and a double walled telescoping corrugated carton. All packaging materials are readily recyclable.

### Warranty

5-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

Note: Actual performance may differ as a result of end-user environment and application.

All values are design or typical values, measured under laboratory conditions at 25°C.

The product images shown are for illustration purposes only and may not be an exact representation of the product.

### A+ Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight<sup>®</sup> control networks when ordered with drivers marked by a shaded background\*
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a shaded background\*

To learn more about A+, visit [www.acuitybrands.com/aplus](http://www.acuitybrands.com/aplus).

\*See ordering tree for details

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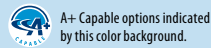
TYPE P1B

Peerless®  
Lighting for People®

Venue Square  
VNU4 | LED | 1/D or Direct | Suspended

Type:

Project:



MODEL NUMBER Example: VNU4 SQ CCV 40IN 80CRI 35K I3500LM 3300LM DARK ZT 120 SCT F2/48A 8FTC C041 DBC041

Luminaire	Shape	Curvature	Size	LED Color Rendering	LED Color Temperature	Indirect LED Output
VNU4	SQ Square	CCV Concave CVX Convex	40IN	80CRI 80+ CRI 90CRI* 90+ CRI <i>*Longer lead times—consult factory</i>	27K* 2700K 30K 3000K 35K 3500K 40K 4000K 50K** 5000K <i>*90CRI Only **80CRI Only</i>	(blank) I1500LM 1500 Nominal lumens I2500LM 2500 Nominal lumens I3500LM 3500 Nominal lumens

Direct LED Output	Minimum Dimming Level	Control Input	Voltage	Wiring Options
3300LM 3300 Nominal lumens 4500LM 4500 Nominal lumens 6600LM 6600 Nominal lumens 8600LM 8600 Nominal lumens 12500LM 12500 Nominal lumens	DARK Constant current, dimming to < 1% MINI Constant current, dimming to 1% MINIO Constant current, dimming to 10%	ZT* 0-10V NLIGHT** nLight enabled DALI*** DALI NLTAIR2* NLight AIR (wireless) enabled ECO* Lutron EcoSystem Interface <i>*0-10V will use linear dimming curve **Will use logarithmic dimming curve ***Will use logarithmic dimming curve</i>	120 120V 277 277V 347 347V MVOLT* 120-277V <i>*Not available with NLIGHT</i>	SCT Single Circuit DCT* Dual Circuit <i>*Not available with ECO</i>

Emergency Options	Mounting Type/	Overall Suspension	Luminaire to Remote Driver Box
EC* (1) emergency circuit module E10WLCP ...10 Watt battery pack, constant power with self diagnostics. CEC Certified <i>*Not available with 347, MVOLT, ZT, DALI or ECO</i>	F1/* T-bar ceiling (universal mounting bracket) F2/** Hard ceiling (horizontal J-box) F5/** Open Ceiling Closed Loop AC Cable F5A/** Open Ceiling Bolt to Ceiling AC Cable <i>*F1 Mount uses standard 3 1/2" canopy on feed and 2" canopy on support **F2 &amp; F5A Mount uses standard 5" canopy on feed and 2" canopy on support ***F5 Mount has no canopies on feed or support **** All feed cords, cord managers &amp; canopies are standard white. They are not painted to match fixture color</i>	48A 48" adjustable suspension 96A* 96" adjustable suspension 144A** 144" adjustable suspension 240A*** 240" adjustable suspension <i>Measured from ceiling to bottom of luminaire. *96A Not available with 8FTC **144A Not available with 8FTC &amp; 12FTC ***240A Not available with 8FTC, 12FTC, 16FTC or 20FTC</i>	8FTC 8FT Feed Cord 12FTC 12FT Feed Cord 16FTC 16FT Feed Cord 20FTC 20FT Feed Cord 30FTC 30FT Feed Cord 40FTC 40FT Feed Cord 50FTC 50FT Feed Cord

Luminaire Color	Driverbox Color	Options
C041 White (low gloss) C110 Painted aluminum (low gloss) C201 Black (low gloss) C099** Custom color RALTBDD* Ral Paint finishes <i>*RALTBDD for pricing only, replace with applicable RAL call out when ready to order. See the RAL BROCHURE for available options **C099 for pricing only, Custom color chip needs to be sent in to Customer Care and matched up with our paint department and customer approved before order is entered.</i>	DBC041 White (low gloss) DBC110 Painted Aluminum (low gloss) DBC201 Black (low gloss) DBC099** Custom Color DBRALTBDD* Ral Color <i>*DBRALTBDD for pricing only, Replace with applicable RAL call out when ready to order. See the RAL BROCHURE for available options **C099 for pricing only, Custom color chip needs to be sent in to Customer Care and matched up with our paint department and customer approved before order is entered</i>	CP* Chicago Plenum MCS** Matching Canopy at support for aesthetics OJB Offset J-box at feed SLP*** Sloped Ceiling <i>*Available with F1, F5 or F5A mounting only with control input limited to ZT, DALI &amp; ECO. Luminaire to driver box must be &gt;=20FT **MCS not available with F5 mount ***When SLP is chosen need to choose F2 mount and OJB</i>

ARCHITECT/OWNER TO CHOOSE LUMINAIRE & DRIVERBOX COLOR(S)

ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES

ELECTRICAL CONTRACTOR TO DETERMINE

ARCHITECT TO DETERMINE

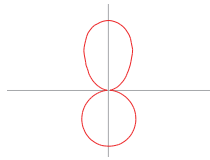
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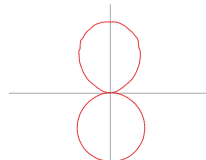
Venue Square  
VNU4 | LED | 1/D or Direct | Suspended

Type:  
Project:

FIXTURE PERFORMANCE DATA



CCV - 30K 13500LM/4500LM  
7728 Delivered Lumens



CVX - 30K 13500LM/4500LM  
8241 Delivered Lumens

EXPECTED LIFE L90@60,000 HOURS

CCT SCALING CHART

Direct			Indirect		
CCT	CRI	MULTIPLIER	CCT	CRI	MULTIPLIER
27K	80CRI	0.9	27K	80CRI	0.96
30K	80CRI	0.93	30K	80CRI	0.99
35K	80CRI	0.96	35K	80CRI	1
40K	80CRI	1	40K	80CRI	1
50K	80CRI	0.98	50K	80CRI	1.1
27K	90CRI	0.76	27K	90CRI	0.81
30K	90CRI	0.79	30K	90CRI	0.83
35K	90CRI	0.81	35K	90CRI	0.85
40K	90CRI	0.84	40K	90CRI	0.86
50K	90CRI	0.83	50K	90CRI	0.92

COMPATIBLE nLIGHT COMPONENTS



nPODMA DX WH



nPODMA 2P DX WH



nPODMA 4P DX WH



nPODMA 2L WH



nPOD UNITOUCH WH

[SensorSwitch.com/DataSheets/nPODMA.PDF](http://SensorSwitch.com/DataSheets/nPODMA.PDF)

[Switch.com/DataSheets/nPOD Unitouch.PDF](http://Switch.com/DataSheets/nPOD Unitouch.PDF)

eldoLED COMPATIBILITY For compatible dimmers & switches please see the EldoLED compatibility document

[PeerlessLighting.com/eldoLED-compatibility](http://PeerlessLighting.com/eldoLED-compatibility)



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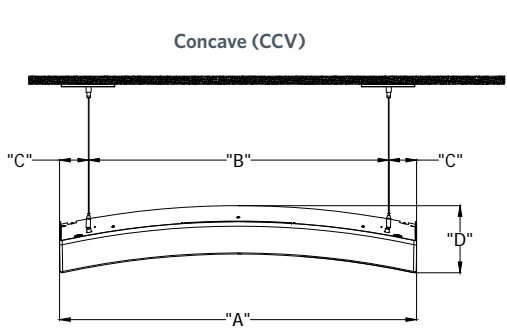
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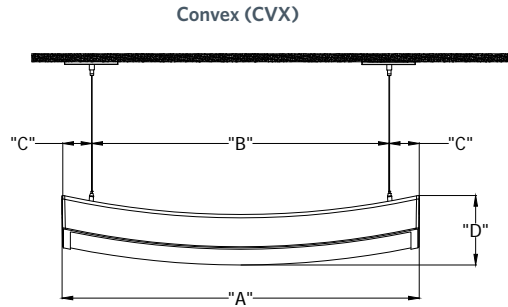
Venue Square  
VNU4 | LED | 1/D or Direct | Suspended

Type:  
Project:

**WEIGHTS**



**SQUARE**



INDIVIDUAL FIXTURES					
ORDERED	"A" O.A.L.	"B" O.C.	"C" FROM END	"D" PEAK TO PEAK	APPROX. WEIGHT
CCV	3'- 4"	2'- 9 3/4"	3 1/8"	7 5/8"	46LB

INDIVIDUAL FIXTURES					
ORDERED	"A" O.A.L.	"B" O.C.	"C" FROM END	"D" PEAK TO PEAK	APPROX. WEIGHT
CVX	3'- 4"	2'- 9 3/4"	3 1/8"	7 5/8"	46LB

**VENUE INTELLIGENT LUMINAIRE CHART**

Choose nomenclature from these columns					
Driver Configurations	Minimum Dimming Level	Control Input	Driver	Dimming Range	Notes
	DARK	+ ZT	= eldoLED SoloDrive	100% to .1%	Linear Dimming, supplied with leads for 0-10V control
	DARK	+ NLIGHT	= eldoLED SoloDrive	100% to .1%	Logarithmic Dimming, NPS80 included with driver box
	DARK	+ DALI	= eldoLED SoloDrive	100% to .1%	Logarithmic Dimming, DALI controls and power supply by others
	DARK	+ NLTAIR2	= eldoLED SoloDrive	100% to .1%	Logarithmic Dimming, RPP20 included with driver box
	DARK	+ ECO	= eldoLED SoloDrive	100% to .1%	Logarithmic Dimming, Lutron TVI-LMF-2A Ecosystem to 0-10V converter in driver box
	MIN1	+ ZT	= eldoLED EcoDrive	100% to 1%	Linear Dimming, supplied with leads for 0-10V control
	MIN1	+ NLIGHT	= eldoLED EcoDrive	100% to 1%	Logarithmic Dimming, NPS80 included with driver box
	MIN1	+ DALI	= eldoLED SoloDrive	100% to 1%	Logarithmic Dimming, DALI controls and power supply by others
	MIN1	+ NLTAIR2	= eldoLED EcoDrive	100% to 1%	Logarithmic Dimming, RPP20 included with driver box
	MIN1	+ ECO	= eldoLED EcoDrive	100% to 1%	Logarithmic Dimming, Lutron TVI-LMF-2A Ecosystem to 0-10V converter in driver box
	MIN10	+ ZT	= eldoLED EcoDrive	100% to 10%	Linear Dimming, supplied with leads for 0-10V control
	MIN10	+ NLIGHT	= eldoLED EcoDrive	100% to 10%	Logarithmic Dimming, NPS80 included with driver box
	MIN10	+ DALI	= eldoLED SoloDrive	100% to 10%	Logarithmic Dimming, DALI controls and power supply by others
	MIN10	+ NLTAIR2	= eldoLED EcoDrive	100% to 10%	Logarithmic Dimming, RPP20 included with driver box
MIN10	+ ECO	= eldoLED EcoDrive	100% to 10%	Logarithmic Dimming, Lutron TVI-LMF-2A Ecosystem to 0-10V converter in driver box	

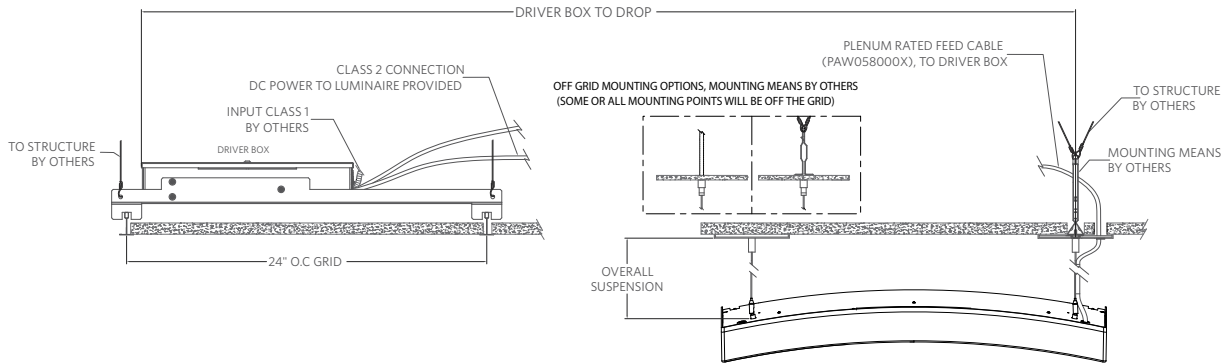
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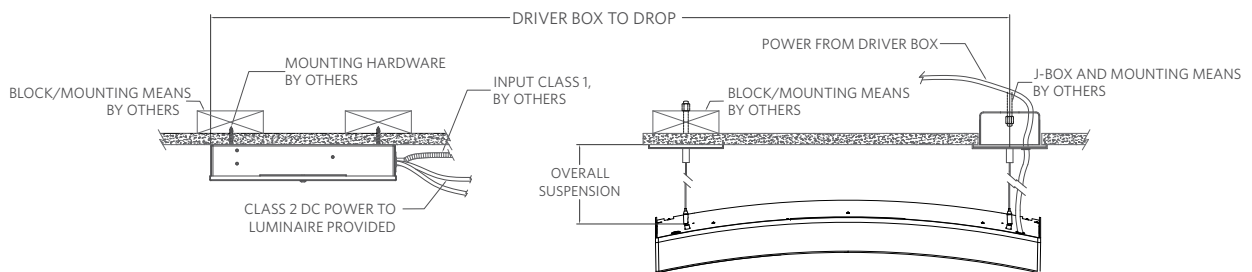
Venue Square  
VNU4 | LED | 1/D or Direct | Suspended

Type:  
Project:

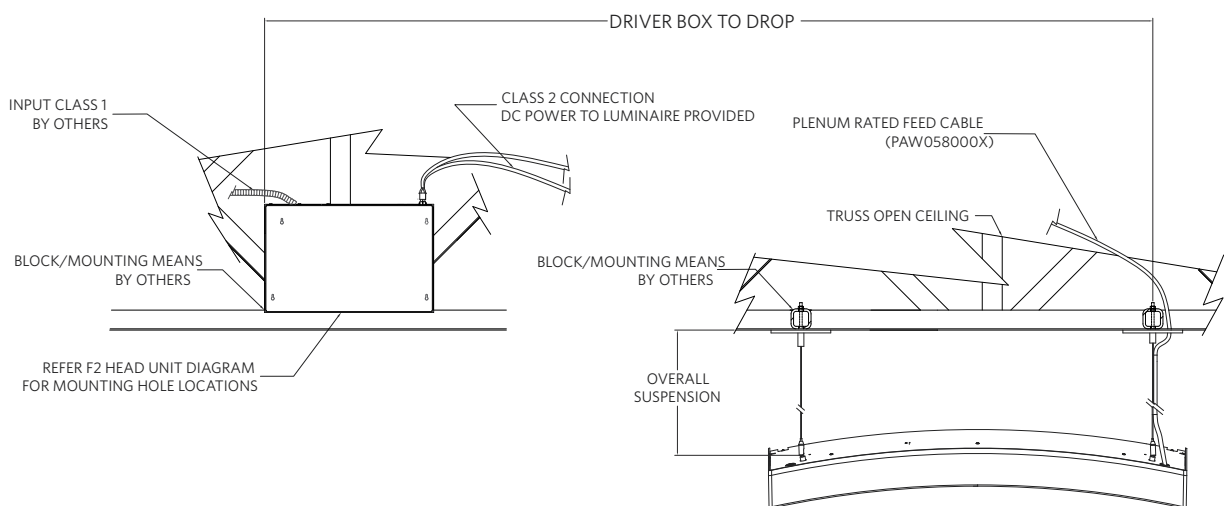
**F1 MOUNTING DETAILS**



**F2 MOUNTING DETAILS**



**F5A MOUNTING DETAILS**



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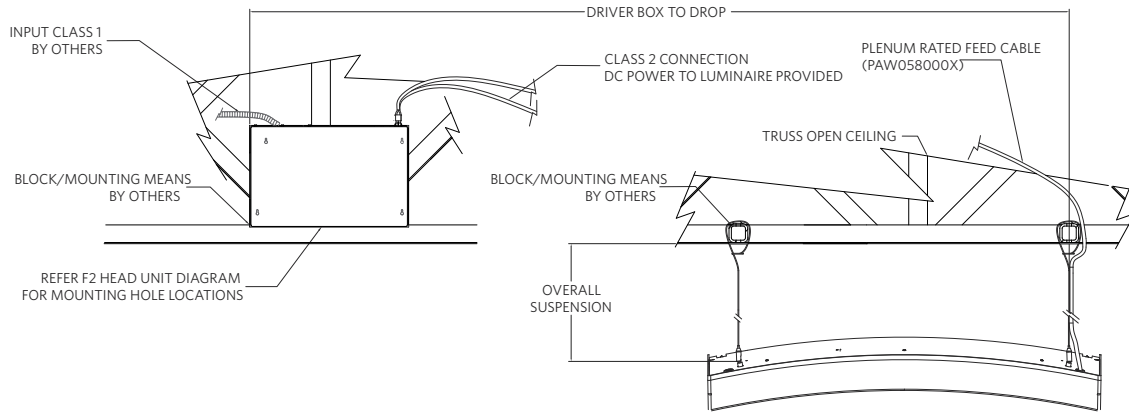
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Venue Square  
VNU4 | LED | I/D or Direct | Suspended

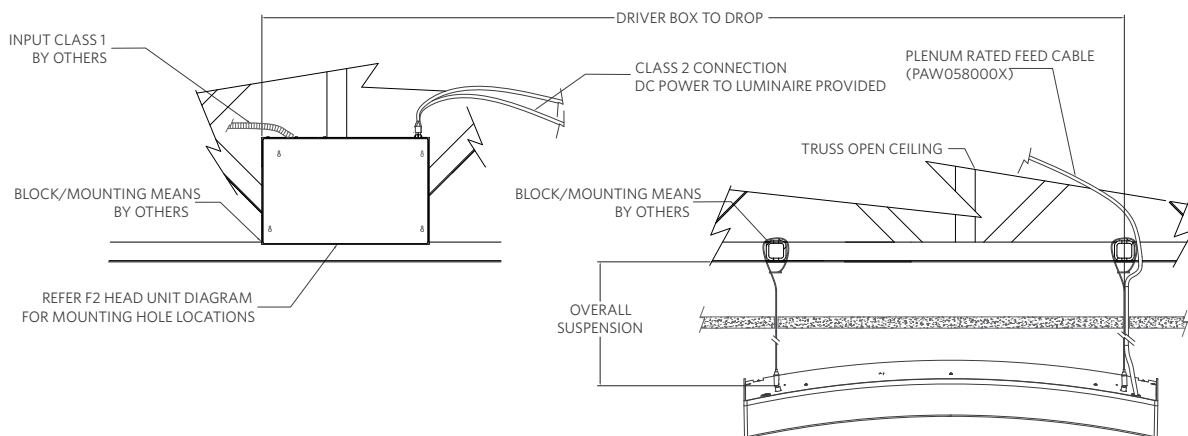
Type:

Project:

F5 MOUNTING DETAILS OPEN CEILING



F5 MOUNTING DETAILS CLOSED CEILING



OVERALL SUSPENSION	
OPTION VALUE	OPTIONAL VALUE DESCRIPTION
48A	Adjustable 48 inch
96A	Adjustable 96 inch
144A	Adjustable 144 inch
240A	Adjustable 240 inch

DRIVER BOX TO LUMINAIRE	
OPTION VALUE	OPTIONAL VALUE DESCRIPTION
8 FTC	8 FT Feed Cable
12 FTC	12 FT Feed Cable
16 FTC	16 FT Feed Cable
20 FTC	20 FT Feed Cable
30 FTC	30 FT Feed Cable
40 FTC	40 FT Feed Cable
50 FTC	50 FT Feed Cable

DRIVER BOX TO LUMINAIRE = DRIVER BOX TO DROP + OVERALL SUSPENSION

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TYPE P1B

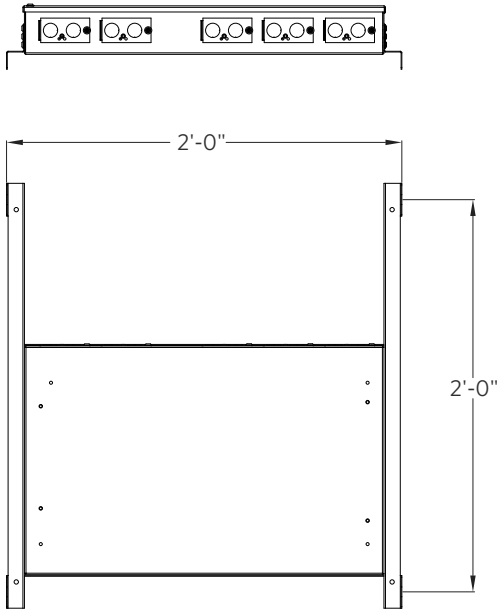
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Venue Square  
VNU4 | LED | I/D or Direct | Suspended

Type:  
Project:

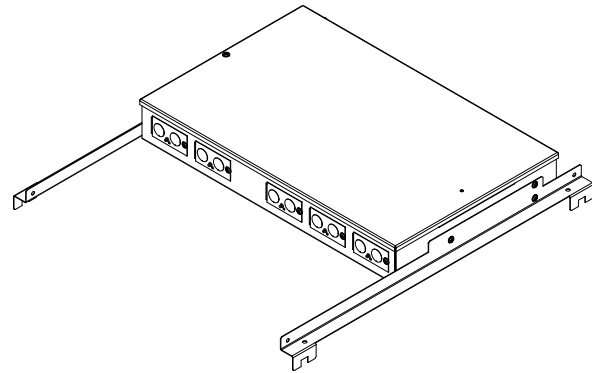
REMOTE DRIVER BOX

F1 MOUNTING LOCATIONS

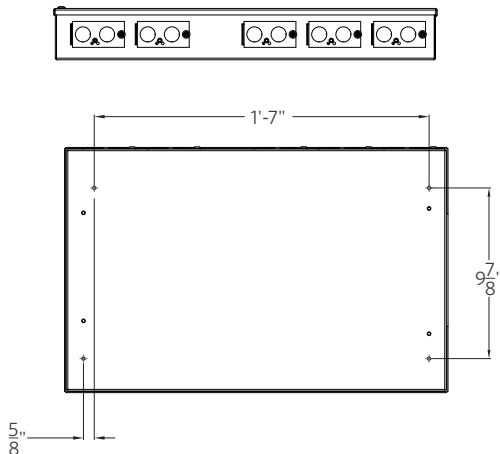


OVERALL DIMENSIONS

2'-1/4" X 2'-2" X 3 7/8"

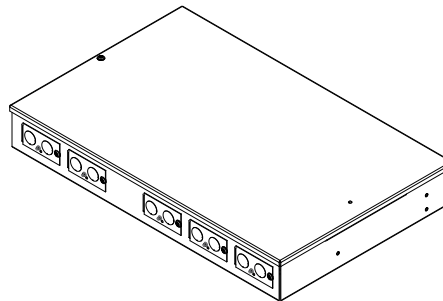


F2/F5/F5A MOUNTING LOCATIONS



OVERALL DIMENSIONS

1'-10 1/4" X 1'-2 1/4" X 3"



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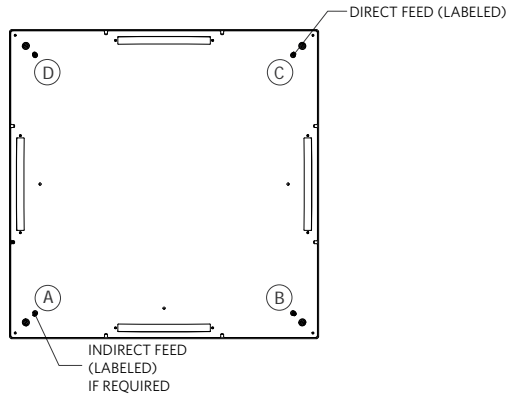
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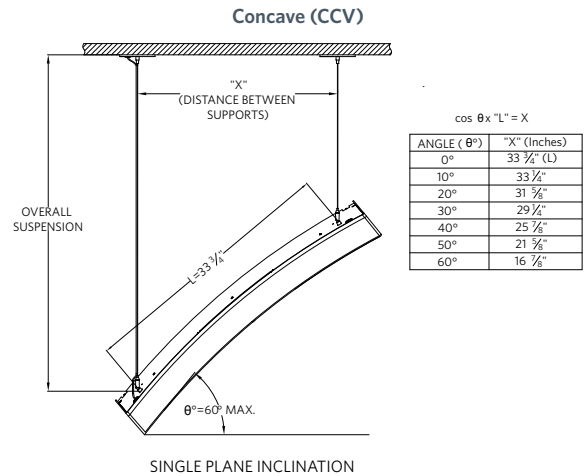
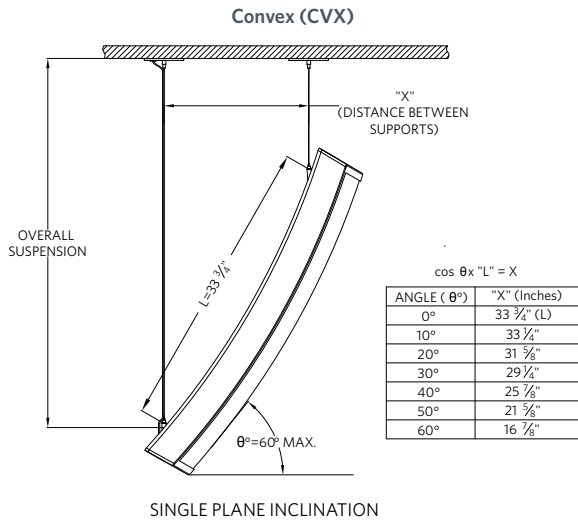
Venue Square  
VNU4 | LED | I/D or Direct | Suspended

Type:  
Project:

**LUMINAIRE SUSPENSION DETAILS**



**MOUNTING ANGLE VIEW SQUARE**



\*When suspending the luminaire at an angle please use the above tables for guidance to ensure your cables hang straight.

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TYPE P1B

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Venue Square  
VNU4 | LED | I/D or Direct | Suspended

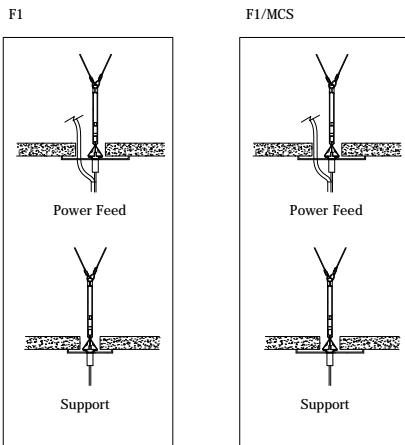
Type:  
Project:

**MOST COMMON MOUNTING TYPES AND OPTIONS** Options available for this specific luminaire are checked in the boxes below.

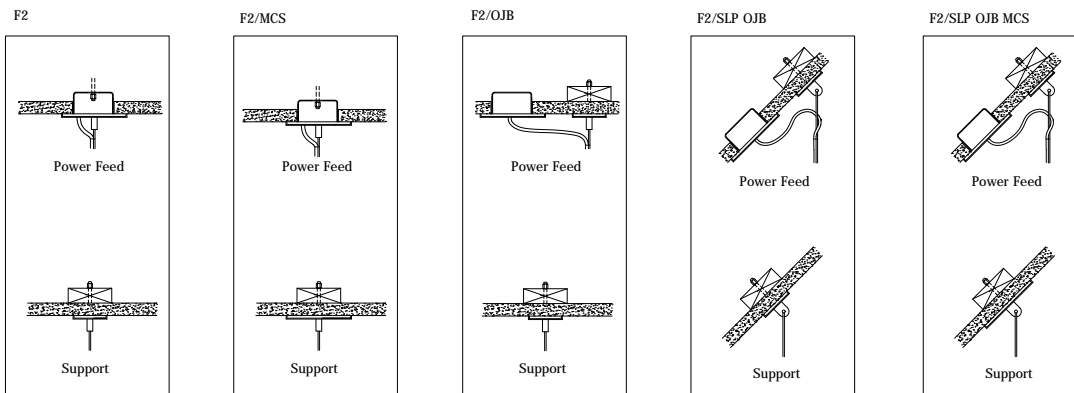
**Mounting Type**

- F1/ For use with most T-Bar and screw slot grid ceilings. Designed for on-grid and off-grid applications.
- F2/ For use with recessed or surface mount horizontal J-box applications.
- F5/ Open Ceiling Closed Loop AC Cable
- F5A/ Open Ceiling Bolt to Ceiling AC Cable

**F1 - T-BAR CEILING (UNIVERSAL MOUNTING BRACKET)**



**F2 - HARD CEILING (HORIZONTAL J-BOX)**



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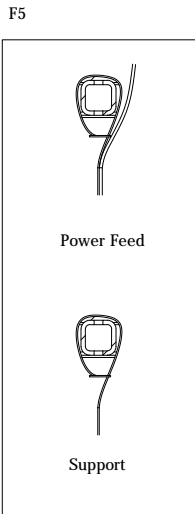


Venue Square  
VNU4 | LED | I/D or Direct | Suspended

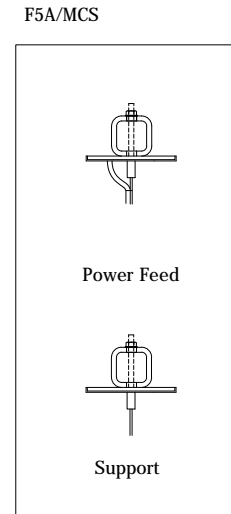
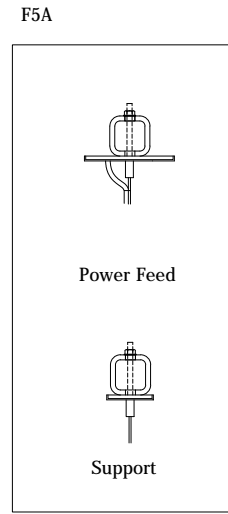
TYPE P1B

Type:  
Project:

F5 - OPEN CEILING CLOSED LOOP AIRCRAFT CABLE



F5A - OPEN CEILING 'BOLT TO CEILING SYSTEM' AIRCRAFT CABLE



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**FEATURES & SPECIFICATIONS**

**INTENDED USE**

Recessed housing rated IC. For new construction and remodel applications. Approved for all ceiling types except air handling plenums. Not for pulling wires. Romex only. Approved for direct burial in insulation.

**CONSTRUCTION**

Air-tight standard. Tested to meet current energy codes.  
Aluminum housing with engineering-grade thermoplastic frame.  
Galvanized bar hangers span up to 24" o.c. and feature built-in nailer and T-bar clips.  
Engineering-grade thermoplastic junction box with four built-in romex clamps; six 3/4" knockouts with slots for pryout.  
Maximum 8 (4 in, 4 out) No 12 AWG conductors. Rated for 90° C.  
Ground wire provided.  
Pre-assembled poke-home connectors for ease of wiring.  
Tilt-up J-box doors for easy access.  
Trim retention (clips): Retaining clips riveted to top of reflector hold trim inside housing.  
Trim retention (TOR): Two-side mounted torsion springs on the trim and 2 receiving brackets in the can ensure a consistently tight fit with the ceiling.

**ELECTRICAL**

Durable medium base porcelain socket with nickel-plated, copper alloy screw shell and contact.  
Socket clips to top of housing to prevent paint overspray in socket screw shell.  
Socket attaches to reflector to ensure proper and consistent lamp position.  
Thermal protection provided against improper lamp usage.  
120 volt only.

**INSTALLATION**

Air-tight housing suitable for air-tight installations. Refer to energy codes for proper installations.  
2 x 6 wood joist or T-bar installation.  
Expandable bar hangers allow for off-center mounting in wood joist or T-bar ceilings.  
Length of 25-1/4" maximum 13-1/4" minimum or cut to fit 9" on center joist construction.  
Vertical adjustment of housing allows for flush mounting with ceiling face.  
Suitable for ceiling up to 1-1/2" thick.

**LISTINGS**

UL Listed to US and Canadian safety standards. Damp location listed.  
See trim selection for wet location listing.

**WARRANTY** — 1-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/CustomerResources/Terms\\_and\\_conditions.aspx](http://www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx)

**Note:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

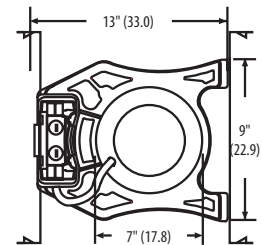
Catalog Number	<b>TYPE R1</b>
Notes	
Type	



6" Housing

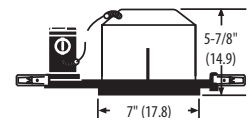
**LCP**

**INCANDESCENT**  
IC Shallow  
New Construction/Remodel



*Specifications*

Height: 5-7/8 (14.9)  
Length: 13 (33.0)  
Width: 9 (22.9)  
Ceiling cutout: 7 (17.8)



All dimensions are inches (centimeters) unless otherwise specified.

**LAMP WITH RED LED RETROFIT A-LAMP  
(SEE TYPE R1-LAMP PRODUCT DATA SHEET)**

**ORDERING INFORMATION**

For shortest lead times, configure product using **standard options (shown in bold)**.

**Example:** LCP R6

LCP		
Series	Options	Packaging
<b>LCP<sup>1</sup></b>	<b>GSKT</b> Foam gasketing. Aids in air-tight installation.	<b>R6</b> Resale pack of six <b>U</b> Unit pack (non-stock)

**ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES**

<b>Accessories:</b> Order as separate catalog number.			
LSMC	T-Bar mounting clips, set of four	HS6875	6-7/8" Hole saw
ARC R24	Remodeler clips <sup>1</sup>	CTR6	6" goof ring, white (8-3/4" O.D.)
ATK6 R6	6" Air-tight trim kit		

**ELECTRICAL CONTRACTOR TO DETERMINE NEEDED ACCESSORIES**

**Notes**

<sup>1</sup> When using in remodel applications the ARC R24 clips must be ordered separately. Sold in packages of 24 only.  
See trim summary on reverse side for maximum wattages.


LCP 6" New Construction Shallow Housing

TYPE R1

Description Catalog number	Maximum wattage <sup>1</sup>	Description Catalog number	Maximum wattage <sup>1</sup>	Description Catalog number	Maximum wattage <sup>1</sup>
-------------------------------	------------------------------	-------------------------------	------------------------------	-------------------------------	------------------------------

**General/Task**


Open Wide Flange  
**C01** White



60 A19  
65 BR30  
75 PAR30

IC


Open Wide Flange  
**C01 TOR** White  
**C01BN TOR** Brushed nickel  
**C01ORB TOR** Oil-rubbed bronze  
**C01BZA TOR** Antique bronze



60 A19  
65 BR30  
75 PAR30

IC


Open Narrow Flange  
**C02** White  
**C02A** Clear diffuse  
**C02AZ** Clear specular



60 A19  
65 BR30  
75 PAR30

IC


Open Wide Flange  
**701 TOR** White



65 BR30  
75 PAR30

IC


Baffle Wide Flange  
**CB1** Black  
**CB1W** White



40 A19  
65 BR30  
75 PAR30

IC


Baffle Wide Flange  
**CB1 TOR** Black  
**CB1W TOR** White  
**CB1BN TOR** Brushed nickel



40 A19  
65 BR30  
75 PAR30

IC


Baffle Narrow Flange  
**7B0W** White



65 BR30  
75 PAR30

IC

Baffle Wide Flange  
**7B1** Black  
**7B1W** White




65 BR30  
75 PAR30

IC

**Accent/Adjustable**


Eyeball Narrow Flange  
**CE1** White



65 BR30  
75 PAR30

IC

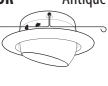
Baffled Eyeball Narrow Flange  
**CE2** White/black  
**CE2W** White/white



65 BR30  
75 PAR30

IC


Eyeball Wide Flange  
**7E1 TOR** White  
**7E1BN TOR** Brushed nickel  
**7E1ORB TOR** Oil-rubbed bronze  
**7E1BZA TOR** Antique bronze



65 BR30  
75 PAR30

IC


Regressed Eyeball Wide Flange  
**7RE1** White



65 BR30  
50 PAR30

IC


Pinhole Narrow Flange  
**CS1** White



40 A19  
50 BR20  
50 PAR20

IC

Wallwash Narrow Flange  
**CW1** White



40 A19

IC

**Lens/Wet Location<sup>2</sup>**

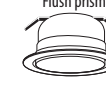
Shower/Closet Narrow Flange  
**CLD1** Drop opal\*



40 A19

IC


Shower/Closet Narrow Flange  
**CLF1** Flush opal\*  
**CLF2** Flush prismatic\*



40 A19

IC

Shower/Closet Narrow Flange  
**7LD1** Drop opal metal flange  
**7LD1 PF** Drop opal plastic\*  
**7LD2 PF** Drop prismatic plastic\*



40 A19

IC

\*For plastic flange add suffix PF

Notes

- 1 Maximum wattage listed. Lower wattage lamps may be used.
- 2 Lens trims are wet location listed. All others are damp location.



LCP

LCP 6" New Construction Shallow Housing

TYPE R1

P Series Open and Baffle Wide Flange LED Modules (Wet Location) <sup>1</sup>



Example: 6BP TRMW LED 27K 90CRI  
LCP<sup>1</sup>

**ORDERING INFORMATION** Lead times will vary depending on options selected. Consult with your sales representative.

Series/Finish	Lamp	CCT / CRI / W / Lumens <sup>2</sup>	Voltage
6BPMW 6" Baffle LED module, matte white	LED	(blank) 3000 K / 83 CRI / 8.9W / 620L	(blank) 120V
6BP TRMW 6" Baffle LED module, black baffle, matte white flange	LED	27K 90CRI 2700K / 93 CRI / 11.2W / 600L	
6BPBN 6" Baffle LED module, brushed nickel	LED	30K 90CRI 3000 K / 93 CRI / 11.2W / 600L	
6BPORB 6" Baffle LED module, oil-rubbed bronze	LED	40K 90CRI 4000K / 92CRI / 9.9W / 650L	
6OPA 6" Open LED module, clear diffuse	HL LED	(blank) 3000 K / 83 CRI / 15.2W / 950L	
6OPAZ 6" Open LED module, clear specular		27K 90CRI 2700K / 93 CRI / 16.5W / 860L	
6OPA TRMW 6" Open LED module, clear diffuse, matte white flange		30K 90CRI 3000 K / 93 CRI / 16.5W / 860L	
6OPAZ TRMW 6" Open LED module, clear specular, matte white flange		40K 90CRI 4000K / 92CRI / 16.4W / 950L	

**Notes**  
1 LCP housing ordered on a separate line.  
2 Total system delivered lumens.

LED Gimbal Module (Damp location)



Example: 6G1MW LED  
LCP<sup>1</sup>

**ORDERING INFORMATION** Lead times will vary depending on options selected. Consult with your sales representative.

Series/Finish	Lamps	CCT / CRI / W / Lumens <sup>2</sup>	Voltage
6G1 6" Gimbal Module	LED	(blank) 3000k / 83CRI / 10.8W / 620L	(blank) 120V
	LED	27K 90CRI 2700K / 91CRI / 11W / 680L	
	LED	30K 90CRI 3000K / 91CRI / 10.3W / 790L	
	LED	40K 90CRI 4000K / 94CRI / 10.5W / 820L	

**Notes**  
1 LCP housing ordered on a separate line.  
2 Total system delivered lumens.

E Series Baffle Wide Flange LED Modules (Wet Location)



Example: 65BEMW LED 27K  
LCP<sup>1</sup>

**ORDERING INFORMATION** Lead times will vary depending on options selected. Consult with your sales representative.

Series/Finish	Lamp	CCT / CRI / W / Lumens <sup>2</sup>	Voltage
65BEMW 5" / 6" Baffle LED module, matte white	LED	27K 2700 K / 82CRI / 11.9W / 640L	(blank) 120V
	LED	30K 3000 K / 82CRI / 11.9W / 687L	
	LED	40K 4000K / 82CRI / 11.9W / 711L	

**Notes**  
1 LCP housing ordered on a separate line.  
2 Total system delivered lumens.



LCP

FEELUX®

DVS Spot

TYPE R2



**PRODUCT FEATURES**

- Ultra Slim Profile
- Single Diode Provides Single Crisp Image / Eliminates Multiple Imaging
- Linkable Units
- White, Silver, and Black Trim Finishes Available
- Millwork, Recessed or Surface Mount
- Dimmable with Accessories: 0-10V or Phase
- Quick Ship\*

**PRODUCT SPECIFICATIONS**

- Voltage: 24VDC Constant Voltage Feelux or Approved Driver
- Operating Temperature: 32-113°F (0-45°C)
- Lamp Life: 50,000 hrs / 70%
- Available Color: 2700K, 3000K, 3500K, 4000K
- CRI/Ra > 85
- Efficiency: 80lm/W - 4.3W - 344lms
- IP20 – Damp Location/Closet Approved
- Beam Angle: 60°
- Finish: White, Silver, Black, Gold
- 5 year Warranty

\* Pending factory availability



**SPECIFICATION DIAGRAM**

**DRIVER OPTIONS**

**Option 1:  
Cord & Plug / Feelux Drivers**



FLC (30 or 75) 24V/XL

**Option 2:  
Hardwire / Feelux Driver**



XLAV80(L)-124V-SSB  
XLD200-224V-FCL-DIM  
XLD75-124V-FC

NOTE: Options 2 & 3 require low voltage wire to be provided by EC

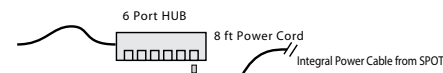
**Option 3:  
3rd Party Drivers**

3rd party drivers are available to 600W. Please consult factory.

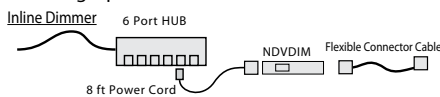


**CONTROLS OPTIONS**

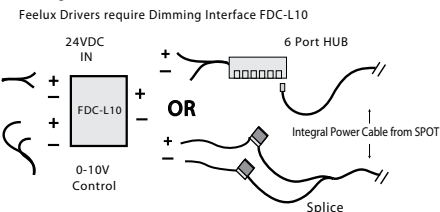
**Non-Dimming Options:**



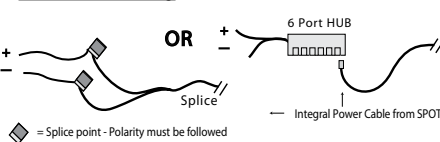
**Dimming Options:**



**Dimming Interface 0-10V**



**Forward Phase Dimming**



**FIXTURE OPTIONS**

**Connect Linkable Spot DVS(A)**



**Connect Linkable Spot DVS(A) to NDP**



**Connect NDP to Linkable Spot DVS(A)**



**MAX 7 Linkable Units On Single Power Feed**

**Drivers Can Support Multiple Power Feeds**

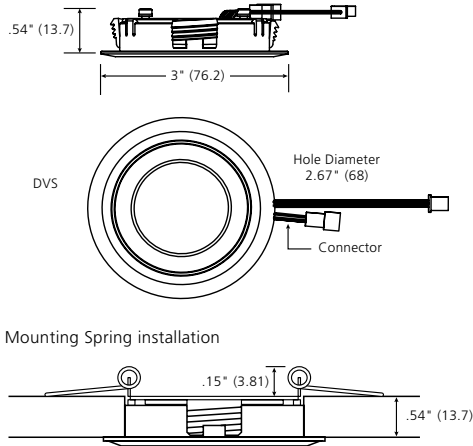
**TOTAL CONNECTED LOAD  
SHOULD NOT EXCEED DRIVER WATTS!**



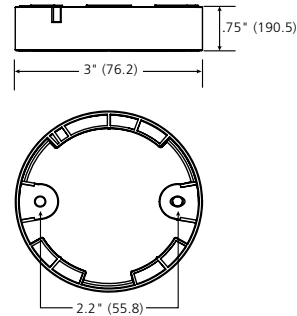
**DVS Spot**  
**TYPE R2**

**FIXTURE AND ACCESSORY DIMENSIONS**

**RECESSED MOUNTING**

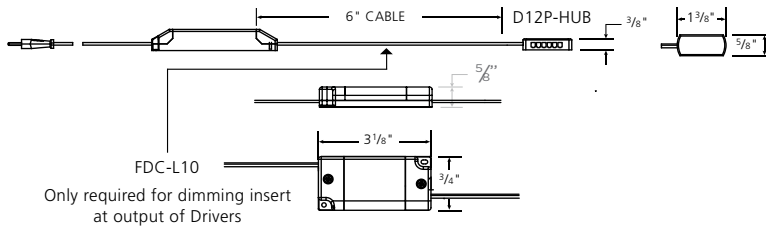


**SURFACE MOUNTING**

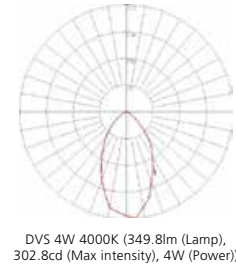


**DIMMING OPTIONS**

**LED DRIVER**

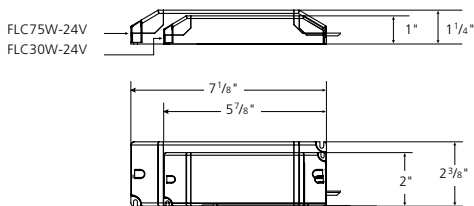


**BEAM SPREAD**



**DRIVER OPTIONS**

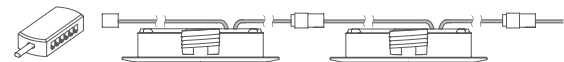
**FLC PLUG-IN DRIVER SIZES**



**COLORS**



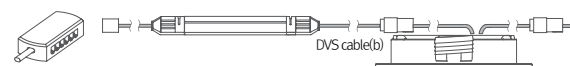
**Linkable between FLX Spot DVS and FLX Spot DVS**



**Linkable between FLX Spot DVS and FLX Stix NDP**



**Linkable between FLX Stix NDP and FLX Spot DVS**





# DVS Spot

TYPE R2

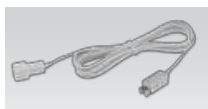
## COMPONENTS



- Linkable Type**
- \_\_\_ DVS4A-(color)K-24V-WT
  - \_\_\_ DVS4A-(color)K-24V-BK
  - \_\_\_ DVS4A-(color)K-24V-SV



- Extension Cable**
- \_\_\_ DVSPTC (98.43")



- Connecting Cable**
- \_\_\_ NDPDVSPTC (39.37")



- Connecting Cord (8')**
- \_\_\_ NDPPC (98.43")



- Mounting Spring**
- \_\_\_ DVS-SPRING



- Surface Mount**
- \_\_\_ DVS-SR-WT
  - \_\_\_ DVS-SR-BK
  - \_\_\_ DVS-SR-SV
  - \_\_\_ DVS-SR-GD



- Deco Ring**
- \_\_\_ DVS-DR-WT
  - \_\_\_ DVS-DR-BK
  - \_\_\_ DVS-DR-SV
  - \_\_\_ DVS-DR-GD

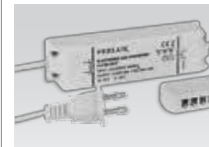


- In-Line Dimmer**
- \_\_\_ NDP-DIM



- Dimming Interface**
- Max. 100W (100W/CH, 1CH)
  - 0 -10V Signal
  - \_\_\_ FDC-L10

**A larger selection of drivers are available including remote and hard wire drivers. Please consult factory.**



- LED Drivers**  
with distributor and power cord (1800mm)
- \_\_\_ FLC30-24V/XL
  - \_\_\_ FLC75-24V/XL



- Hard Wire Driver**  
(90V to 300V)
- \_\_\_ XLAV80(L)-124V-SSB
  - \_\_\_ XLD200-224V-FCL-DIM
  - \_\_\_ XLD75-124V-FC



- Hard Wire Driver**
- \_\_\_ FLE90-24V-L110-DIM
- Other Power Supply/Driver Options Available. Please contact factory.



- 12 Port Hub**
- \_\_\_ D12P-HUB
- Included with Cord and Plug drivers. Order separately for Hard Wire or 3rd Party Drivers

**ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE COMPONENTS, MOUNTING HARDWARE & ACCESSORIES**

**SPECIFICATION GUIDE:** NOT TO BE USED FOR ORDERING. The Specification Guide is intended solely to ensure that all options are considered.

MODEL	COLOR	LENS	MOUNTING	TRIM/COLOR	QUANTITY	DRIVER	CONTROLS	VOLTAGE
DVS4					3			
DVS4A-Linkable	27K -2700K 30K -3000K 40K -4000K	ST -Flat Frosted	RM - Recessed Mount SP- Spring Mount SR- Surface Mount	WT -White BK -Black SV -Silver GD- Gold	Spot quantity powered together	CP - Cable/Plug HW - Hard Wire TD - 3rd Party Drivers Consult Factory	NDM Non-Dim IDM Inline Dim FDC 0-10V Interface FPH Forward Phase RPH Reverse Phase	100V 120V 230V 277V

↑  
**ARCHITECT TO CHOOSE TRIM COLOR**

FEELUX Lighting, Inc., 3000 Northwoods Parkway, Suite 165, Peachtree Corners, GA 30071 USA | Tel: 678.668.7005 | feeluxlighting.com/us  
If you have any questions, please contact your local Feelux Representative. Specifications subject to change without notice. All Rights Reserved. © 2016 Feelux Lighting, Inc.



TYPE S1A

**JUNO**

# JUNO SLIMFORM™ LED SURFACE MOUNT DOWNLIGHTS

FOR J-BOX INSTALLATION  
5", 7", 11", 13" ROUND

**JSF SERIES**

Project: \_\_\_\_\_

Fixture Type: \_\_\_\_\_

Location: \_\_\_\_\_

Contact/Phone: \_\_\_\_\_



## PRODUCT DESCRIPTION

Sleek, ultra-low profile energy efficient LED surface mount downlights in multiple sizes from 5" to 13" • Provides economical installation by mounting directly over standard and fire-rated junction boxes • Optional finish trims and shrouds available for custom, designer look similar to standard recessed downlights • Provides general illumination in residential and commercial applications including multi-family and hospitality • Ideal for use in corridors, living spaces, closets, hallways, pantries, stairways, outdoor covered areas without Emergency Option and much more.

## PRODUCT SPECIFICATIONS

**Construction** Shallow, less than 1", solid ring with white finish • Non conductive fixture for shower light applications • Optional, field installable finish trims available for 5" and 7" versions to change the exterior finish of fixture • Optional, field installable decorative baffle and cone shrouds for 5" and 7" versions provide the aesthetic and source shielding similar to the experience of a fully recessed downlight.

**Optics** Light guide technology combined with diffusing lens conceals the LEDs from direct view and provides uniform lens luminance.

**LED Light Engine** LEDs mounted directly to heatsink designed to provide superior thermal management and ensure long life • 2700K, 3000K, 3500K or 4000K LED color temperature • LEDs binned for 4-step MacAdam ellipse color consistency • 90 CRI minimum.

**LED Driver** Choice of dedicated 120 volt (120) driver or universal voltage (MVOLT) driver that accommodates input voltages from 120-277 volts AC at 50/60Hz • Power factor > 0.9 at 120V input • 120 volt driver is dimmable with the use of most incandescent, magnetic low voltage and electronic low voltage wall box dimmers • Universal voltage driver is dimmable with the use of most 0-10V wall box dimmers • External driver is only available on 5" and 7" models • For a list of compatible dimmers, see [JUNOSLIMFORM-DIM](#).

**Emergency Battery Option** Available on fixture sizes 11" and larger • Battery factory assembled to fixture with integral test switch (EL option) • Drives LEDs for 90 minutes to meet Life Safety Code (NFPA-LSC), National Electrical Code (NEC), and UL requirements • Emergency battery not available in California due to Title 20 restrictions • EBX option provides back box without battery for consistent look when used in same space as fixtures with EL emergency option • Damp location only with emergency option.

**Life** Rated for 50,000 hours at >70% lumen maintenance.

**Labels** ENERGY STAR® certified • Certified to the high efficacy requirements of California T24 JA8-2016 • CSA listed for US and Canada • Suitable for wet locations (covered ceilings) • Damp location only with emergency option.

**Testing** All reports are based on published industry procedures; actual performance may differ as a result of the end-user environment and applications. All values are design or typical values, measured under laboratory conditions at 25 °C.

**Warranty** 5-year limited warranty. Complete warranty terms located at: [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

Specifications subject to change without notice.

## INSTALLATION

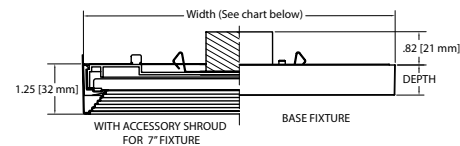
**Junction Box Mounting** Fixture provided with leads for direct wire connection in j-box • Installs directly to industry standard junction boxes • Compatible boxes include 4" metal or plastic octagonal standard and fire-rated junction boxes (3 1/2" junction box screw-hole spacing required for installation) • Minimum 2 1/8" deep junction box required for 5" and 7" fixtures (no depth requirement for 11" and larger fixtures) • Quick mount bracket provides fast installation of fully assembled fixture to junction box • Suitable for ceiling mount • Suitable for use within closet storage spaces when installed per NEC requirements.

**Junction box sizes vary - Verify compatibility with fixture prior to installation**

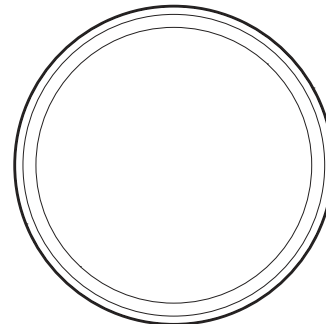
**AcuityBrands** 1300 S. Wolf Road • Des Plaines, IL 60018 • Phone 1-800-705-SERV (7378) • Visit us at [www.acuitybrands.com/juno-recessed](http://www.acuitybrands.com/juno-recessed)  
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## DIMENSIONS



External driver available on 5" and 7" models only.

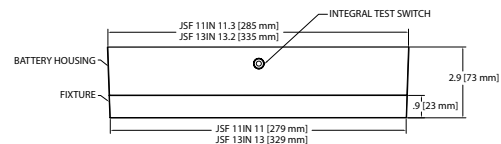


## ROUND SPECIFICATIONS

	Width	Depth
JSF 5IN	5.25 (13.34)	0.75 (1.91)
JSF 7IN	7.77 (19.74)	0.75 (1.91)
JSF 11IN	11.08 (28.14)	0.9 (2.29)
JSF 13IN	13.05 (33.15)	0.9 (2.29)

All dimensions are in inches (centimeters) unless otherwise indicated.

## EMERGENCY BATTERY FOR 11" AND 13"



TYPE S1A

# JUNO SLIMFORM™ LED SURFACE MOUNT DOWNLIGHTS

FOR J-BOX INSTALLATION  
5", 7", 11", 13" ROUND

**JSF SERIES**

ELECTRICAL CONTRACTOR TO DETERMINE  
APPROPRIATE MOUNTING HARDWARE & ACCESSORIES

## PERFORMANCE DATA

	JSF 5IN		JSF 7IN		JSF 11IN		JSF 13IN	
	120V	MVOLT	120V	MVOLT	120V	MVOLT	120V	MVOLT
Lumens	700	700	1000	1000	1300	1300	1800	1800
CRI	90CRI		90CRI		90CRI		90CRI	
CCT	27K, 30K, 35K, 40K		27K, 30K, 35K, 40K		27K, 30K, 35K, 40K		27K, 30K, 35K, 40K	
Voltage	120V	120V-277V	120V	120V-277V	120V	120V-277V	120V	120V-277V
Input Power	10W	10W	13W	13W	15W	15W	20W	20W
Input Current	110MA	50MA	150MA	60MA	180MA	80MA	240MA	110MA
Frequency	50/60Hz		50/60Hz		50/60Hz		50/60Hz	
Power Factor	>0.9		>0.9		>0.9		>0.9	

## ORDERING INFORMATION

Example: JSF 5IN 07LM 27K 90CRI 120 FRPC WH

Series	Size/Lumens	Color Temperature	CRI	Voltage/Driver	Finish	Emergency Battery <sup>1,2,3</sup>
JSF SlimForm Surface Mount Downlight - Round	5IN 07LM 5", 700 Lumens	27K 2700K	90CRI 90+ CRI	120 FRPC Dedicated 120V, Forward Reverse Phase Dimmign MVOLT ZT Universal Voltage 120V-277V, 0-10V Dimming	WH White	EL <sup>3†</sup> Battery Back-up Option EBX Empty Back Box for Aesthetics
	7IN 10LM 7", 1000 Lumens	30K 3000K				
	11IN 13LM 11", 1300 Lumens	35K 3500K				
	13IN 18LM 13", 1800 Lumens	40K 4000K				

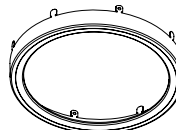
†: EL Battery Back-up option is not Energy Star certified

## ACCESSORIES

**TRIM** – Optional, field installable finish trim rings available to change the exterior finish of fixture.  
Example: JSFTRIM 5IN BL

ARCHITECT/OWNER TO CHOOSE WHETHER A TRIM FINISH OTHER THAN WHITE IS PREFERRED.

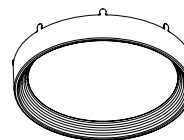
Series	Size	Finish
JSFTRIM SlimForm Accessory- Trim	5IN 5 inches	BL Black
	7IN 7 inches	BZ Bronze
		SN Satin Nickel



TRIM

**SHROUD** – Optional, field installable decorative baffle and cone shrouds provides the aesthetic and source shielding similar to the experience of a fully recessed downlight.  
Example: JSFSHROUD 5IN DB WWH

Series	Size	Shroud Style	Finish
JSFSHROUD SlimForm Accessory Shroud - Round	7IN 7 inches	DB Downlight Baffle	WWH White trim, white shroud



BAFFLE SHROUD

### Notes:

- 1 Emergency battery available with 11IN and 13IN only.
- 2 Emergency battery is only available with MVOLT ZT.
- 3 Emergency battery option not available in California due to Title 20 restrictions.

TYPE S1A

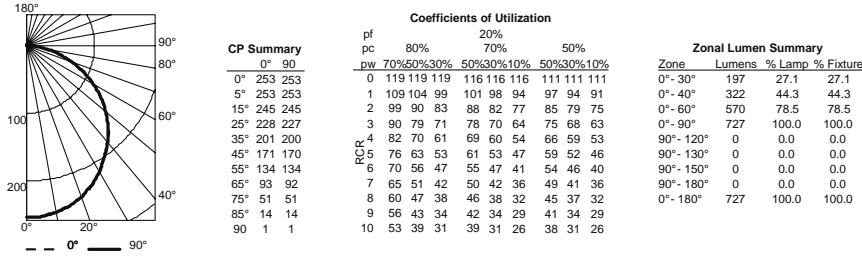
# JUNO SLIMFORM™ LED SURFACE MOUNT DOWNLIGHTS

FOR J-BOX INSTALLATION  
5", 7", 11", 13" ROUND  
**JSF SERIES**

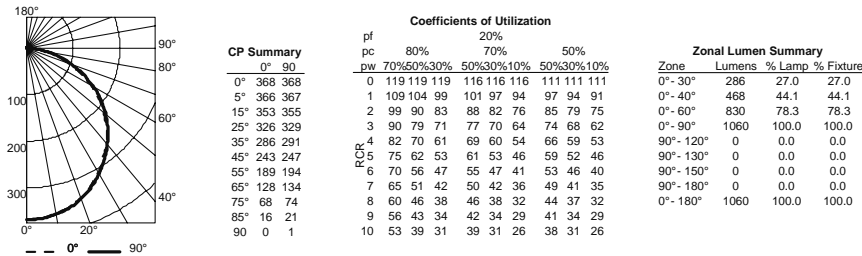
## PHOTOMETRICS

**Distribution Curve**      **Distribution Data**      **Coefficient of Utilization**      **Illuminance Data at 30" Above Floor for a Single Luminaire**

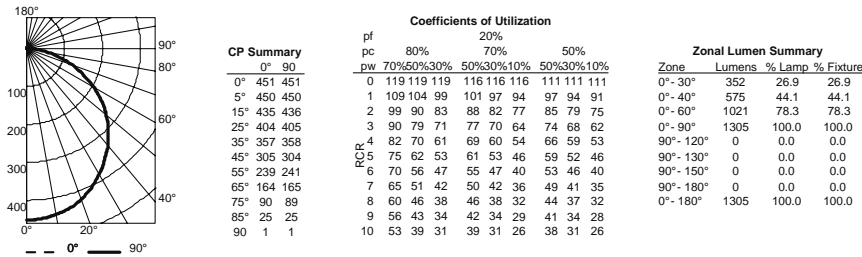
JSF 5IN 27K, 2700K LEDs, input watts: 9.72, delivered lumens: 727, LM/W = 74.8, test no. ISF 33599, tested in accordance to IESNA LM-79.



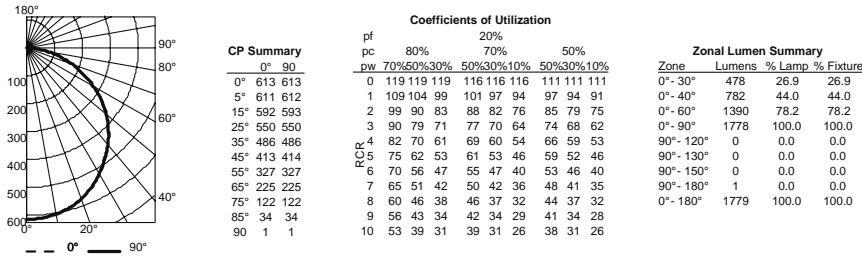
JSF 7IN 27K, 2700K LEDs, input watts: 12.8, delivered lumens: 1060, LM/W = 82.8, test no. ISF 33600, tested in accordance to IESNA LM-79.



JSF 11IN 27K, 2700K LEDs, input watts: 15.2, delivered lumens: 1305, LM/W = 85.9, test no. ISF 33661, tested in accordance to IESNA LM-79.



JSF 13IN 27K, 2700K LEDs, input watts: 20.2, delivered lumens: 1779, LM/W = 88, test no. ISF 33663, tested in accordance to IESNA LM-79.



For 30K fixtures, use 1.02 multiplier; For 35K fixtures, use 1.03 multiplier, For 40K fixtures, use 1.07 multiplier.



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TYPE S1B

**JUNO**

# JUNO SLIMFORM™ LED SURFACE MOUNT DOWNLIGHTS

FOR J-BOX INSTALLATION  
5", 7", 11", 13" ROUND

**JSF SERIES**

Project: \_\_\_\_\_

Fixture Type: \_\_\_\_\_

Location: \_\_\_\_\_

Contact/Phone: \_\_\_\_\_



## PRODUCT DESCRIPTION

Sleek, ultra-low profile energy efficient LED surface mount downlights in multiple sizes from 5" to 13" • Provides economical installation by mounting directly over standard and fire-rated junction boxes • Optional finish trims and shrouds available for custom, designer look similar to standard recessed downlights • Provides general illumination in residential and commercial applications including multi-family and hospitality • Ideal for use in corridors, living spaces, closets, hallways, pantries, stairways, outdoor covered areas without Emergency Option and much more.

## PRODUCT SPECIFICATIONS

**Construction** Shallow, less than 1", solid ring with white finish • Non conductive fixture for shower light applications • Optional, field installable finish trims available for 5" and 7" versions to change the exterior finish of fixture • Optional, field installable decorative baffle and cone shrouds for 5" and 7" versions provide the aesthetic and source shielding similar to the experience of a fully recessed downlight.

**Optics** Light guide technology combined with diffusing lens conceals the LEDs from direct view and provides uniform lens luminance.

**LED Light Engine** LEDs mounted directly to heatsink designed to provide superior thermal management and ensure long life • 2700K, 3000K, 3500K or 4000K LED color temperature • LEDs binned for 4-step MacAdam ellipse color consistency • 90 CRI minimum.

**LED Driver** Choice of dedicated 120 volt (120) driver or universal voltage (MVOLT) driver that accommodates input voltages from 120-277 volts AC at 50/60Hz • Power factor > 0.9 at 120V input • 120 volt driver is dimmable with the use of most incandescent, magnetic low voltage and electronic low voltage wall box dimmers • Universal voltage driver is dimmable with the use of most 0-10V wall box dimmers • External driver is only available on 5" and 7" models • For a list of compatible dimmers, see [JUNOSLIMFORM-DIM](#).

**Emergency Battery Option** Available on fixture sizes 11" and larger • Battery factory assembled to fixture with integral test switch (EL option) • Drives LEDs for 90 minutes to meet Life Safety Code (NFPA-LSC), National Electrical Code (NEC), and UL requirements • Emergency battery not available in California due to Title 20 restrictions • EBX option provides back box without battery for consistent look when used in same space as fixtures with EL emergency option • Damp location only with emergency option.

**Life** Rated for 50,000 hours at >70% lumen maintenance.

**Labels** ENERGY STAR® certified • Certified to the high efficacy requirements of California T24 JA8-2016 • CSA listed for US and Canada • Suitable for wet locations (covered ceilings) • Damp location only with emergency option.

**Testing** All reports are based on published industry procedures; actual performance may differ as a result of the end-user environment and applications. All values are design or typical values, measured under laboratory conditions at 25 °C.

**Warranty** 5-year limited warranty. Complete warranty terms located at: [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

Specifications subject to change without notice.

## INSTALLATION

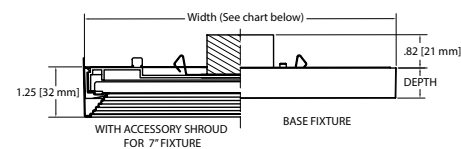
**Junction Box Mounting** Fixture provided with leads for direct wire connection in j-box • Installs directly to industry standard junction boxes • Compatible boxes include 4" metal or plastic octagonal standard and fire-rated junction boxes (3 1/2" junction box screw-hole spacing required for installation) • Minimum 2 1/8" deep junction box required for 5" and 7" fixtures (no depth requirement for 11" and larger fixtures) • Quick mount bracket provides fast installation of fully assembled fixture to junction box • Suitable for ceiling mount • Suitable for use within closet storage spaces when installed per NEC requirements.

**Junction box sizes vary - Verify compatibility with fixture prior to installation**

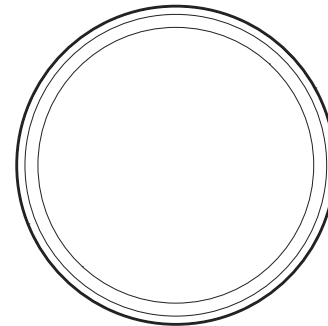
**AcuityBrands** 1300 S. Wolf Road • Des Plaines, IL 60018 • Phone 1-800-705-SERV (7378) • Visit us at [www.acuitybrands.com/juno-recessed](http://www.acuitybrands.com/juno-recessed)  
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## DIMENSIONS



External driver available on 5" and 7" models only.

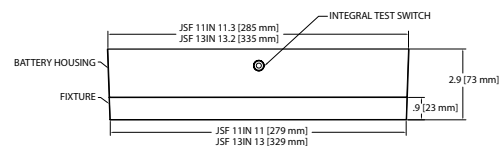


## ROUND SPECIFICATIONS

	Width	Depth
JSF 5IN	5.25 (13.34)	0.75 (1.91)
JSF 7IN	7.77 (19.74)	0.75 (1.91)
JSF 11IN	11.08 (28.14)	0.9 (2.29)
JSF 13IN	13.05 (33.15)	0.9 (2.29)

All dimensions are in inches (centimeters) unless otherwise indicated.

## EMERGENCY BATTERY FOR 11" AND 13"



TYPE S1B

# JUNO SLIMFORM™ LED SURFACE MOUNT DOWNLIGHTS

FOR J-BOX INSTALLATION  
5", 7", 11", 13" ROUND

**JSF SERIES**

ELECTRICAL CONTRACTOR TO DETERMINE  
APPROPRIATE MOUNTING HARDWARE & ACCESSORIES

## PERFORMANCE DATA

	JSF 5IN		JSF 7IN		JSF 11IN		JSF 13IN	
	120V	MVOLT	120V	MVOLT	120V	MVOLT	120V	MVOLT
Lumens	700	700	1000	1000	1300	1300	1800	1800
CRI	90CRI		90CRI		90CRI		90CRI	
CCT	27K, 30K, 35K, 40K		27K, 30K, 35K, 40K		27K, 30K, 35K, 40K		27K, 30K, 35K, 40K	
Voltage	120V	120V-277V	120V	120V-277V	120V	120V-277V	120V	120V-277V
Input Power	10W	10W	13W	13W	15W	15W	20W	20W
Input Current	110MA	50MA	150MA	60MA	180MA	80MA	240MA	110MA
Frequency	50/60Hz		50/60Hz		50/60Hz		50/60Hz	
Power Factor	>0.9		>0.9		>0.9		>0.9	

## ORDERING INFORMATION

Example: JSF 5IN 07LM 27K 90CRI 120 FRPC WH

Series	Size/Lumens	Color Temperature	CRI	Voltage/Driver	Finish	Emergency Battery <sup>1,2,3</sup>
JSF SlimForm Surface Mount Downlight - Round	5IN 07LM 5", 700 Lumens	27K 2700K	90CRI 90+ CRI	120 FRPC Dedicated 120V, Forward Reverse Phase Dimming	WH White	EL <sup>3†</sup> Battery Back-up Option EBX Empty Back Box for Aesthetics
	7IN 10LM 7", 1000 Lumens	30K 3000K				
	11IN 13LM 11", 1300 Lumens	35K 3500K		MVOLT ZT Universal Voltage 120V-277V, 0-10V Dimming		
	13IN 18LM 13", 1800 Lumens	40K 4000K				

†: EL Battery Back-up option is not Energy Star certified

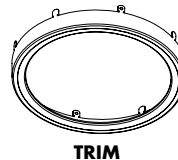
## ACCESSORIES

**TRIM** – Optional, field installable finish trim rings available to change the exterior finish of fixture.  
Example: JSFTRIM 5IN BL

ARCHITECT/OWNER TO CHOOSE WHETHER A TRIM FINISH OTHER THAN WHITE IS PREFERRED.

ORDER BATTERY BACK-UP OPTION FOR LUMINAIRES DESIGNATED WITH 'EM' SUFFIX.

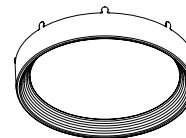
Series	Size	Finish
JSFTRIM SlimForm Accessory- Trim	5IN 5 inches	BL Black
	7IN 7 inches	BZ Bronze
		SN Satin Nickel



TRIM

**SHROUD** – Optional, field installable decorative baffle and cone shrouds provides the aesthetic and source shielding similar to the experience of a fully recessed downlight.  
Example: JSFSHROUD 5IN DB WWH

Series	Size	Shroud Style	Finish
JSFSHROUD SlimForm Accessory Shroud - Round	7IN 7 inches	DB Downlight Baffle	WWH White trim, white shroud



BAFFLE SHROUD

### Notes:

- 1 Emergency battery available with 11IN and 13IN only.
- 2 Emergency battery is only available with MVOLT ZT.
- 3 Emergency battery option not available in California due to Title 20 restrictions.

TYPE S1B

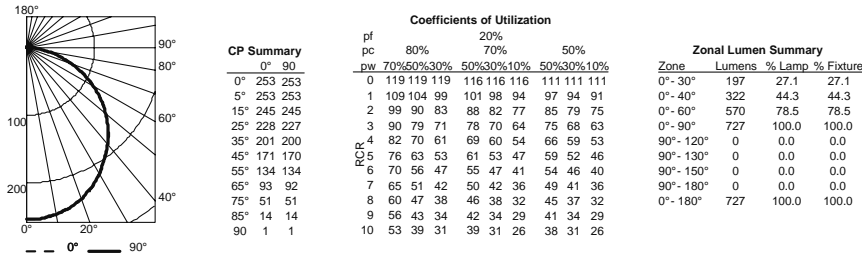
# JUNO SLIMFORM™ LED SURFACE MOUNT DOWNLIGHTS

FOR J-BOX INSTALLATION  
5", 7", 11", 13" ROUND  
JSF SERIES

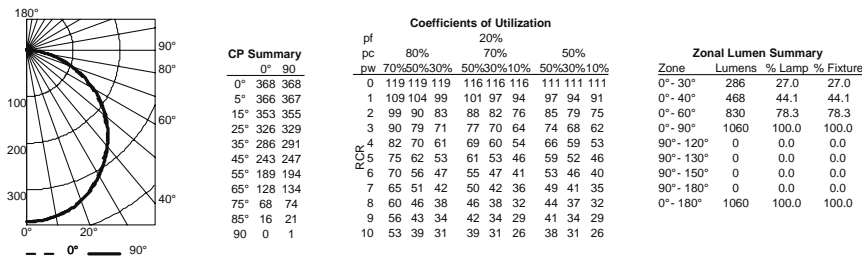
## PHOTOMETRICS

Distribution Curve      Distribution Data      Coefficient of Utilization      Illuminance Data at 30" Above Floor for a Single Luminaire

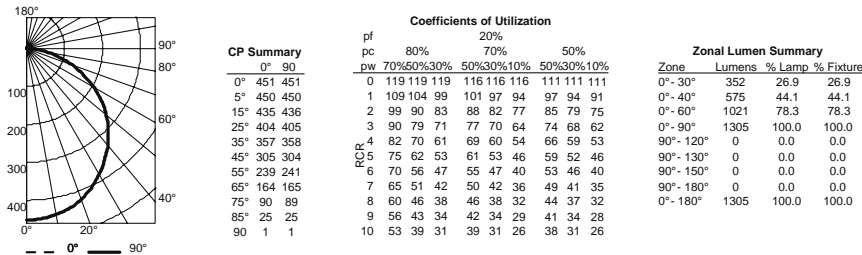
JSF 5IN 27K, 2700K LEDs, input watts: 9.72, delivered lumens: 727, LM/W = 74.8, test no. ISF 33599, tested in accordance to IESNA LM-79.



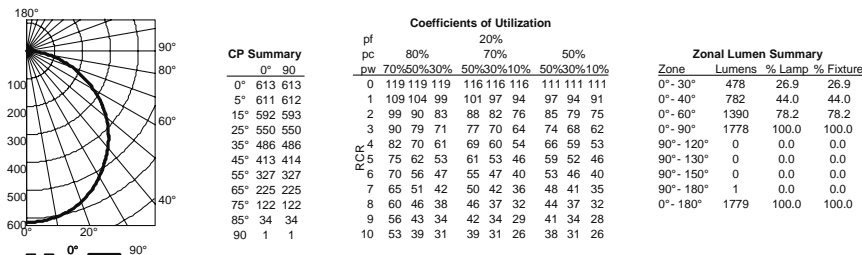
JSF 7IN 27K, 2700K LEDs, input watts: 12.8, delivered lumens: 1060, LM/W = 82.8, test no. ISF 33600, tested in accordance to IESNA LM-79.



JSF 11IN 27K, 2700K LEDs, input watts: 15.2, delivered lumens: 1305, LM/W = 85.9, test no. ISF 33661, tested in accordance to IESNA LM-79.



JSF 13IN 27K, 2700K LEDs, input watts: 20.2, delivered lumens: 1779, LM/W = 88, test no. ISF 33663, tested in accordance to IESNA LM-79.



For 30K fixtures, use 1.02 multiplier; For 35K fixtures, use 1.03 multiplier, For 40K fixtures, use 1.07 multiplier.



## TSLED4-36YN/D10/US/BL/E2

**RAB**

TYPE S2



<b>Project:</b> <input type="text"/>	<b>Type:</b> <input type="text"/>
<b>Prepared By:</b> <input type="text"/>	<b>Date:</b> <input type="text"/>

Driver Info		LED Info	
Type	Constant Current	Watts	36W
120V	0.31A	Color Temp	3500K (Warm Neutral)
208V	0.18A	Color Accuracy	83 CRI
240V	0.15A	L70 Lifespan	100,000 Hours
277V	0.14A	Lumens	4,802
Input Watts	36.7W	Efficacy	130.8 lm/W

### Technical Specifications

#### Compliance

##### UL Listed:

Suitable for damp locations

##### IESNA LM-79 & IESNA LM-80 Testing:

RAB LED luminaires and LED components have been tested by an independent laboratory in accordance with IESNA LM-79 and LM-80.

##### DLC Listed:

This product is on the Design Lights Consortium (DLC) Qualified Products List and is eligible for rebates from DLC Member Utilities.  
DLC Product Code: PDGM7361

#### Electrical

##### Driver:

Constant Current, Class 2, 100-277V, 50/60 Hz., 2KV surge protection, 120V: 0.31A, 208V: 0.18A, 240V: 0.15A, 277V: 0.14A

##### Dimming Driver:

Driver includes dimming control wiring for 0-10V dimming systems. Requires separate 0-10V DC dimming circuit. Dims down to 10%.

##### THD:

7.44% at 120V, 11% at 277V

##### Power Factor:

99.6% at 120V, 97.4% at 277V

##### Battery Backup:

Battery backup will operate the LED Lamp for 90 minutes if power fails. Wired for 120V-277V. Illuminated push to test switch available to test battery backup functionality.

#### LED Characteristics

##### LEDs:

Long-life, high-efficacy, surface-mount LEDs

##### Color Stability:

LED color temperature is warranted to shift no more than 200K in color temperature over a 5-year period

##### Color Uniformity:

RAB's range of Correlated Color Temperature follows the guidelines of the American National Standard for Specifications for the Chromaticity of Solid State Lighting (SSL) Products, ANSI C78.377-2017.

#### Performance

##### Lifespan:

100,000-Hour LED lifespan based on IES LM-80 results and TM-21 calculations

##### Note:

Note: Calculated at 50% of normal output

#### Construction

##### Maximum Ambient Temperature:

Suitable for use in up to 40°C (104°F)

## TSLED4-36YN/D10/US/BL/E2

**RAB**

TYPE S2

### Technical Specifications (continued)

#### Construction

##### Housing:

Die-formed, 20 gauge, cold-rolled, post-painted steel (white)

##### Lens:

Soft-glow acrylic lens reduces glare and has smooth and even light distribution

##### Reflector:

High-reflectance white steel

##### Mounting:

Surface mount, ceiling or wall. Knockouts on sides and back.

##### Finish:

Formulated for high durability and long-lasting color

##### Green Technology:

Mercury and UV free. RoHS-compliant components.

##### Other

##### Bi-Level:

Allows 25%, 50% or 75% output modes

##### Ultrasonic Sensor:

Detects the presence of people by sending ultrasonic sound waves and measuring frequency changes caused by movement. They cover the entire space and don't need a line of sight. As a result, they can detect people behind obstacles and are ideal for stairwells in which a line sight is not always possible, and higher levels of sensitivity are required.

##### Warranty:

RAB warrants that our LED products will be free from defects in materials and workmanship for a period of five (5) years from the date of delivery to the end user, including coverage of light output, color stability, driver performance and fixture finish. RAB's warranty is subject to all terms and conditions found at [rablighting.com/warranty](http://rablighting.com/warranty).

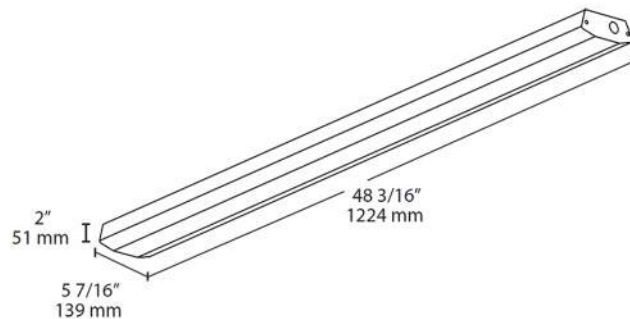
##### Equivalency:

Equivalent to (2) F32T8

##### Buy American Act Compliance:

RAB values USA manufacturing! Upon request, RAB may be able to manufacture this product to be compliant with the Buy American Act (BAA). Please contact customer service to request a quote for the product to be made BAA compliant.

### Dimensions



### Features

- Diffused lens for smooth light distribution
- 0-10V dimming driver, standard
- 100,000-Hour LED lifespan
- 5-Year, No-Compromise Warranty



# TSLED4-36YN/D10/US/BL/E2

**RAB**  
TYPE S2

## Ordering Matrix

Family	Size	Wattage	Color Temp	Dimming	Options
TSLED	4 4 = 4 ft 2 = 2 ft	- 28 = 28W 36 = 36W	YN Blank = 5000K (Cool) N = 4000K (Neutral) YN = 3500K (Warm Neutral)	/D10 /D10 = Dimmable	/US/BL/E2 Blank = No Option /LC = Lightcloud® Controller <sup>1</sup> /US = Ultrasonic Sensor /US/BL = Ultrasonic Sensor & Bi-Level Operation /E2 = Battery Backup /US/E2 = Ultrasonic Sensor & Battery Backup /US/BL/E2 = Ultrasonic Sensor, Bi-Level Operation & Battery Backup

**ELECTRICAL CONTRACTOR TO DETERMINE  
APPROPRIATE MOUNTING HARDWARE & ACCESSORIES**

<sup>1</sup> Only available as a stand-alone option. May not be combined with sensor, bi-level or emergency options.



Catalog Number	TYPE S3
Notes	
Type	

**FEATURES & SPECIFICATIONS**

**INTENDED USE** — The CLX is a linear lighting solution that is available in multiple lengths, lumen packages and distributions. Designed for versatility, the CLX can address virtually any indoor lighting need. The CLX is also offered in standard and high efficacy configurations and capable of being continuous row mounted or installed as a stand-alone fixture. Ideal for upright and downlight in commercial, retail, manufacturing, warehouse, and display applications. **Certain airborne contaminants can diminish the integrity of acrylic and/or polycarbonate. Click here for Acrylic-Polycarbonate Compatibility table for suitable uses.**

**CONSTRUCTION** — Channel and cover are formed from code-gauge cold-rolled steel. Housing and lens endcaps are injection molded plastic to provide a more architectural look and feel. The endcaps come standard with a 7/8" knock out for continuous mounting but can be ordered without.

Finish: Paint options include high-gloss, baked white polyester (WH), galvanized (GALV), matte black (MB) and smoke gray (SKGY). Five-stage iron phosphate pre-treatment ensures superior paint adhesion and rust resistance.

**OPTICS** — Offered with acrylic lens and less lens configurations. Provides a choice of optical distributions including, wide, narrow, and aisle.

**ELECTRICAL** — Utilizes high-output LEDs integrated on a two-layer circuit board, ensuring cool-running operation. Optional internal pluggable wiring harness for reduced labor cost in row mounting applications. (See PLR\_ordering information on page 14.) Electronic LED driver is multi-volt input and 0-10V dimming standard (see Operational Data on page 12 for actual wattage consumption). This fixture is designed to withstand a maximum line surge of 2.5kV at 0.75ka combination wave for indoor locations, for applications requiring higher level of protection additional surge protection must be provided.

L70>100,000 hours at 25°C.

LEDs provide nominal 80 CRI or 90CRI at 3000 K, 3500 K, 4000 K, or 5000 K.

Lumen output up to 2,500 lumens per foot.

**INSTALLATION** — Fixture may be ceiling or wall mounted (with or without THCLX hanger or angle mounted with CLXANGRT), pendant or stem mounted with appropriate mounting options.

**WARNING** — Removing the lens and opening the fixture during installation exposes the LEDs, putting them at risk for damage.

If you plan to surface mount the fixture, we recommend using the THCLX. This eliminates the need to open the fixture.

If you plan to continuous row mount, we recommend using the PLR wiring harness option. This eliminates the need to open the fixture.

Damage to the LEDs caused during installation will not be covered under the warranty.

**LISTINGS** — CSA certified to US and Canadian safety standards. For use in damp locations between -4°F (-20°C) and 104°F (40°C). Optional High Ambient (HA) ranging to 122°F(50°C) available on certain lumen packages (See ambient temperature chart for additional information).

DesignLights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at [www.designlights.org/QPL](http://www.designlights.org/QPL) to confirm which versions are qualified.

**WARRANTY** — 5-year limited warranty. Complete warranty terms located at: [www.acuitybrands.com/support/customer-support/terms-and-conditions](http://www.acuitybrands.com/support/customer-support/terms-and-conditions)

**Note:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25°C. Specifications subject to change without notice.

LED Linear

**CLX**

24", 36", 48" and 96" Lengths



Flat Diffuse Lens

Round Diffuse Lens

Wide Diffuse Lens



Stock configurations are offered for shorter lead times:

Stock Part Number	UPC	DLC QPL Product ID	DLC Premium
CLX L48 3000LM SEF FDL MVOLT GZ10 40K 80CRI WH	00191723525816	PJANKZR4	Yes
CLX L48 3000LM SEF FDL MVOLT GZ10 50K 80CRI WH	00191723525885	PKW32VKL	Yes
CLX L48 5000LM SEF FDL MVOLT GZ10 40K 80CRI WH	00191723525939	P7718Z20	Yes
CLX L48 5000LM SEF FDL MVOLT GZ10 50K 80CRI WH	00191723525908	P8A42C1H	Yes
CLX L96 6000LM SEF FDL MVOLT GZ10 40K 80CRI WH	00191723525861	PPFTGRBV	Yes
CLX L96 6000LM SEF FDL MVOLT GZ10 50K 80CRI WH	00191723525915	PW6250TE	Yes
CLX L96 10000LM SEF FDL MVOLT GZ10 40K 80CRI WH	00191723525922	PYKOC7EW	Yes
CLX L96 10000LM SEF FDL MVOLT GZ10 50K 80CRI WH	00191723525830	PKYPL35K	Yes
CLX L48 3000LM SEF RDL MVOLT GZ10 40K 80CRI WH	00191723525960	PJANKZR4	Yes
CLX L48 3000LM SEF RDL MVOLT GZ10 50K 80CRI WH	00191723525892	PKW32VKL	Yes
CLX L48 5000LM SEF RDL MVOLT GZ10 40K 80CRI WH	00191723525854	P7718Z20	Yes
CLX L48 5000LM SEF RDL MVOLT GZ10 50K 80CRI WH	00191723525946	P8A42C1H	Yes
CLX L96 6000LM SEF RDL MVOLT GZ10 40K 80CRI WH	00191723525878	PPFTGRBV	Yes
CLX L96 6000LM SEF RDL MVOLT GZ10 50K 80CRI WH	00191723525823	PD0SSIAD	Yes
CLX L96 10000LM SEF RDL MVOLT GZ10 40K 80CRI WH	00191723525953	PYKOC7EW	Yes
CLX L96 10000LM SEF RDL MVOLT GZ10 50K 80CRI WH	00191723525847	PKYPL35K	Yes

**A+ Capable Luminaire**

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® or XPoint™ Wireless control networks marked by a shaded background\*

To learn more about A+, visit [www.acuitybrands.com/aplus](http://www.acuitybrands.com/aplus).

\*See ordering tree for details

CLX LED Linear

**TYPE S3**

**ORDERING INFORMATION** Lead times will vary depending on options selected. Consult with your sales representative. **Example:** CLX L48 5000LM SEF WDL MVOLT GZ10 40K 80CRI WH

Series	Length	Nominal lumens	Performance package	Louver	Lens	
CLX LED linear	L24 24" <sup>1,2</sup>	1500LM	1,500 lumens	SEF Standard efficiency <sup>5</sup>	(Blank) Less louver	L/Lens Less lens
		2000LM	2,000 lumens	HEF Premium efficiency	SBLW Straight blade louver, white <sup>6</sup>	FDL Flat diffuse <sup>7,8</sup>
		2500LM	2,500 lumens		SBLMB Straight blade louver, matte black <sup>6</sup>	RDL Round diffuse <sup>7,8</sup>
		3500LM	3,500 lumens		SBLGV Straight blade louver, galvanized <sup>6</sup>	WDL Wide diffuse <sup>7,8</sup>
		4500LM	4,500 lumens		SBSLKGY Straight blade louver, smoke gray <sup>6</sup>	
		5000LM	5,000 lumens <sup>3,4</sup>			
	L36 36" <sup>2</sup>	2250LM	2,250 lumens			
		3000LM	3,000 lumens			
		3750LM	3,750 lumens			
		5250LM	5,250 lumens			
		6750LM	6,750 lumens			
		7500LM	7,500 lumens <sup>3,4</sup>			
	L48 48"	3000LM	3,000 lumens			
		4000LM	4,000 lumens			
		5000LM	5,000 lumens			
		7000LM	7,000 lumens <sup>2</sup>			
9000LM		9,000 lumens <sup>2</sup>				
10000LM		10,000 lumens <sup>2,4</sup>				
L96 96"	6000LM	6,000 lumens				
	8000LM	8,000 lumens				
	10000LM	10,000 lumens				
	14000LM	14,000 lumens <sup>2,4</sup>				
	18000LM	18,000 lumens <sup>2,4</sup>				
	20000LM	20,000 lumens <sup>2,4</sup>				

**ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES**

Distribution	Voltage	Driver <sup>14</sup>	Color temperature	Coloring rendering index
(Blank) General	MVOLT 120-277V <sup>10</sup>	GZ10 0-10V dimming <sup>15</sup>	30K 3000 K	80CRI 80 CRI
ND Narrow <sup>8,9</sup>	120 120V	EZ1 Dimming to 1% <sup>2</sup>	35K 3500 K	90CRI 90 CRI
WD Wide <sup>8,9</sup>	208 208V <sup>11</sup>		40K 4000 K	
AD2 Aisle, 24° off center <sup>8,9</sup>	240 240V <sup>11</sup>		50K 5000 K	

Options	Finish
PS1050 Emergency battery pack, 10W, CA Title 20 Noncompliant <sup>2,11,13,16,17</sup>	WH White
E10WLCP Emergency battery pack, 10W Linear Constant Power, Certified in CA Title 20 MAEDBS <sup>2,11,13,16,17</sup>	GALVW Galvanized with white lens end caps
BGTD Generator transfer device, not available with PS1050 <sup>13,16,18</sup>	GALVB Galvanized with black lens end caps
OCS 5', 18/3 Reloc selectable One Pass cable <sup>16</sup>	MB Matte black
HA High ambient, for use in ambient temperatures up to 50°C <sup>11</sup>	SKGYW Smoke gray with white lens end caps
EPNKO Decorative endplate, no knock out <sup>19</sup>	SKGYB Smoke gray with black lens end caps
OUTCTR Wiring leads pulled through back center of fixture <sup>20</sup>	
OUTEND Wiring leads pulled through end of fixture <sup>21</sup>	
<b>Cord Sets:</b>	
CS1W Straight blade plug, 120V <sup>10,16</sup>	
CS3W NEMA twist-lock plug, 120V <sup>10,16</sup>	
CS7W Straight blade plug, 277V <sup>10,16</sup>	
CS11W NEMA twist-lock plug, 277V <sup>10,16</sup>	
CS25W NEMA twist-lock plug, 347V <sup>10,16</sup>	
CS97W NEMA twist-lock plug, 480V <sup>10,16</sup>	
CS93W 600V SE00W white cord, no plug (no voltage required)	
CS6WG16STOWD5D 6' white cord, 16/5, no plug, includes low voltage dimming wires (no voltage required) <sup>15</sup>	
PLR Plug-in wiring, see page 16 for ordering information	nLight® Wired: <sup>23,25</sup>
PLR1LVG Plug-in wiring, low voltage dimming <sup>22</sup>	N100 nLight® without lumen management
RRL RELOC®-ready luminaire. See page 15 for ordering information	NES7 nLight® nES 7 PIR integral occupancy sensor <sup>26</sup>
SPD Surge protection device, provides up to 6kV protection <sup>20</sup>	NESPDT7 nLight® nES PDT 7 dual technology integral occupancy control <sup>26</sup>
USPOM Assembled in the United States	NES7ADCX nLight® nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell <sup>26</sup>
nLight® Wireless: <sup>23,24</sup>	NESPDT7ADCX nLight® nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell <sup>26</sup>
NLTAIR2 RES7 nLight® Generation 2 enabled PIR integral occupancy sensor with automatic dimming photocell	<b>Individual controls:</b> <sup>23,25</sup>
NLTAIR2 RES7PDT nLight AIR Generation 2 enabled dual technology integral occupancy sensor with automatic dimming photocell	MSD7 PIR integral occupancy sensor
NLTAIR2 RIO No sensor control	MSDPDT7 PDT 7 dual technology integral occupancy control
	MSD7ADC PIR integral occupancy sensor with automatic dimming control photocell
	MSDPDT7ADC PDT integral occupancy sensor with automatic dimming control photocell

See Accessories and footnotes on next page



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Accessories: Order as separate catalog number.			
<b>Mounting:</b>		THCLX ___ Tong hanger (Must specify color) (one pair) <sup>28</sup>	CLXRWU24 ___ Wide decorative 24" reflector with uplight, (Must specify color) <sup>30</sup>
ZACVH Aircraft cable 120" (one pair)		CLXANGBKT ___ Angle bracket, (Must specify color) (one pair) <sup>28</sup>	CLXRWU36 ___ Wide decorative 36" reflector with uplight, (Must specify color) <sup>30</sup>
ZAC120 One adjustable aircraft cable with canopy 120" <sup>27</sup>		HC36 Hanger chain, 36" (one pair)	CLXRWU48 ___ Wide decorative 48" reflector with uplight, (Must specify color) <sup>30</sup>
ZACFP120 One adjustable aircraft cable with feed (3 conductor) and canopy, 120" <sup>27</sup>		<b>Sensors &amp; Controls:</b>	CLXRWU96 ___ Two wide decorative 48" reflectors with uplight, (Must specify color) <sup>30</sup>
ZACFPD120 One adjustable aircraft cable with feed (5 conductor) and canopy 120" <sup>27</sup>		LSXR Sensor Switch ® LSXR occupancy sensor <sup>29</sup>	CLXRN24 Narrow 24" reflector, (Must specify color) <sup>31</sup>
ZAC240 One adjustable aircraft cable with canopy 240" <sup>27</sup>		NPP16D nLight® switching/dimming module	CLXRN36 Narrow 36" reflector, (Must specify color) <sup>31</sup>
ZACFP240 One adjustable aircraft cable with feed (3 conductor) and canopy, 240" <sup>27</sup>		NPP16DER nLight® switching/dimming module with emergency relay	CLXRN48 Narrow 48" reflector, (Must specify color) <sup>31</sup>
ZACFPD240 One adjustable aircraft cable with feed (5 conductor) and canopy 240" <sup>27</sup>		rPP20D nLight® air dimming/switching module	CLXRN96 ___ Two narrow 48" reflectors, (Must specify color) <sup>31</sup>
SQ ___ Stem kit, 2" increments up to 48" <sup>27</sup>		XPA CMR80 XPoint™ Wireless 0-10V relay, external, 55°C max ambient	<b>Wireguards:</b>
		<b>Reflectors:</b>	WGCLX24 ___ 24" wireguard, (Must specify color) <sup>32</sup>
		CLXRW24 ___ Wide decorative 24" reflector, (Must specify color) <sup>30</sup>	WGCLX36 ___ 36" wireguard, (Must specify color) <sup>32</sup>
		CLXRW36 ___ Wide decorative 36" reflector, (Must specify color) <sup>30</sup>	WGCLX48 ___ 48" wireguard, XX, (Must specify color) 96" fixture requires two <sup>32</sup>
		CLXRW48 ___ Wide decorative 48" reflector, (Must specify color) <sup>30</sup>	
		CLXRW96 ___ Two wide decorative 48" reflectors, (Must specify color) <sup>30</sup>	

Notes

- Not available with OUTCTR option.
- Not available with HA option.
- Not available with SEF when ordered in combination with EZ1.
- Not available with NLTAIR2 RES7, NLTAIR2 RES7PDT, or NLTAIR2 RIO.
- Not available with EZ1 when ordered with L24 with 5000LM or L36 with 7500LM.
- When ordered with L24 only available with 1500LM or 2000LM in combination with G210 driver. Not for use with THCLX, CLXANGBKT, CLX reflectors or WGCLX accessories. Not available with RDL lens options.
- Only available with general distribution.
- Not available with CLXRN accessories.
- Available L/LENS only.
- Not available with PS1050, E10WLCP, or BGTD.
- Not available with BGTD option.
- Voltage selected utilizes a step-down transformer. Not available with L24 when ordered with N100. Not available with PS1050, E10WLCP or BGTD option.
- Requires SPD option.
- When continuous row mounting, fixtures must all have the same driver selection.
- Not available with Individual controls, nLight wired networking, nLight wireless networking, nLight wireless zone control options.
- Must specify voltage.

- Not available with L24 or L36. Not available with L48 in combination with N100.
- Available with L48 or L96 only. 20 Not available with PS1050 or E10WLCP options. Not available with 208 or 240V. Not available Individual controls, nLight Wired, or nLight Wireless options.
- Not available OUTEND.
- Required with PS1050, E10WLCP, BGTD, XAD, or XAD924.
- Not available with PLR options.
- Not available with XPoint, Individual controls, nLight Wired, or nLight Wireless options.
- Sensor housing will be the same color as lens end caps.
- Not available with L24 in combination with 5000LM, not available with L36 in combination with 7500LM, not available with L48 in combination with 10000LM, and not available with L96 in combination with 14000LM, 18000LM, or 20000LM. Not available with PLRs containing low voltage dimming wires.
- Not available with any other control option. Requires EZ1.
- Requires N100 option.
- Ships standard as white.
- Not available with louver, wireguards, wide reflectors.
- More configurations on [LSXR Specification Sheet](#).
- L24 reflector is 22.65", L36 reflector is 34.01", L48 reflector is 46.80", L96 comes with two L48 reflectors.
- For use with L/LENS fixtures only. L24 reflector is 22.75", L36 reflector is 34.20", L48 reflector is 46.85", L96 comes with two L48 reflectors.
- Not for use with CLX wide reflector accessories.

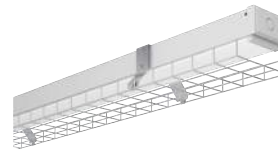
OPTIONS AND ACCESSORIES



**Narrow reflector**  
Ships separately from fixture.  
Order as:  
CLXRN24 \_\_\_  
CLXRN36 \_\_\_  
CLXRN48 \_\_\_  
CLXRN96 \_\_\_



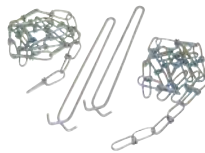
**Wide decorative reflector**  
Ships separately from fixture.  
Order as:  
CLXRW24 \_\_\_  
CLXRW36 \_\_\_  
CLXRW48 \_\_\_  
CLXRW96 \_\_\_



**Wireguard**  
Ships separately from fixture:  
96" fixture requires two WGCLX48.  
Order as:  
WGCLX24 \_\_\_  
WGCLX36 \_\_\_  
WGCLX48 \_\_\_



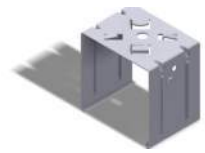
**Aircraft Cable with Canopy**  
Available in 120" or 240"  
Order as:  
ZAC120  
ZAC240



**HANGER CHAIN**  
36" chain with Y hanger, ships as a pair  
Order as:  
HC36



**ZACVH HANGER**  
10' Aircraft cable with Y hanger.  
Order as:  
ZACVH



**Tong hanger**  
Ships as a pair  
Order As:  
THCLX \_\_\_



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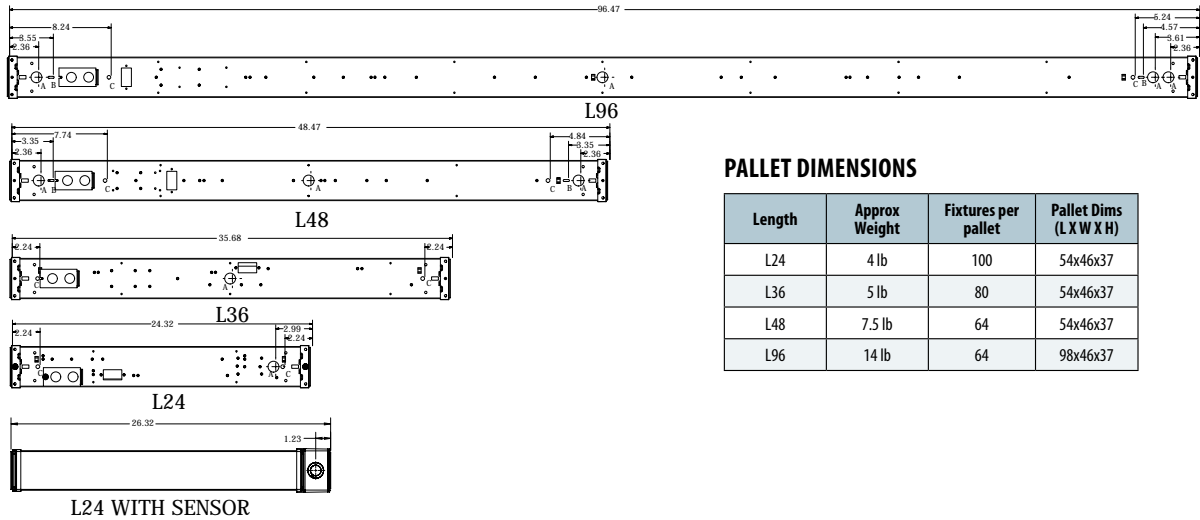
TYPE S3

**DIMENSIONS**

All dimensions are in inches (centimeters) unless otherwise indicated.  
Dimensions may vary with options or accessories.

INTEGRATED SENSOR ADDS 2.0 INCHES TO STANDALONE FIXTURE LENGTH  
HOUSING END CAP ADDS 0.236 INCHES TO FIXTURE LENGTH PER SIDE. DIMENSIONS BELOW INCLUDE ENDCAPS.

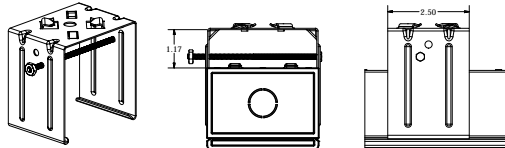
A - 7/8" KNOCK OUT  
B - 0.5" by 0.16" SLOT  
C - 0.3" DIA HOLE



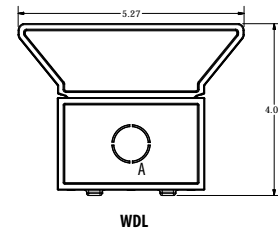
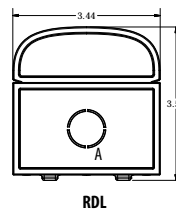
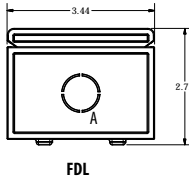
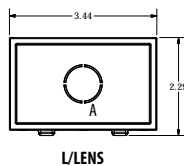
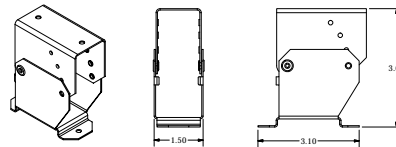
**PALLET DIMENSIONS**

Length	Approx Weight	Fixtures per pallet	Pallet Dims (L X W X H)
L24	4 lb	100	54x46x37
L36	5 lb	80	54x46x37
L48	7.5 lb	64	54x46x37
L96	14 lb	64	98x46x37

THCLX - SHIPS TWO PER ORDER.  
UTILIZES A #8 HEX HEAD SCREW AND NUT  
FIXTURE SITS 1.3 INCHES FROM STRUCTURE WHEN MOUNTED



CLXANGBKT - SHIPS TWO PER ORDER  
HOLES TO MOUNTING STRUCTURE ARE 0.175" DIA, 2.5" APART  
FIXTURE SITS APPROXIMATELY 3.5" FROM STRUCTURE  
WHEN MOUNTED HORIZONTAL TO STRUCTURE



**PHOTOMETRICS**

See [www.lithonia.com](http://www.lithonia.com).



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POWER SENTRY EMERGENCY BATTERY PACKS

		SEF Emergency Lumens	HEF Emergency Lumens
<a href="#">PS1050</a>	Factory installable	1400	1500
<a href="#">E10WLCP</a>	Factory installable	1400	1500
<a href="#">PS1555LCP</a>	Field installable, remote mount only	2000	2100

Note: For emergency lumen output of specific model, please consult factory. One board will be illuminated during emergency operation.

CLX CHARACTERISTICS

Nominal Lumen Package	Length	Wattage								Length	Width	Depth	Comparable Light Source
		Standard efficiency				High efficiency							
		120V	277V	347V	480V	120V	277V	347V	480V				
Dimensions are shown in inches													
2500LM	24"	19.9	19.9	25.9	25.9	18.5	18.5	24.5	24.5	24	3.5	3.75	1-lamp 32WT8, 1-lamp 54W T5HO, 50W HID
5000LM	24"	41.9	41.9	47.9	47.9	37.9	37.9	43.9	43.9	24	3.5	3.75	2-lamp 32WT8, 1-lamp 54W T5HO, 70W HID
3750LM	36"	28.1	28.1	34.1	34.1	27.0	27.0	33.0	33.0	36	3.5	3.75	1-lamp 32WT8, 1-lamp 54W T5HO, 50W HID
7500LM	36"	62.9	62.9	68.9	68.9	56.8	56.8	62.8	62.8	36	3.5	3.75	2-lamp 32WT8, 1-lamp 54W T5HO, 70W HID
5000LM	48"	35.4	35.4	41.4	41.4	32.9	32.9	38.9	38.9	48	3.5	3.75	2-lamp 32WT8, 1-lamp 54W T5HO, 70W HID
10000LM	48"	77.1	77.1	83.1	83.1	70.4	70.4	76.4	76.4	48	3.5	3.75	3-lamp 32WT8, 2-lamp 54W T5HO, 100W HID
10000LM	96"	70.8	70.8	76.8	76.8	65.8	65.8	71.8	71.8	96	3.5	3.75	3-lamp 32WT8, 2-lamp 54W T5HO, 100W HID
20000LM	96"	154.2	154.2	160.2	160.2	140.8	140.8	146.8	146.8	96	3.5	3.75	6-lamp 32WT8, 4-lamp 54T5HO, 200W HID

AMBIENT TEMPERATURE RATINGS

Driver Package		GZ10			EZ1			Any Driver	
Length	Lumen package	Direct Surface	THCLX/ Suspended	HA Option (Direct or Suspended)	Direct Surface	THCLX	Suspended 18"	Xpoint/ BGTD Direct Surface	PS1050 Suspended
L24	1500LM	40C	40C	N/A	35C	35C	35C	N/A	N/A
	2000LM	40C	40C		35C	35C	35C		
	2500LM	40C	40C		35C	35C	35C		
	3000LM	40C	40C		40C	40C	40C		
	4500LM	40C	40C		35C	35C	40C		
	5000LM	40C	40C		25C	30C	35C		
L36	2250LM	40C	40C		40C	40C	40C		
	3000LM	40C	40C		40C	40C	40C		
	3750LM	40C	40C		40C	40C	40C		
	5250LM	40C	40C		35C	35C	40C		
	6750LM	30C	40C		35C	35C	40C		
	7500LM	30C	40C		25C	30C	35C		
L48	3000LM	40C	40C	50C	40C	40C	40C	35C	25C
	4000LM	40C	40C	50C	40C	40C	40C		
	5000LM	40C	40C	50C	35C	35C	40C		
	7000LM	30C	40C	N/A	35C	35C	40C		
	9000LM	30C	40C		25C	30C	35C		
	10000LM	30C	40C		25C	30C	35C		
L96	6000LM	40C	40C		50C	35C	35C		
	8000LM	30C	40C	50C	35C	35C	40C		
	10000LM	30C	40C	50C	25C	30C	35C		
	14000LM	40C	40C	N/A	35C	35C	40C		
	18000LM	30C	40C		25C	30C	35C		
	20000LM	30C	40C		25C	30C	35C		



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CLX OPERATIONAL DATA

	Length	Nominal lumen package	Performance package	CRI	Delivered Lumens				Wattage
					Color Temperature				
					3000K	3500K	4000K	5000K	
L/Lens	L24	1500LM	SEF	80	1497	1540	1582	1619	10.85
				90	1305	1333	1371	1441	10.85
			HEF	80	1493	1514	1582	1586	10.39
				90	1220	1237	1301	1301	10.39
		2000LM	SEF	80	2066	2125	2183	2235	14.48
				90	1801	1840	1892	1989	14.48
			HEF	80	2060	2089	2183	2189	13.46
				90	1684	1708	1796	1796	13.46
		2500LM	SEF	80	2616	2689	2763	2829	18.41
				90	2279	2329	2394	2517	18.41
			HEF	80	2607	2644	2763	2771	17.42
		90	2132	2161	2273	2273	17.42		
		3500LM	SEF	80	3518	3617	3716	3804	25.83
				90	3065	3132	3220	3385	25.83
			HEF	80	3506	3556	3716	3726	25.04
				90	2867	2907	3057	3057	25.04
		4500LM	SEF	80	5040	5182	5325	5451	38.7
				90	4392	4487	4614	4851	38.7
			HEF	80	5024	5096	5325	5339	34.8
		90	4108	4165	4380	4380	34.8		
		5000LM	SEF	80	5355	5506	5657	5791	41.48
				90	4667	4767	4902	5153	41.48
			HEF	80	5338	5414	5657	5672	38.11
				90	4364	4425	4653	4653	38.11
	L36	2250LM	SEF	80	2411	2547	2101	2207	16.36
				90	2479	2607	2146	2320	16.36
			HEF	80	2437	2554	1965	2095	15.47
				90	2547	2403	1992	2095	15.47
		3000LM	SEF	80	3221	3388	2730	2868	20.8
				90	3310	3133	2789	3015	20.8
			HEF	80	3167	3319	2553	2722	19.98
		90	3310	3123	2589	2722	19.98		
		3750LM	SEF	80	4123	4337	3495	3671	26.47
				90	4236	4010	3570	3859	26.47
			HEF	80	4054	4248	3268	3485	25.09
		90	4236	3997	3314	3485	25.09		
		5250LM	SEF	80	5545	5833	4700	4937	39.9
				90	5698	5393	4801	5190	39.9
			HEF	80	5452	5713	4396	4687	34.3
		90	5698	5376	4457	4687	34.3		
		6750LM	SEF	80	7081	7448	6001	6303	54.85
				90	7275	6886	6131	6627	54.85
			HEF	80	6962	7294	5613	5984	47.97
		90	7275	6864	5691	5984	47.97		
		7500LM	SEF	80	7756	8158	6574	6905	62.6
				90	7969	7543	6716	7260	62.6
			HEF	80	7626	7991	6148	6555	54.02
		90	7969	7519	6234	6555	54.02		



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TYPE S3

CLX OPERATIONAL DATA (continued)

	Length	Nominal lumen package	Performance package	CRI	Delivered Lumens				Wattage
					Color Temperature				
					3000K	3500K	4000K	5000K	
L/Lens	L48	3000LM	SEF	80	3019	3104	3190	3265	20.32
				90	2631	2688	2764	2906	20.32
			HEF	80	3010	3052	3190	3198	19.01
				90	2461	2495	2624	2624	19.01
		4000LM	SEF	80	4034	4148	4262	4363	27.58
				90	3515	3591	3693	3882	27.58
			HEF	80	4021	4078	4262	4273	24.75
				90	3288	3334	3505	3505	24.75
		5000LM	SEF	80	5047	5189	5332	5458	34.8
				90	4398	4493	4620	4857	34.8
			HEF	80	5031	5102	5332	5346	31.77
				90	4113	4171	4386	4386	31.77
		7000LM	SEF	80	7311	7517	7724	7907	49.05
				90	6371	6509	6692	7036	49.05
			HEF	80	7288	7391	7724	7744	44.67
				90	5959	6042	6353	6353	44.67
		9000LM	SEF	80	9215	9475	9735	9967	63.99
				90	8031	8204	8435	8869	63.99
			HEF	80	9186	9317	9735	9762	58.58
				90	7511	7615	8008	8008	58.58
		10000LM	SEF	80	10299	10590	10880	11139	73.37
				90	8975	9169	9427	9912	73.37
			HEF	80	10266	10412	10880	10910	66.27
				90	8394	8511	8950	8950	66.27
	L96	6000LM	SEF	80	5942	6110	6278	6427	38.15
				90	5178	5290	5439	5719	38.15
			HEF	80	5923	6008	6278	6294	35.54
				90	4843	4911	5164	5164	35.54
		8000LM	SEF	80	7929	8153	8376	8575	52.32
				90	6910	7059	7258	7631	52.32
			HEF	80	7903	8016	8376	8399	48.5
				90	6462	6552	6890	6890	48.5
		10000LM	SEF	80	9808	10085	10362	10608	66.47
				90	8548	8732	8978	9439	66.47
			HEF	80	9777	9916	10362	10390	60.89
				90	7994	8106	8523	8523	60.89
		14000LM	SEF	80	14323	14727	15131	15491	94.78
				90	12482	12752	13111	13784	94.78
			HEF	80	14277	14480	15131	15172	85.96
				90	11674	11836	12447	12447	85.96
		18000LM	SEF	80	18458	18979	19500	19963	128.98
				90	16086	16433	16896	17764	128.98
			HEF	80	18399	18661	19500	19552	116.92
				90	15044	15254	16040	16040	116.92
		20000LM	SEF	80	20386	20962	21537	22048	146.83
				90	17766	18150	18661	19619	146.83
			HEF	80	20321	20610	21537	21595	131.6
				90	16616	16847	17716	17716	131.6



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TYPE S3

CLX OPERATIONAL DATA (continued)

	Length	Nominal lumen package	Performance package	CRI	Delivered Lumens				Wattage
					Color Temperature				
					3000K	3500K	4000K	5000K	
RDL	L24	1500LM	SEF	80	1359	1397	1436	1470	10.85
				90	1184	1210	1244	1308	10.85
			HEF	80	1355	1374	1436	1439	10.39
				90	1107	1123	1181	1181	10.39
		2000LM	SEF	80	1875	1928	1981	2028	14.48
				90	1634	1670	1717	1805	14.48
			HEF	80	1869	1896	1981	1987	13.46
				90	1528	1550	1630	1630	13.46
		2500LM	SEF	80	2374	2441	2508	2567	18.41
				90	2069	2113	2173	2284	18.41
			HEF	80	2366	2400	2508	2514	17.42
				90	1935	1962	2063	2063	17.42
		3500LM	SEF	80	3192	3282	3372	3452	25.83
				90	2782	2842	2922	3072	25.83
			HEF	80	3182	3227	3372	3381	25.04
				90	2602	2638	2774	2774	25.04
		4500LM	SEF	80	4574	4703	4832	4947	38.7
				90	3986	4072	4187	4402	38.7
			HEF	80	4560	4624	4832	4845	34.8
				90	3728	3780	3975	3975	34.8
		5000LM	SEF	80	4860	4997	5134	5256	41.48
				90	4235	4327	4448	4677	41.48
			HEF	80	4844	4913	5134	5148	38.11
				90	3961	4016	4223	4223	38.11
	L36	2250LM	SEF	80	2188	2250	2311	2366	16.36
				90	1907	1948	2003	2106	16.36
			HEF	80	2181	2212	2311	2318	15.47
				90	1783	1808	1901	1901	15.47
		3000LM	SEF	80	2843	2924	3004	3075	20.8
				90	2478	2531	2603	2736	20.8
			HEF	80	2834	2875	3004	3012	19.98
				90	2317	2350	2471	2471	19.98
		3750LM	SEF	80	3639	3742	3845	3936	26.47
				90	3171	3240	3331	3502	26.47
			HEF	80	3628	3679	3845	3855	25.09
				90	2966	3007	3162	3162	25.09
		5250LM	SEF	80	4895	5033	5171	5294	39.9
				90	4265	4357	4480	4710	39.9
			HEF	80	4879	4948	5171	5185	34.3
				90	3989	4045	4253	4253	34.3
		6750LM	SEF	80	6250	6426	6602	6759	54.85
				90	5446	5564	5721	6014	54.85
			HEF	80	6230	6318	6602	6620	47.97
				90	5094	5165	5431	5431	47.97
		7500LM	SEF	80	6846	7039	7232	7404	62.6
				90	5966	6095	6266	6588	62.6
			HEF	80	6824	6921	7232	7252	54.02
				90	5580	5657	5949	5949	54.02



CLX

CLX LED Linear

TYPE S3

CLX OPERATIONAL DATA (continued)

	Length	Nominal lumen package	Performance package	CRI	Delivered Lumens				Wattage
					Color Temperature				
					3000K	3500K	4000K	5000K	
RDL	L48	3000LM	SEF	80	2740	2817	2895	2963	20.32
				90	2388	2439	2508	2637	20.32
			HEF	80	2731	2770	2895	2902	19.01
				90	2233	2264	2381	2381	19.01
		4000LM	SEF	80	3661	3764	3868	3959	27.58
				90	3190	3259	3351	3523	27.58
			HEF	80	3649	3701	3868	3878	24.75
				90	2984	3025	3181	3181	24.75
		5000LM	SEF	80	4580	4710	4839	4954	34.8
				90	3992	4078	4193	4408	34.8
			HEF	80	4566	4631	4839	4852	31.77
				90	3733	3785	3980	3980	31.77
		7000LM	SEF	80	6635	6822	7009	7176	49.05
				90	5782	5907	6073	6385	49.05
			HEF	80	6614	6708	7009	7028	44.67
				90	5408	5483	5766	5766	44.67
		9000LM	SEF	80	8363	8599	8835	9045	63.99
				90	7288	7446	7655	8049	63.99
			HEF	80	8336	8455	8835	8859	58.58
				90	6816	6911	7268	7268	58.58
		10000LM	SEF	80	9347	9611	9874	10109	73.37
				90	8145	8321	8556	8995	73.37
			HEF	80	9317	9450	9874	9901	66.27
				90	7618	7724	8122	8122	66.27
	L96	6000LM	SEF	80	5393	5545	5697	5832	38.15
				90	4700	4801	4936	5190	38.15
			HEF	80	5375	5452	5697	5712	35.54
				90	4395	4457	4686	4686	35.54
		8000LM	SEF	80	7196	7399	7602	7782	52.32
				90	6271	6406	6587	6925	52.32
			HEF	80	7173	7275	7602	7622	48.5
				90	5865	5946	6253	6253	48.5
		10000LM	SEF	80	8902	9153	9404	9627	66.47
				90	7757	7925	8148	8567	66.47
			HEF	80	8873	8999	9404	9429	60.89
				90	7255	7356	7735	7735	60.89
		14000LM	SEF	80	12999	13366	13732	14058	94.78
				90	11328	11573	11899	12510	94.78
			HEF	80	12957	13142	13732	13769	85.96
				90	10594	10742	11296	11296	85.96
		18000LM	SEF	80	16751	17224	17697	18117	128.98
				90	14598	14913	15334	16121	128.98
			HEF	80	16698	16936	17697	17744	116.92
				90	13653	13843	14557	14557	116.92
		20000LM	SEF	80	18501	19023	19545	20009	146.83
				90	16123	16471	16935	17805	146.83
			HEF	80	18442	18705	19545	19598	131.6
				90	15079	15290	16078	16078	131.6

CLX LED Linear

TYPE S3

CLX OPERATIONAL DATA (continued)

	Length	Nominal lumen package	Performance package	CRI	Delivered Lumens				Wattage
					Color Temperature				
					3000K	3500K	4000K	5000K	
FDL	L24	1500LM	SEF	80	1320	1358	1395	1428	10.85
				90	1151	1175	1208	1271	10.85
			HEF	80	1316	1335	1395	1399	10.39
				90	1076	1091	1147	1147	10.39
		2000LM	SEF	80	1822	1874	1925	1971	14.48
				90	1588	1622	1668	1754	14.48
			HEF	80	1816	1842	1925	1930	13.46
				90	1485	1506	1583	1583	13.46
		2500LM	SEF	80	2306	2371	2436	2494	18.41
				90	2010	2053	2111	2219	18.41
			HEF	80	2299	2332	2436	2443	17.42
				90	1880	1906	2004	2004	17.42
		3500LM	SEF	80	3102	3189	3277	3354	25.83
				90	2703	2761	2839	2985	25.83
			HEF	80	3092	3136	3277	3285	25.04
				90	2528	2563	2695	2695	25.04
		4500LM	SEF	80	4444	4570	4695	4807	38.7
				90	3873	3957	4068	4277	38.7
			HEF	80	4430	4493	4695	4708	34.8
				90	3622	3673	3862	3862	34.8
		5000LM	SEF	80	4722	4855	4988	5107	41.48
				90	4115	4204	4322	4544	41.48
			HEF	80	4707	4774	4988	5002	38.11
				90	3848	3902	4103	4103	38.11
	L36	2250LM	SEF	80	2126	2186	2246	2299	16.36
				90	1852	1892	1946	2046	16.36
			HEF	80	2119	2149	2246	2252	15.47
				90	1732	1757	1847	1847	15.47
		3000LM	SEF	80	2762	2840	2918	2988	20.8
				90	2407	2459	2529	2659	20.8
			HEF	80	2754	2793	2918	2926	19.98
				90	2251	2283	2401	2401	19.98
		3750LM	SEF	80	3536	3636	3735	3824	26.47
				90	3081	3148	3237	3403	26.47
			HEF	80	3525	3575	3735	3745	25.09
				90	2882	2922	3073	3073	25.09
		5250LM	SEF	80	4755	4890	5024	5143	39.9
				90	4144	4234	4353	4577	39.9
			HEF	80	4740	4808	5024	5037	34.3
				90	3876	3930	4132	4132	34.3
		6750LM	SEF	80	6072	6243	6415	6567	54.85
				90	5292	5406	5558	5844	54.85
			HEF	80	6053	6139	6415	6432	47.97
				90	4949	5018	5276	5276	47.97
		7500LM	SEF	80	6651	6839	7027	7194	62.6
				90	5796	5922	6088	6401	62.6
			HEF	80	6630	6725	7027	7046	54.02
				90	5421	5497	5780	5780	54.02



CLX

CLX LED Linear

TYPE S3

CLX OPERATIONAL DATA (continued)

	Length	Nominal lumen package	Performance package	CRI	Delivered Lumens				Wattage
					Color Temperature				
					3000K	3500K	4000K	5000K	
FDL	L48	3000LM	SEF	80	2662	2737	2812	2879	20.32
				90	2320	2370	2437	2562	20.32
			HEF	80	2654	2691	2812	2820	19.01
				90	2170	2200	2313	2313	19.01
		4000LM	SEF	80	3557	3657	3758	3847	27.58
				90	3100	3167	3256	3423	27.58
			HEF	80	3546	3596	3758	3768	24.75
				90	2899	2939	3091	3091	24.75
		5000LM	SEF	80	4450	4576	4701	4813	34.8
				90	3878	3962	4073	4283	34.8
			HEF	80	4436	4499	4701	4714	31.77
				90	3627	3678	3867	3867	31.77
		7000LM	SEF	80	6446	6628	6810	6972	49.05
				90	5618	5739	5901	6204	49.05
			HEF	80	6426	6517	6810	6829	44.67
				90	5254	5327	5602	5602	44.67
		9000LM	SEF	80	8126	8355	8584	8788	63.99
				90	7081	7234	7438	7820	63.99
			HEF	80	8100	8215	8584	8607	58.58
				90	6623	6715	7061	7061	58.58
		10000LM	SEF	80	9081	9338	9594	9822	73.37
				90	7914	8085	8313	8740	73.37
			HEF	80	9052	9181	9594	9620	66.27
				90	7402	7505	7892	7892	66.27
	L96	6000LM	SEF	80	5240	5387	5535	5667	38.15
				90	4566	4665	4796	5042	38.15
			HEF	80	5223	5297	5535	5550	35.54
				90	4270	4330	4553	4553	35.54
		8000LM	SEF	80	6991	7189	7386	7561	52.32
				90	6093	6224	6400	6728	52.32
			HEF	80	6969	7068	7386	7406	48.5
				90	5698	5778	6075	6075	48.5
		10000LM	SEF	80	8649	8893	9137	9354	66.47
				90	7537	7700	7917	8323	66.47
			HEF	80	8621	8744	9137	9161	60.89
				90	7049	7147	7516	7516	60.89
		14000LM	SEF	80	12630	12986	13342	13659	94.78
				90	11006	11244	11561	12154	94.78
			HEF	80	12589	12768	13342	13378	85.96
				90	10293	10437	10975	10975	85.96
		18000LM	SEF	80	16276	16735	17194	17602	128.98
				90	14184	14490	14898	15663	128.98
			HEF	80	16223	16454	17194	17240	116.92
				90	13265	13450	14143	14143	116.92
		20000LM	SEF	80	17976	18483	18990	19441	146.83
				90	15665	16004	16454	17300	146.83
			HEF	80	17918	18173	18990	19041	131.6
				90	14651	14855	15621	15621	131.6



CLX

CLX LED Linear

TYPE S3

CLX OPERATIONAL DATA (continued)

	Length	Nominal lumen package	Performance package	CRI	Delivered Lumens				Wattage
					Color Temperature				
					3000K	3500K	4000K	5000K	
WDL	L24	1500LM	SEF	80	1377	1415	1454	1489	10.85
				90	1200	1226	1260	1325	10.85
			HEF	80	1372	1392	1454	1458	10.39
				90	1122	1138	1196	1196	10.39
		2000LM	SEF	80	1900	1953	2007	2055	14.48
				90	1656	1691	1739	1828	14.48
			HEF	80	1894	1921	2007	2012	13.46
				90	1548	1570	1651	1651	13.46
		2500LM	SEF	80	2405	2472	2540	2601	18.41
				90	2095	2141	2201	2314	18.41
			HEF	80	2397	2431	2540	2547	17.42
				90	1960	1987	2090	2090	17.42
		3500LM	SEF	80	3234	3325	3416	3497	25.83
				90	2818	2879	2960	3112	25.83
			HEF	80	3223	3269	3416	3426	25.04
				90	2636	2672	2810	2810	25.04
		4500LM	SEF	80	4634	4765	4895	5012	38.7
				90	4038	4125	4242	4459	38.7
			HEF	80	4619	4685	4895	4908	34.8
				90	3777	3829	4027	4027	34.8
		5000LM	SEF	80	4923	5062	5201	5324	41.48
				90	4290	4383	4506	4738	41.48
			HEF	80	4907	4977	5201	5215	38.11
				90	4012	4068	4278	4278	38.11
	L36	2250LM	SEF	80	2216	2279	2341	2397	16.36
				90	1931	1973	2029	2133	16.36
			HEF	80	2209	2241	2341	2348	15.47
				90	1806	1832	1926	1926	15.47
		3000LM	SEF	80	2880	2962	3043	3115	20.8
				90	2510	2564	2636	2772	20.8
			HEF	80	2871	2912	3043	3051	19.98
				90	2347	2380	2503	2503	19.98
		3750LM	SEF	80	3687	3791	3895	3987	26.47
				90	3213	3282	3375	3548	26.47
			HEF	80	3675	3727	3895	3905	25.09
				90	3005	3047	3204	3204	25.09
		5250LM	SEF	80	4958	5098	5238	5362	39.9
				90	4321	4414	4539	4772	39.9
			HEF	80	4942	5013	5238	5252	34.3
				90	4041	4097	4309	4309	34.3
		6750LM	SEF	80	6331	6510	6688	6847	54.85
				90	5517	5636	5795	6093	54.85
			HEF	80	6311	6401	6688	6706	47.97
				90	5160	5232	5502	5502	47.97
		7500LM	SEF	80	6935	7131	7326	7500	62.6
				90	6044	6174	6348	6674	62.6
			HEF	80	6913	7011	7326	7346	54.02
				90	5652	5731	6027	6027	54.02



CLX

CLX LED Linear

TYPE S3

CLX OPERATIONAL DATA (continued)

	Length	Nominal lumen package	Performance package	CRI	Delivered Lumens				Wattage	
					Color Temperature					
					3000K	3500K	4000K	5000K		
WDL	L48	3000LM	SEF	80	2776	2854	2932	3002	20.32	
				90	2419	2471	2541	2671	20.32	
			HEF	80	2767	2806	2932	2940	19.01	
				90	2262	2294	2412	2412	19.01	
		4000LM	SEF	80	3709	3813	3918	4011	27.58	
				90	3232	3302	3395	3569	27.58	
			HEF	80	3697	3749	3918	3929	24.75	
				90	3023	3065	3223	3223	24.75	
		5000LM	SEF	80	4640	4771	4902	5018	34.8	
				90	4044	4131	4247	4465	34.8	
			HEF	80	4625	4691	4902	4915	31.77	
				90	3782	3834	4032	4032	31.77	
		7000LM	SEF	80	6721	6911	7101	7269	49.05	
				90	5857	5984	6152	6469	49.05	
			HEF	80	6700	6795	7101	7120	44.67	
				90	5478	5554	5841	5841	44.67	
		9000LM	SEF	80	8472	8711	8950	9163	63.99	
				90	7383	7543	7755	8154	63.99	
			HEF	80	8445	8565	8950	8974	58.58	
				90	6905	7001	7362	7362	58.58	
		10000LM	SEF	80	9469	9736	10003	10240	73.37	
				90	8252	8430	8667	9112	73.37	
			HEF	80	9438	9573	10003	10030	66.27	
				90	7717	7825	8228	8228	66.27	
	L96	6000LM	SEF	80	5463	5617	5771	5908	38.15	
				90	4761	4864	5001	5258	38.15	
			HEF	80	5445	5523	5771	5787	35.54	
				90	4452	4515	4747	4747	35.54	
			8000LM	SEF	80	7289	7495	7701	7884	52.32
					90	6353	6490	6672	7015	52.32
		HEF		80	7266	7370	7701	7722	48.5	
				90	5941	6024	6334	6334	48.5	
		10000LM	SEF	80	9017	9272	9526	9752	66.47	
				90	7858	8028	8254	8678	66.47	
			HEF	80	8988	9117	9526	9552	60.89	
				90	7349	7452	7836	7836	60.89	
		14000LM	SEF	80	13168	13540	13911	14241	94.78	
				90	11476	11723	12054	12673	94.78	
			HEF	80	13126	13313	13911	13949	85.96	
				90	10732	10882	11443	11443	85.96	
		18000LM	SEF	80	16970	17448	17927	18353	128.98	
				90	14788	15108	15533	16331	128.98	
			HEF	80	16915	17156	17927	17975	116.92	
				90	13831	14024	14746	14746	116.92	
		20000LM	SEF	80	18742	19271	19800	20270	146.83	
				90	16333	16686	17156	18037	146.83	
			HEF	80	18682	18948	19800	19853	131.6	
				90	15276	15489	16287	16287	131.6	

## CLX LED Linear

TYPE S3

### RRL - RELOC®-Ready Luminaire

- RRL connectors can be used with Quick-Flex®, System 820 and OnePass® systems.
- Load side of connector factory installed to luminaire.
- 4-pole mating connector with push-in terminations allows for simple installation.
- Touch-safe design on both halves meets UL/CSA requirement.
- Wiping contact design allows safe disconnect under load.



#### ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: RRLA

Series	Wiring instructions
RRL RELOC®-ready luminaire	A Hot conductor wired to position #1 (phase A) B Hot conductor wired to position #2 (phase B) C Hot conductor wired to position #3 (phase C) <sup>1</sup>

### Compatible RELOC® Cables for Industrial Luminaires (ordered and shipped separately)



#### Notes

<sup>1</sup> C, ABE, and C12S options are not used with Quick-Flex QFC, QSFC, QPT, and QD.

### PRODUCT INFORMATION

Advanced plug-in system with two-circuit capability. Available on industrial and strip products and a variety of architectural products mounted in continuous rows. 1, 2, 3 and 4-lamp fixtures. PLR22 (2-circuit) and crossover harness switches hot circuit serving next fixture in row. Reduces fixture types on job for alternating circuit applications (see example below.)

Easy one-step installation, saves up to 35% on labor costs. Expanded switching flexibility helps save energy.

Rows can be 50% longer with two-circuit systems. Polarized, lock-together nylon connectors prevent miswiring in the field. #12 THHN conductor, rated 600V, 90°C. White neutral wire included. Grounding accomplished by fixture in-row connectors.

CSA certified systems available with up to 2 circuits. G ground required.

Note: Specifications subject to change without notice.



Wiring

PLR

Advanced 1 or 2-Circuit Plug-In

#### ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Series	Number of hot wires	Branch circuits	Dimming	Ground
PLR	(blank) Not required for 22	<u>Circuits to which ballast is connected</u>	<u>Emergency circuit connected</u>	
PLR22	1 Black	(blank) Not required for 22	(blank) No emergency circuit	G Ground
	2 Black and red	A Black wire	ELA Emergency circuit wired to black wire	
		B Red wire	ELB Emergency circuit wired to red wire	
			LV Low-voltage dimming	

#### Typical Applications

- Multiple-circuit and single-circuit for longer continuous rows
- Multiple-circuit with alternating fixtures on separate circuits and 2-circuit (PLR 22)
- Multiple circuit with night-lights located along row as desired



CLX



**DIGITAL NAVIGATION**  
[Ordering Tree](#)   [nLight Platform](#)   [Sensor Switch JOT](#)   [Photometrics](#)   [Performance Data](#)

## FEATURES & SPECIFICATIONS

**INTENDED USE** — The BLT Best-in-Value Low Profile LED luminaire features a popular center basket design that offers a clean, versatile style and volumetric distribution. High efficacy LED light engines deliver energy savings and low maintenance compared to traditional sources. An extensive selection of configurations and options make the BLT the perfect choice for many lighting applications including schools, offices and other commercial spaces, retail, hospitals and healthcare facilities. The low profile BLT design (2-3/8") also makes it an excellent choice for renovation projects.

**CONSTRUCTION** — Prior to fabrication, BLT components are coated with a proprietary paint blend and die-formed for dimensional consistency.

The BLT reflector is available in both smooth and ribbed finishes. Choose RB from the fixture style section below for a ribbed finish.

End plates contain easy-to-position integral T-bar clips for securely attaching the luminaire to the T-grid. For additional T-grid security, optional screw on T-bar clips are available.

Diffusers are extruded from impact modified acrylic for increased durability.

LED boards and drivers are accessible from the plenum.

**OPTICS** — Volumetric illumination is achieved by creating an optimal mix of light to walls, partitions and vertical and horizontal work surfaces – rendering the interior space, objects and occupants in a more balanced, complimentary luminous environment. High performance extruded acrylic diffusers conceal LEDs and efficiently deliver light in a volumetric distribution. Four diffuser choices available – curved and square designs with ribbed or a smooth frosted finish.

**ELECTRICAL** — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and quality of illumination for extended service life. 80% LED lumen maintenance at 60,000 hours (L80/60,000). Color Variation within 3-step MacAdam ellipse (3SDCM).

**Non-Configurable BLT:** Generic 0-10 volt dimming driver. Dims to 10%

**Configurable BLT:** available in High Efficiency (HE) versions for applications where a lower wattage (over the standard product) is required. The High Efficiency versions deliver >130 LPW and can be specified via the Lumen Package designations in the Ordering Information below.

eldoLED driver options deliver choice of dimming range, and choices for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Optional integrated nLight® controls make each luminaire addressable – allowing it to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Connection to nLight is simple. It can be accomplished with integrated nLight AIR wireless RIO, RES7 sensors, or through standard Cat-5 cabling. nLight offers unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission. nLight AIR is commissioned easily through an intuitive mobile app.

Lumen Management: Unique lumen management system (option N80) provides on board intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing the energy waste created by the traditional practice of over-lighting.

Step-level dimming option allows system to be switched to 50% power for compliance with common energy codes while maintaining fixture appearance.

**SENSOR** — Integrated sensor (**individual control**): Sensor Switch MSD7ADCX ((Passive infrared (PIR)) or MSDPDT7ADCX ((PIR/Microphonics Dual Tech (PDT))) integrated occupancy sensor/automatic dimming photocell allows the luminaire to power off when the space is unoccupied or enough ambient light is entering the space. See page 4 for more details on the integrated sensor.

**Integrated Sensor (nLight Wired Networking):** This sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired, using CAT-5 cabling, with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 4 for the nLight sensor options.

**Integrated Smart Sensor (nLight Air Wireless Platform):** The RES7 sensor is nLight AIR enabled, meaning it has the ability to communicate over the wireless nLight control platform. It is available with an automatic dimming photocell, and either a digital PIR or a microphonics (PDT) dual technology occupancy sensor. It pairs to other luminaires and wall switches through our mobile app, CLAIRITY, which allows for simple sensor adjustment. See page 4 for more details on the Integrated Smart Sensor.

**Integrated Wireless Sensor (single room control):** Sensor Switch VERTEX JOT or JOTVIX15 luminaire-embedded occupancy and ambient light sensor allows the luminaire to power off when the space is unoccupied or when enough ambient light is entering the space. See page X for more details on the integrated wireless sensor.

**INSTALLATION** — The BLT's low profile design of only 2-3/8" provides increased installation flexibility especially in restrictive plenum applications. The BLT fits into standard 15/16" and narrow 9/16" T-grid ceiling systems.

Suitable for damp location.

For recessed mounting in hard ceiling applications, Drywall Grid Adapters (DGA) are available as an accessory. See Accessories section.

**LISTINGS** — CSA Certified to meet U.S. and Canadian standards. IC rated. Tested in accordance with ISO 14644-1; suitable for ISO Class 5-9 positive and negative pressure clean rooms.

Designlights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at [www.designlights.org/QPL](http://www.designlights.org/QPL) to confirm which versions are qualified.

**BUY AMERICAN** — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.

**WARRANTY** — 5-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

**NOTE:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

TYPE T1A

Catalog Number
Notes
Type



*Specifications*

Length: 47-3/4 (121.2)	
Width: 23-3/4 (60.3)	
Depth: 2-3/8 (6.0)	
Depth with Air supply/return: 2-3/4 (6.9)	

All dimensions are inches (centimeters) unless otherwise specified.

### Embed nLight controls today. Prepare for tomorrow.

Now	Tomorrow
User-friendly install	Scalability
Enhanced energy savings	Space configuration
Code compliance	Future-ready

**Capable Luminaire**

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

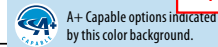
- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® control networks when ordered with drivers marked by a **shaded background**\*
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a **shaded background**\*

To learn more about A+, visit [www.acuitybrands.com/aplus](http://www.acuitybrands.com/aplus).

\*See ordering tree for details



TYPE T1A



## 2BLT Volumetric Recessed Lighting 2'x4'

### ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: 2BLT4 40L ADP EZ1 LP840

Series	Fixture Style	Air function	Lumens ‡	Diffuser	Voltage	Driver	Color temperature	
2BLT4 2x4 BLT	(blank) Smooth Reflector RB Ribbed Reflector	(blank) Static A Air supply/return ‡	<b>Standard efficiency (&gt;100 LPW)</b> 30L 3000 40L 4000 48L 4800 60L 6000 72L 7200 85L 8500 100L 10000 120L 12000	<b>High efficiency ‡ (&gt;130 LPW)</b> 30LHE 3000 40LHE 4000 48LHE 4800 60LHE 6000 72LHE 7200 85LHE 8500	ADP Curved, ribbed ADSM Curved, smooth SDP Square, ribbed SDSM Square, smooth <b>Includes trim rings to match sensed version</b> ADPT Curved, ribbed ADSMT Curved, smooth SDPT Square, ribbed SDSMT Square, smooth	(blank) MVOLT 120 120V 277 277V 347 347V ‡	EZ1 eldoLED dims to 1% (0-10 volt dimming) GZ1 Dims to 1% (0-10V dimming) ‡ GZ10 Dims to 10% (0-10V dimming) ‡ SLD Step-level dimming ‡	LP830 82CRI, 3000 K LP835 82CRI, 3500 K LP840 82CRI, 4000 K LP850 82CRI, 5000 K LP930 90CRI, 3000K LP935 90CRI, 3500K LP940 90CRI, 4000K LP950 90CRI, 5000K

nLight Interface	Control ‡	Individual Control
<b>nLight Wired</b> (blank) no nLight® interface N80 nLight with 80% lumen management N80EMG nLight with 80% lumen management For use with generator supply EM power ‡ N100 nLight without lumen management N100EMG nLight without lumen management For use with generator supply EM power ‡  <b>nLight Wireless</b> (blank) no nLight® interface NLTAIR2 nLight AIR Generation 2 enabled ‡	<b>nLight Wired ‡</b> (blank) No sensor control NES7 nLight™ nES 7 PIR integral occupancy sensor NESPD7 nLight™ nES PDT 7 dual technology integral occupancy control NES7ADCX nLight™ nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell NESPD7ADCX nLight™ nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell  <b>nLight Wireless</b> RES7 nLight AIR PIR integral occupancy sensor with automatic dimming photocell for Networking Capabilities RES7PDT nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell RIO nLight AIR radio module without sensor RES7EM nLight AIR PIR integral occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RES7PDTEM nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RIOEM nLight AIR radio module less sensor, with UL924 Emergency Operation, via power interrupt detection ‡	<b>MSD7ADCX</b> PIR integral occupancy sensor with automatic dimming control photocell ‡ <b>MSDPDT7ADCX</b> PDT integral occupancy sensor with automatic dimming control photocell ‡ <b>JOT</b> Wireless room control with "Just One Touch" pairing ‡ <b>JOTVTX15</b> Wireless occupancy sensor with "Just One Touch" pairing ‡

Standy Mode	Options
NOC NOC Occupancy sensor disabled ‡	<b>BDP Disconnect Plug</b> EL7L 700 lumen battery pack (Noncompliant with CA T20) ‡ EL14L 1400 lumen battery pack (Noncompliant with CA T20) ‡ EL14LSD 1400 lumen battery pack with self-diagnostic testing feature (Noncompliant with CA T20) ‡ E10WLCP EM Self-Diagnostic battery pack, 10W Constant Power, Certified in CA Title 20 MAEDBS ‡  CP Chicago plenum ‡ BGTD Bodine Generator Transfer Device ‡ PWS1836 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit PWS1846 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuit PWS1846 PWSLV Two cables: one 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuits; one 6' pre-wire, 3/8" diameter, 18 gauge ‡ PWS1856LV 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit w/low voltage wires ‡  GLR Fast-blowing fuse ‡ GMF Slow-blowing fuse ‡ NPLT Narrow pallet RRL_ RELOC®-ready luminaire ‡ LATC Earthquake clip DWAM Anti-Microbial paint JP14 Job packaging ‡ JP18 Job packaging ‡ IP5X Gasketed diffuser compartment to meet IP5X rating ‡ BAA Buy America(n) Act Compliant

NOTE: ‡ indicates option value has ordering restrictions. Please reference the Option Value Ordering Restrictions chart on the next page. Options are sorted alphanumerically.

LUMINAIRES WITH "EM" DESIGNATION TO HAVE BATTERY PACK

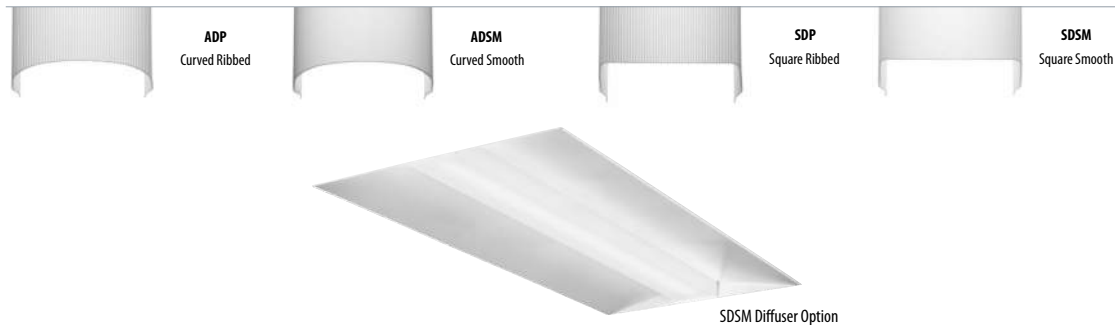
ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES

TYPE T1A

## 2BLT Volumetric Recessed Lighting 2'x4'

‡ Option Value Ordering Restrictions	
Option value	Restriction
347	Not available with SLD, EL7L, EL14L, or E10WLCP options.
A	Not available with RB fixture style, consult factory for air flow data.
BGTD	Not available with TD, JOT, JOTVTX15 sensor options or emergency battery options. Must specify voltage. Requires BSE labeling, voltage specific. Consult factory for options. Example: BGTD BSE10.
Controls	Must specify diffuser with trim rings.
CP	Not available with N80, N80EMG, N100, or N100EMG.
GZ1, GZ10	Not available with any Control or Sensor options except JOT & JOTVTX15
EL14LSD, E10WLCP, EL7L, EL14L	When using pre-wire option, use PWS1846 or PWS1846 PWSLV. For more information, please see the <a href="#">PSSD2 specification sheet</a> .
FAO	EZ1 driver required. Not available with USPOM, FAO or lumen packages > 6000LM. FAO restricts use of external Dimming controls. See chart on page 3 for additional details.
GLR, GMF	Must specify voltage. 120 or 277, with GLR and GMF fusing.
IP5X	Not available with air supply/return or Wired Networking (NES_) and Individual Control (MSD_) sensors.
JOT, JOTVTX15	Not available with standard efficiency 85L, 100L or 120L lumen options. Not available with SLD, nLight, NLTAIR2, NOC, or BGTD options.
JP14	Only available on fixtures with NES7, NESPDT7, NESPDT7ADCX, MSD7ADCX, MSDPDT7ADCX, RES7, RES7PDT, RIO, JOT, JOTVTX15. Not available when air supply/return function and sensor options are combined.
JP18	Not available with option: NES7, NESPDT7, NESPDT7ADCX, MSD7ADCX, MSDPDT7ADCX, RES7, RES7PDT, RIO, JOT, JOTVTX15.
Lumens	Approximate lumen output. For high Efficiency, all versions may not achieve 130+ LPW. Refer to photometry on <a href="http://www.acuitybrands.com">www.acuitybrands.com</a> . Air supply/return option, 90 CRI, and versions with integral sensor trim rings may not achieve 130 LPW.
MSD7ADCX, MSDPDT7ADCX	Only available with EZ1 driver option. 0-10v dimming wires not accessible via access plate.
NES7, NESPDT7, NES7ADCX, NESPDT7ADCX	Requires N80, N80EMG, N100, or N100EMG. Only available with EZ1 driver.
NLTAIR2	Must order with nLight Wireless option from Control section. Only available with EZ1 driver. Not available with 85L, 100L, or 120L options.
NOC	Can only be ordered in conjunction with EZ1, NLTAIR2, RES7/RES7PDT. Occupancy sensor disabled at factory but can be re-enabled upon commissioning.
N80EMG, N100EMG	nLight EMG option requires a connection to existing nLight network. Power is provided from a separate N80 or N100 enabled fixture.
RES7EM, RES7PDTEM, RIOEM	See UL924 Sequence of Operation chart on page 4. Not available with 72L, 72LHE, or 85LHE lumen packages.
RRL	For ordering logic consult: <a href="#">RRL_2013</a> .
SLD	Not available with any nLight Interface or Control options.

### Multiple Diffuser Options



TYPE T1A

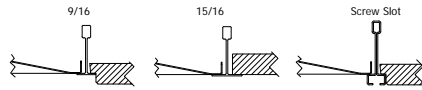
## 2BLT Volumetric Recessed Lighting 2'x4'

### Non-Configurable BLT

Non-Configurable BLT								
Stock/MTO	Catalog Description *	UPC	Lumens	Wattage	LPW	Color Temperature	Voltage	Pallet Qty
Stock	2BLT4 40L ADP LP835	00190887470789	4000	31.69	126.22	3500K/82 CRI	120-277	28
	2BLT4 40L ADP LP840	00190887470765	4063	31.69	128.23	4000K/82CRI	120-277	28
	2BLT4 46L ADP LP835	00190887468656	4960	38	130.5	3500K/82 CRI	120-277	28
	2BLT4 46L ADP LP840	00190887468649	5039.18	38	132.58	4000K/82CRI	120-277	28
	2BLT4 40L ADP EL14L LP835	00190887470925	4000	31.69	126.22	3500K/82 CRI	120-277	28
	2BLT4 40L ADP EL14L LP840	00190887470918	4063	31.69	128.23	4000K/82 CRI	120-277	28
	2BLT4 46L ADP EL14L LP835	00190887468670	4960	38	130.5	3500K/82 CRI	120-277	28
	2BLT4 46L ADP EL14L LP840	00190887468663	5039.18	38	132.58	4000K/82 CRI	120-277	28

\*Generic 0-10V Dimming to 10%.

MOUNTING DATA	
Ceiling Type	Appropriate Trim Type
Exposed grid tee (1' and 9/16")	G
Concealed grid tee	G
Plaster or plasterboard	G*



\*DGA accessory available to provide ceiling trim flange and fixture support for plaster or plasterboard ceiling. Recommended rough-in dimensions for DGA installation is 24-3/4" x 24-3/4" (Tolerance is +1/8", -0").

#### UL924 Sequence of Operation

For 90 minutes following any complete AC power interruption >200 ms:

- Digital dimming is commanded to high end trim level.
- Device ignores wireless lighting control commands.

## Accessories & Replacement Parts

Accessories: Order as separate catalog number.	
DGA24	Drywall grid adapter for 2x4 recessed fixture
2X4SMKSH PAF	Surface Mount Troffer Kit Post Paint
RK8BDP 2P U	Disconnect Plug (BDP), 2 Pole, Package of 1
RK8BDP 3P U	Disconnect Plug (BDP), 3 Pole, Package of 1
RK8BDP 2P J10	Disconnect Plug (BDP), 2 Pole, Package of 10
RK8BDP 2P J40	Disconnect Plug (BDP), 2 Pole, Package of 40

Replacement Parts: Order as separate catalog number.		
*249P2N	2DBLT48 ADP LENS ASSEMBLY	4 ft. replacement lens
*249P2T	2DBLT48 SDP LENS ASSEMBLY	4 ft. replacement lens
*249P30	2DBLT48 ADSM LENS ASSEMBLY	4 ft. replacement lens
*249P33	2DBLT48 SDSM LENS ASSEMBLY	4 ft. replacement lens
*237LT2	2DBLT48 ADPT LENS ASSEMBLY	4 ft. replacement lens
*237LT4	2DBLT48 SDPT LENS ASSEMBLY	4 ft. replacement lens
*237LT6	2DBLT48 ADSMT LENS ASSEMBLY	4 ft. replacement lens
*237LT8	2DBLT48 SDSMT LENS ASSEMBLY	4 ft. replacement lens
*237LTA	2DBLT48 ADPT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MS2	2DBLT48 SDPT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MSA	2DBLT48 ADSMT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MSL	2DBLT48 SDSMT SENSOR LENS ASSEMBLY	4 ft. replacement lens

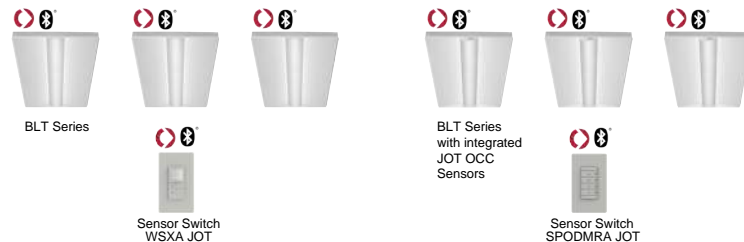
## JOT Wireless



#### Sensor Switch JOT Enabled Wireless Solution

Designed with contractors in mind, the Sensor Switch JOT enabled wireless solution offers a straightforward approach to the installation and pairing of lighting fixtures and controls. Absolutely no 0-10V control wires and no mobile apps are needed with JOT enabled products, allowing for lightning speed installation right out of the box.

- Power:** Install JOT enabled fixtures and controls as instructed.
- Pair:** Insert the pairing tool into the pinhole on the wall switch; press and hold any button for 6 seconds.
- Play:** Once paired, each fixture will individually dim down to 10% brightness. All products will be fully functional.



BLT-2X4

COMMERCIAL INDOOR: One Lithonia Way, Conyers, GA 30012 Phone: 800-705-SERV (7378) www.lithonia.com

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TYPE T1A

## 2BLT Volumetric Recessed Lighting 2'x4'

### nLight Platform

nLight embedded fixtures offer:	Customers get:
Manual Dimming	Convenience and visual comfort for occupants
Motion Sensing and/or Daylight Harvesting	Energy savings and code compliance
Fixture or Group Level Control	Ability to configure lighting to the space requirements
Flexibility	Ease of fixture moves, adds and changes
Wireless Wall Switch (nLight AIR Only)	Ease and flexibility of placement
Astronomical and Time of Day Scheduling	Energy savings and building security
Scalable Solution	nLight controls to grow with your business
Future-Ready	nLight platform to set foundation for future upgrades and capabilities

### nLight Air Wireless



#### Simple as 1,2,3

1. Install the nLight® AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CLAIRITY app, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome



### nLight Wired Networking



#### Simple as 1,2,3

1. Install the nLight® Wired fixtures with embedded control
2. Install the nLight Wired wall switch
3. Connect the fixtures using standard CAT5e cables and the devices will automatically discover each other and work (plug and play)



TYPE T1A

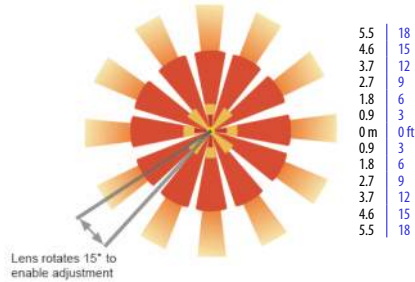
## 2BLT Volumetric Recessed Lighting 2'x4'

Sensor Options					
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking	nLight AIR Networking
		PIR	PDT		
MSD7ADCX	X	X			
MSDPDT7ADCX	X		X		
NES7		X		X	
NES7ADCX	X	X		X	
NESPDT7			X	X	
NESPDT7ADCX	X		X	X	
RES7	X	X			X
RESPDT7	X	X	X		X

### Sensor Coverage Pattern Mini 360° Lens

- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and
- 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor

#### 9 FT Mounting



### Integrated Sensor with Individual Control

The MSD7ADCX PIR occupancy sensor/automatic dimming photocell is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.

The MSDPDT7ADCX PIR/Microphonics Dual Tech occupancy sensor/automatic dimming photocell is ideal for areas with obstructions and where daylight harvesting is desired. Suggested applications include, but not limited to, open offices, private offices, classrooms, public restrooms, and conference rooms.

### nLight AIR Wireless

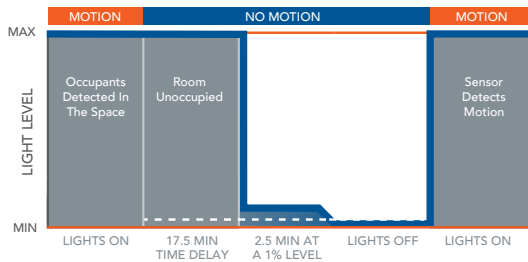
nLight AIR is the ideal solution for retrofit or new construction spaces where adding additional wiring can be labor intensive and nLight AIR is available with or without an integral sensor. The integrated rES7 or rES7PDT smart sensors are part of each luminaire in the nLight AIR network, which can be grouped to control multiple luminaires. The granularity of control with the digital PIR occupancy detection and daylight sensing makes a great solution for any application.

### nLight Wired Networking

The nES7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the nES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

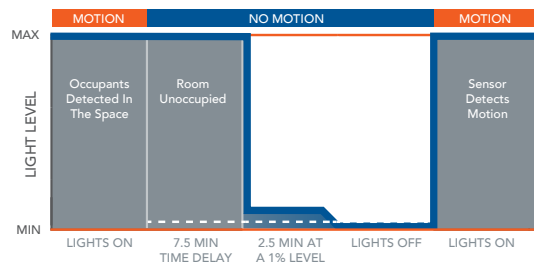
For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy. Additionally, the nESPDT7ADCX includes an integrated photocell, which enables daylight harvesting controls which is ideal for areas where windows are present.

### Sequence of Operation (MSD7 Sensor)



\*The presetting on the automatic dimming photocell is 5fc.

### Sequence of Operation (nES7 and rES7 and Sensor)



\*The presetting on the automatic dimming photocell is 5fc (NES7) and 10fc (RES7).

TYPE T1A

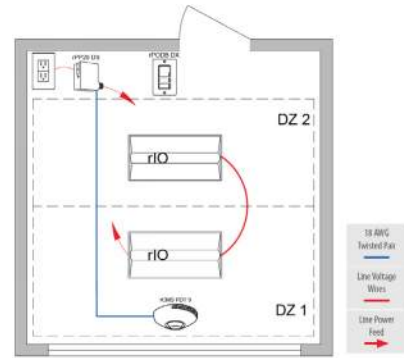
## 2BLT Volumetric Recessed Lighting 2'x4'

### Controls Accessories

<b>nLight® Wired Control Accessories:</b> <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlight">www.acuitybrands.com/products/controls/nlight</a>.</i>			
<b>WallPod stations</b>	<b>Model number</b>	<b>Occupancy sensors</b>	<b>Model number</b>
On/Off	nPODMA [Color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODMA DX [Color]	Large motion 360°, ceiling (PIR / dual tech)	nCM10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD TOUCH [Color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
<b>Photocell controls</b>	<b>Model number</b>	<b>Cat-5 cable (plenum rated)</b>	<b>Model number</b>
Full range dimming	nCM ADCX RJB	10' cable	CAT5 10FT J1
		30' cable	CAT5 30FT J1

<b>nLight® AIR Control Accessories:</b> <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlightair">www.acuitybrands.com/products/controls/nlightair</a>.</i>	
<b>Wall switches</b>	<b>Model number</b>
On/Off single pole	rPODBA [color] G2
On/Off two pole	rPODB A2P [color] G2
On/Off & raise/lower single pole	rPODBA DX [color] G2
On/Off & raise/lower two pole	rPODBA 2P DX [color] G2

BLT fixtures with integrated rIO devices complement any small office space. Pair them with an rCMS occupancy sensor and the space now has wireless occupancy sensing and dimming capability. For additional configuration options please consult with Tech Support.



rCMS <sup>1</sup>		Example: RCMS PDT 10 AR G2						
Series / Detection	Power Supply <sup>1</sup>	Occupancy Detection	Lens (Required)		Operating Mode		Generation	
RCMS nLight AIR occupancy and daylight sensor	[blank] Power Supply ordered separately PS 150 Standard 150 mA Power Supply	[blank] PIR Detection PDT Dual Tech PIR/Microphonics	10 Large Motion/ Extended Range 360°	9 Small Motion/ Extended Range 360°	6 High Bay 360° Lens	[BLANK] None AR Auxiliary Relay	G2	Generation 2 compatibility

**Notes**

<sup>1</sup> RCMS requires low voltage power from either RPP20 DS 24V G2 or PS150.

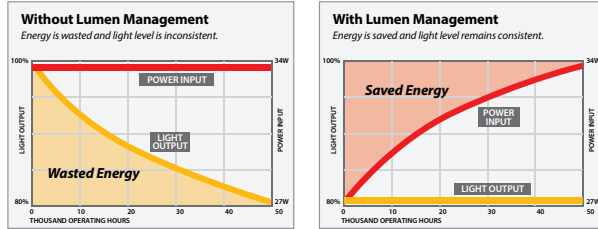


TYPE T1A

## 2BLT Volumetric Recessed Lighting 2'x4'

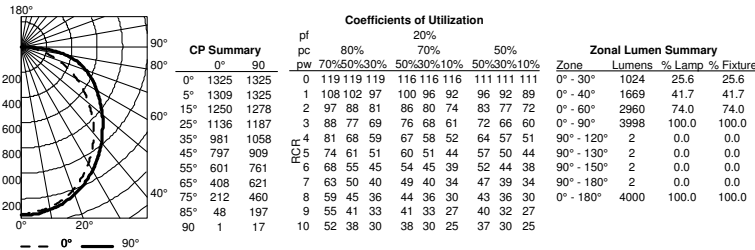
### Constant Lumen Management

Enabled by the embedded nLight control, the BLT actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.

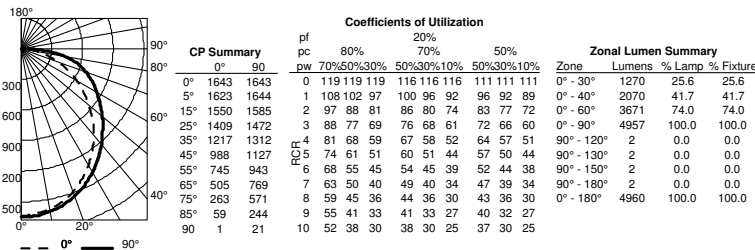


### PHOTOMETRICS

2BLT4 40L ADP LP835, 4000 delivered lumens, test no. ISF36900P109, tested in accordance to IESNA LM-79



2BLT4 48L ADP LP835, 4960 delivered lumens, test no. ISF 36900P117, tested in accordance to IESNA LM-79



TYPE T1A

## 2BLT Volumetric Recessed Lighting 2'x4'

Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT4 30L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	2962	127.31	23.26	Premium	PWJDEMHS
2BLT4 30L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3009.28	129.34	23.26	Premium	P18J5GLD
2BLT4 30L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	2969.16	127.62	23.26	Premium	P3HB2XSG
2BLT4 40L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4000	126.22	31.69	Premium	PDWKYXFD
2BLT4 40L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4063.86	128.23	31.69	Premium	PEYXAZWD
2BLT4 40L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3946.66	124.53	31.69	Premium	PS63CPK6
2BLT4 40L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4009.67	126.52	31.69	Premium	PK79UR9W
2BLT4 48L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4960	130.5	38	Premium	PJ9K6C1
2BLT4 48L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	5039.18	132.58	38	Premium	P9W2R5AK
2BLT4 48L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4893.86	128.76	38	Premium	PPFKZU3U
2BLT4 48L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4971.99	130.82	38	Premium	PC8HMC9
2BLT4 60L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	6016	126.39	47.59	Premium	PSJ6QERM
2BLT4 60L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	6112.04	128.4	47.59	Premium	PVXQXUV
2BLT4 60L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	5935.78	124.7	47.59	Premium	PHT84BW4
2BLT4 60L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	6030.55	126.69	47.59	Premium	PXV55BC8
2BLT4 72L ADP EZ1 (GZ10) LP840 [All Options]	7360.66	125.3	58.74	Premium	P5C22CB
2BLT4 72L ADP GZ1 LP835 [All Options]	7245	119.07	60.84	standard	PISHTCTS
2BLT4 72L ADP GZ1 LP840 [All Options]	7360.66	120.97	60.84	standard	PBERALG7
2BLT4 72L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	7148.4	117.48	60.84	standard	PDQ53CYK
2BLT4 72L ADPT EZ1 (GZ10) LP840 [All Options]	7262.52	123.63	58.74	Premium	P2KMMVN
2BLT4 72L ADPT GZ1 LP840 [All Options]	7262.52	119.36	60.84	standard	P10DUPC0
2BLT4 85L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	8567	116.43	73.58	standard	PYD2G06V
2BLT4 85L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	8703.77	118.28	73.58	standard	P8Z4IV4X
2BLT4 85L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	8452.77	114.87	73.58	standard	PTZEW3QM
2BLT4 85L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	8587.72	116.71	73.58	standard	P01DMEK9
2BLT4 100L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	9837	103.14	95.36	standard	PGDES20R
2BLT4 100L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	9994.04	104.79	95.36	standard	P007CHGX
2BLT4 100L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	9705.84	101.77	95.36	standard	PSZUQY7M
2BLT4 100L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	9860.79	103.39	95.36	standard	P6V6X6HY
2BLT4 120L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	11709	118.18	99.07	standard	PGM4Y7DP
2BLT4 120L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	11895.9	120.07	99.07	standard	POODDCG2
2BLT4 120L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	11552.9	116.61	99.07	standard	PXM0FS09
2BLT4 120L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	11737.3	118.47	99.07	standard	PJ4GEBZM

DLC information is subject to change, for the most up-to-date information please refer to [www.dlc.org](http://www.dlc.org). Above listings do not cover 347v or SLD.

### How to Estimate Delivered Lumens in Emergency Mode

Use the formula below to estimate the delivered lumens in emergency mode

$$\text{Delivered Lumens} = 1.25 \times P \times \text{LPW}$$

P = Output power of emergency driver, P = 10W for E10WLCP option.

LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet. LPW = Lumen per watt rating of the luminaire. LPW information available in Performance Data section.

HE Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT4 30LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	3107	135.17	22.98	Premium	P7KEICW5
2BLT4 30LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3156.6	137.33	22.98	Premium	PD0M06BH
2BLT4 30LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3065.57	133.37	22.98	Premium	P7PZAJDZ
2BLT4 30LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	3114.51	135.5	22.98	Premium	P2N23EBP
2BLT4 40LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4085	138.56	29.48	Premium	P67P65SY
2BLT4 40LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4150.21	140.77	29.48	Premium	P95UQD66
2BLT4 40LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4030.53	136.71	29.48	Premium	PC15DQEC
2BLT4 40LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4094.88	138.89	29.48	Premium	PGRC5J2T
2BLT4 48LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4770	138.16	34.52	Premium	PX8JBG8N
2BLT4 48LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4846.15	140.37	34.52	Premium	P5PQ5RRX
2BLT4 48LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4706.4	136.32	34.52	Premium	P2NK2H33
2BLT4 48LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4781.53	138.5	34.52	Premium	PK8C1321
2BLT4 60LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	5894	135.12	43.61	Premium	PQZN176R
2BLT4 60LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	5988.09	137.28	43.61	Premium	PG5CYJUC
2BLT4 60LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	5815.41	133.32	43.61	Premium	PZ72TAWM
2BLT4 60LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	5908.25	135.45	43.61	Premium	PRC4W72B
2BLT4 72LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	7149	135.94	52.58	Premium	PUB38GEQ
2BLT4 72LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	7263.13	138.11	52.58	Premium	P7GDHZTN
2BLT4 72LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	7053.68	134.12	52.58	Premium	P5CC2VKV
2BLT4 72LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	7166.29	136.26	52.58	Premium	P6P1BKDM
2BLT4 85LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	8158	128.96	63.25	Premium	PRTW6BXW
2BLT4 85LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	8288.24	131.02	63.25	Premium	PGH1V2D6
2BLT4 85LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	8049.22	127.24	63.25	Premium	P1VG5TA3
2BLT4 85LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	8177.73	129.27	63.25	Premium	PN5BKJ6E

DLC information is subject to change, for the most up-to-date information please refer to [www.dlc.org](http://www.dlc.org). Above listings do not cover 347v or SLD.



BLT-2X4





**DIGITAL NAVIGATION**  
[Ordering Tree](#)   [nLight Platform](#)   [Sensor Switch JOT](#)   [Photometrics](#)   [Performance Data](#)

## FEATURES & SPECIFICATIONS

**INTENDED USE** — The BLT Best-in-Value Low Profile LED luminaire features a popular center basket design that offers a clean, versatile style and volumetric distribution. High efficacy LED light engines deliver energy savings and low maintenance compared to traditional sources. An extensive selection of configurations and options make the BLT the perfect choice for many lighting applications including schools, offices and other commercial spaces, retail, hospitals and healthcare facilities. The low profile BLT design (2-3/8") also makes it an excellent choice for renovation projects.

**CONSTRUCTION** — Prior to fabrication, BLT components are coated with a proprietary paint blend and die-formed for dimensional consistency.

The BLT reflector is available in both smooth and ribbed finishes. Choose RB from the fixture style section below for a ribbed finish.

End plates contain easy-to-position integral T-bar clips for securely attaching the luminaire to the T-grid. For additional T-grid security, optional screw on T-bar clips are available.

Diffusers are extruded from impact modified acrylic for increased durability.

LED boards and drivers are accessible from the plenum.

**OPTICS** — Volumetric illumination is achieved by creating an optimal mix of light to walls, partitions and vertical and horizontal work surfaces – rendering the interior space, objects and occupants in a more balanced, complimentary luminous environment. High performance extruded acrylic diffusers conceal LEDs and efficiently deliver light in a volumetric distribution. Four diffuser choices available – curved and square designs with ribbed or a smooth frosted finish.

**ELECTRICAL** — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and quality of illumination for extended service life. 80% LED lumen maintenance at 60,000 hours (L80/60,000). Color Variation within 3-step MacAdam ellipse (3SDCM).

**Non-Configurable BLT:** Generic 0-10 volt dimming driver. Dims to 10%

**Configurable BLT:** available in High Efficiency (HE) versions for applications where a lower wattage (over the standard product) is required. The High Efficiency versions deliver >130 LPW and can be specified via the Lumen Package designations in the Ordering Information below.

eldoLED driver options deliver choice of dimming range, and choices for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Optional integrated nLight® controls make each luminaire addressable – allowing it to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Connection to nLight is simple. It can be accomplished with integrated nLight AIR wireless RIO, RES7 sensors, or through standard Cat-5 cabling. nLight offers unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission. nLight AIR is commissioned easily through an intuitive mobile app.

Lumen Management: Unique lumen management system (option N80) provides on board intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing the energy waste created by the traditional practice of over-lighting.

Step-level dimming option allows system to be switched to 50% power for compliance with common energy codes while maintaining fixture appearance.

**SENSOR** — Integrated sensor (**individual control**): Sensor Switch MSD7ADCX ((Passive infrared (PIR)) or MSDPDT7ADCX ((PIR/Microphonics Dual Tech (PDT))) integrated occupancy sensor/automatic dimming photocell allows the luminaire to power off when the space is unoccupied or enough ambient light is entering the space. See page 4 for more details on the integrated sensor.

**Integrated Sensor (nLight Wired Networking):** This sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired, using CAT-5 cabling, with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 4 for the nLight sensor options.

**Integrated Smart Sensor (nLight Air Wireless Platform):** The RES7 sensor is nLight AIR enabled, meaning it has the ability to communicate over the wireless nLight control platform. It is available with an automatic dimming photocell, and either a digital PIR or a microphonics (PDT) dual technology occupancy sensor. It pairs to other luminaires and wall switches through our mobile app, CLARITY, which allows for simple sensor adjustment. See page 4 for more details on the Integrated Smart Sensor.

**Integrated Wireless Sensor (single room control):** Sensor Switch VERTEX JOT or JOTVIX15 luminaire-embedded occupancy and ambient light sensor allows the luminaire to power off when the space is unoccupied or when enough ambient light is entering the space. See page X for more details on the integrated wireless sensor.

**INSTALLATION** — The BLT's low profile design of only 2-3/8" provides increased installation flexibility especially in restrictive plenum applications. The BLT fits into standard 15/16" and narrow 9/16" T-grid ceiling systems.

Suitable for damp location.

For recessed mounting in hard ceiling applications, Drywall Grid Adapters (DGA) are available as an accessory. See Accessories section.

**LISTINGS** — CSA Certified to meet U.S. and Canadian standards. IC rated. Tested in accordance with ISO 14644-1; suitable for ISO Class 5-9 positive and negative pressure clean rooms.

Designlights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at [www.designlights.org/QPL](http://www.designlights.org/QPL) to confirm which versions are qualified.

**BUY AMERICAN** — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.

**WARRANTY** — 5-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

**NOTE:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

TYPE T1B

Catalog Number
Notes
Type

BLT Series LED



ADP Diffuser Option

# 2BLT4

2' x 4'  
LED

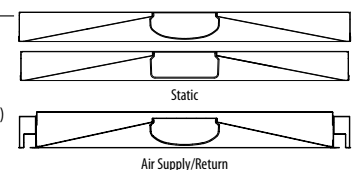


Ribbed Reflector Option



*Specifications*

- Length: 47-3/4 (121.2)
  - Width: 23-3/4 (60.3)
  - Depth: 2-3/8 (6.0)
  - Depth with Air supply/return: 2-3/4 (6.9)
- All dimensions are inches (centimeters) unless otherwise specified.



### Embed nLight controls today. Prepare for tomorrow.

Now	Tomorrow
User-friendly install	Scalability
Enhanced energy savings	Space configuration
Code compliance	Future-ready

### A+ Capable Luminaire

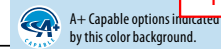
This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® control networks when ordered with drivers marked by a **shaded background**\*
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a **shaded background**\*

To learn more about A+, visit [www.acuitybrands.com/aplus](http://www.acuitybrands.com/aplus).

\*See ordering tree for details

2BLT Volumetric Recessed Lighting 2'x4'



TYPE T1B

ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: 2BLT4 40L ADP EZ1 LP840

Series	Fixture Style	Air function	Lumens ‡	Diffuser	Voltage	Driver	Color temperature
2BLT4 2x4 BLT	(blank) Smooth Reflector RB Ribbed Reflector	(blank) Static A Air supply/return ‡	Standard efficiency (>100 LPW) 30L 3000 40L 4000 48L 4800 60L 6000 72L 7200 85L 8500 100L 10000 120L 12000 High efficiency ‡ (>130 LPW) 30LHE 3000 40LHE 4000 48LHE 4800 60LHE 6000 72LHE 7200 85LHE 8500	ADP Curved, ribbed ADSM Curved, smooth SDP Square, ribbed SDSM Square, smooth Includes trim rings to match sensed version	(blank) MVOLT 120 120V 277 277V 347 347V ‡	EZ1 eldoLED dims to 1% (0-10 volt dimming) GZ1 Dims to 1% (0-10V dimming) ‡ GZ10 Dims to 10% (0-10V dimming) ‡ SLD Step-level dimming ‡	LP830 82CRI, 3000 K LP835 82CRI, 3500 K LP840 82CRI, 4000 K LP850 82CRI, 5000 K LP930 90CRI, 3000K LP935 90CRI, 3500K LP940 90CRI, 4000K LP950 90CRI, 5000K

nLight Interface	Control ‡	Individual Control
<b>nLight Wired</b> (blank) no nLight® interface N80 nLight with 80% lumen management N80EMG nLight with 80% lumen management For use with generator supply EM power ‡ N100 nLight without lumen management N100EMG nLight without lumen management For use with generator supply EM power ‡ <b>nLight Wireless</b> (blank) no nLight® interface NLTAIR2 nLight AIR Generation 2 enabled ‡	<b>nLight Wired ‡</b> (blank) No sensor control NES7 nLight™ nES 7 PIR integral occupancy sensor NESPD7 nLight™ nES PDT 7 dual technology integral occupancy control NES7ADCX nLight™ nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell NESPD7ADCX nLight™ nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell <b>nLight Wireless</b> RES7 nLight AIR PIR integral occupancy sensor with automatic dimming photocell for Networking Capabilities RES7PDT nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell RIO nLight AIR radio module without sensor RES7EM nLight AIR PIR integral occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RES7PDTEM nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RIOEM nLight AIR radio module less sensor, with UL924 Emergency Operation, via power interrupt detection ‡	<b>MSD7ADCX</b> PIR integral occupancy sensor with automatic dimming control photocell ‡ <b>MSDPDT7ADCX</b> PDT integral occupancy sensor with automatic dimming control photocell ‡ <b>JOT</b> Wireless room control with "Just One Touch" pairing ‡ <b>JOTVTX15</b> Wireless occupancy sensor with "Just One Touch" pairing ‡

Standy Mode	Options
NOC NOC Occupancy sensor disabled ‡	<b>BDP Disconnect Plug</b> EL7L 700 lumen battery pack (Noncompliant with CA T20) ‡ EL14L 1400 lumen battery pack (Noncompliant with CA T20) ‡ EL14LSD 1400 lumen battery pack with self-diagnostic testing feature (Noncompliant with CA T20) ‡ E10WLCP EM Self-Diagnostic battery pack, 10W Constant Power, Certified in CA Title 20 MAEDBS ‡ CP Chicago plenum ‡ BGTD Bodine Generator Transfer Device ‡ PWS1836 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit PWS1846 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuit PWS1846 PWSLV Two cables: one 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuits; one 6' pre-wire, 3/8" diameter, 18 gauge ‡ PWS1856LV 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit w/low voltage wires ‡ GLR Fast-blowing fuse ‡ GMF Slow-blowing fuse ‡ NPLT Narrow pallet RRL_ RELOC®-ready luminaire ‡ LATC Earthquake clip DWAM Anti-Microbial paint JP14 Job packaging ‡ JP18 Job packaging ‡ IP5X Gasketed diffuser compartment to meet IP5X rating ‡ BAA Buy America(n) Act Compliant

NOTE: ‡ indicates option value has ordering restrictions. Please reference the Option Value Ordering Restrictions chart on the next page. Options are sorted alphanumerically.

LUMINAIRE WITH "EM" DESIGNATION TO HAVE BATTERY PACK

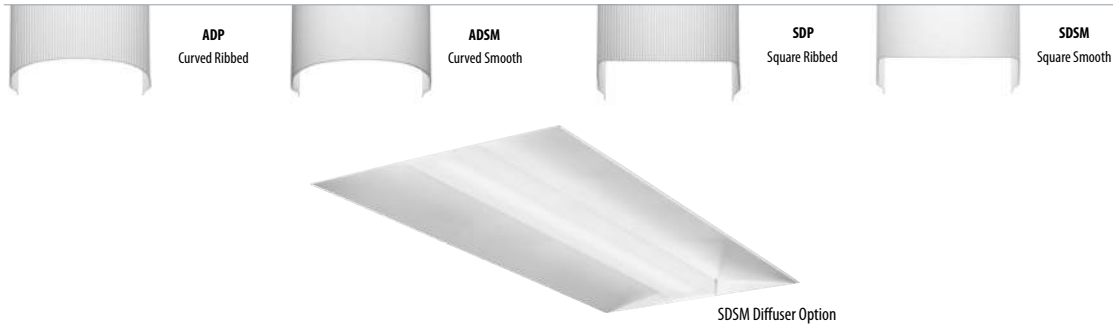
ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES

TYPE T1B

## 2BLT Volumetric Recessed Lighting 2'x4'

‡ Option Value Ordering Restrictions	
Option value	Restriction
347	Not available with SLD, EL7L, EL14L, or E10WLCP options.
A	Not available with RB fixture style, consult factory for air flow data.
BGTD	Not available with TD, JOT, JOTVTX15 sensor options or emergency battery options. Must specify voltage. Requires BSE labeling, voltage specific. Consult factory for options. Example: BGTD BSE10.
Controls	Must specify diffuser with trim rings.
CP	Not available with N80, N80EMG, N100, or N100EMG.
GZ1, GZ10	Not available with any Control or Sensor options except JOT & JOTVTX15
EL14LSD, E10WLCP, EL7L, EL14L	When using pre-wire option, use PWS1846 or PWS1846 PWSLV. For more information, please see the <a href="#">PSSD2 specification sheet</a> .
FAO	EZ1 driver required. Not available with USPOM, FAO or lumen packages > 6000LM. FAO restricts use of external Dimming controls. See chart on page 3 for additional details.
GLR, GMF	Must specify voltage. 120 or 277, with GLR and GMF fusing.
IP5X	Not available with air supply/return or Wired Networking (NES_) and Individual Control (MSD_) sensors.
JOT, JOTVTX15	Not available with standard efficiency 85L, 100L or 120L lumen options. Not available with SLD, nLight, NLTAIR2, NOC, or BGTD options.
JP14	Only available on fixtures with NES7, NESPDT7, NESPDT7ADCX, MSD7ADCX, MSDPDT7ADCX, RES7, RES7PDT, RIO, JOT, JOTVTX15. Not available when air supply/return function and sensor options are combined.
JP18	Not available with option: NES7, NESPDT7, NESPDT7ADCX, MSD7ADCX, MSDPDT7ADCX, RES7, RES7PDT, RIO, JOT, JOTVTX15.
Lumens	Approximate lumen output. For high Efficiency, all versions may not achieve 130+ LPW. Refer to photometry on <a href="http://www.acuitybrands.com">www.acuitybrands.com</a> . Air supply/return option, 90 CRI, and versions with integral sensor trim rings may not achieve 130 LPW.
MSD7ADCX, MSDPDT7ADCX	Only available with EZ1 driver option. 0-10v dimming wires not accessible via access plate.
NES7, NESPDT7, NES7ADCX, NESPDT7ADCX	Requires N80, N80EMG, N100, or N100EMG. Only available with EZ1 driver.
NLTAIR2	Must order with nLight Wireless option from Control section. Only available with EZ1 driver. Not available with 85L, 100L, or 120L options.
NOC	Can only be ordered in conjunction with EZ1, NLTAIR2, RES7/RES7PDT. Occupancy sensor disabled at factory but can be re-enabled upon commissioning.
N80EMG, N100EMG	nLight EMG option requires a connection to existing nLight network. Power is provided from a separate N80 or N100 enabled fixture.
RES7EM, RES7PDTEM, RIOEM	See UL924 Sequence of Operation chart on page 4. Not available with 72L, 72LHE, or 85LHE lumen packages.
RRL	For ordering logic consult: <a href="#">RRL_2013</a> .
SLD	Not available with any nLight Interface or Control options.

### Multiple Diffuser Options



TYPE T1B

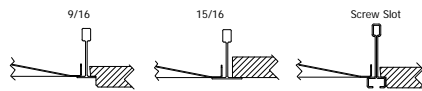
## 2BLT Volumetric Recessed Lighting 2'x4'

### Non-Configurable BLT

Non-Configurable BLT								
Stock/MTO	Catalog Description *	UPC	Lumens	Wattage	LPW	Color Temperature	Voltage	Pallet Qty
Stock	2BLT4 40L ADP LP835	00190887470789	4000	31.69	126.22	3500K/82 CRI	120-277	28
	2BLT4 40L ADP LP840	00190887470765	4063	31.69	128.23	4000K/82CRI	120-277	28
	2BLT4 46L ADP LP835	00190887468656	4960	38	130.5	3500K/82 CRI	120-277	28
	2BLT4 46L ADP LP840	00190887468649	5039.18	38	132.58	4000K/82CRI	120-277	28
	2BLT4 40L ADP EL14L LP835	00190887470925	4000	31.69	126.22	3500K/82 CRI	120-277	28
	2BLT4 40L ADP EL14L LP840	00190887470918	4063	31.69	128.23	4000K/82 CRI	120-277	28
	2BLT4 46L ADP EL14L LP835	00190887468670	4960	38	130.5	3500K/82 CRI	120-277	28
	2BLT4 46L ADP EL14L LP840	00190887468663	5039.18	38	132.58	4000K/82 CRI	120-277	28

\*Generic 0-10V Dimming to 10%.

MOUNTING DATA	
Ceiling Type	Appropriate Trim Type
Exposed grid tee (1' and 9/16")	G
Concealed grid tee	G
Plaster or plasterboard	G*



\*DGA accessory available to provide ceiling trim flange and fixture support for plaster or plasterboard ceiling. Recommended rough-in dimensions for DGA installation is 24-3/4" x 24-3/4" (Tolerance is +1/8", -0").

UL924 Sequence of Operation
For 90 minutes following any complete AC power interruption >200 ms:
<ul style="list-style-type: none"> <li>Digital dimming is commanded to high end trim level.</li> <li>Device ignores wireless lighting control commands.</li> </ul>

## Accessories & Replacement Parts

Accessories: Order as separate catalog number.	
DGA24	Drywall grid adapter for 2x4 recessed fixture
2X4SMKSH PAF	Surface Mount Troffer Kit Post Paint
RK8BDP 2P U	Disconnect Plug (BDP), 2 Pole, Package of 1
RK8BDP 3P U	Disconnect Plug (BDP), 3 Pole, Package of 1
RK8BDP 2P J10	Disconnect Plug (BDP), 2 Pole, Package of 10
RK8BDP 2P J40	Disconnect Plug (BDP), 2 Pole, Package of 40

Replacement Parts: Order as separate catalog number.		
*249P2N	2DBLT48 ADP LENS ASSEMBLY	4 ft. replacement lens
*249P2T	2DBLT48 SDP LENS ASSEMBLY	4 ft. replacement lens
*249P30	2DBLT48 ADSM LENS ASSEMBLY	4 ft. replacement lens
*249P33	2DBLT48 SDSM LENS ASSEMBLY	4 ft. replacement lens
*237LT2	2DBLT48 ADPT LENS ASSEMBLY	4 ft. replacement lens
*237LT4	2DBLT48 SDPT LENS ASSEMBLY	4 ft. replacement lens
*237LT6	2DBLT48 ADSMT LENS ASSEMBLY	4 ft. replacement lens
*237LT8	2DBLT48 SDSMT LENS ASSEMBLY	4 ft. replacement lens
*237LTA	2DBLT48 ADPT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MS2	2DBLT48 SDPT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MSA	2DBLT48 ADSMT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MSL	2DBLT48 SDSMT SENSOR LENS ASSEMBLY	4 ft. replacement lens

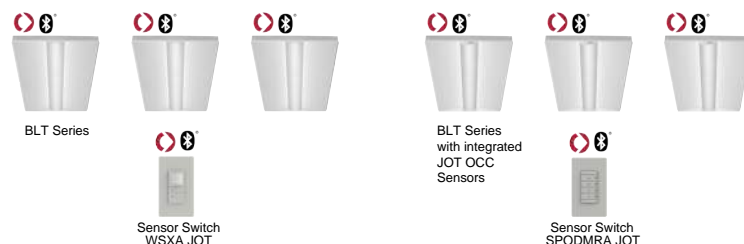
## JOT Wireless



### Sensor Switch JOT Enabled Wireless Solution

Designed with contractors in mind, the Sensor Switch JOT enabled wireless solution offers a straightforward approach to the installation and pairing of lighting fixtures and controls. Absolutely no 0-10V control wires and no mobile apps are needed with JOT enabled products, allowing for lightning speed installation right out of the box.

- Power:** Install JOT enabled fixtures and controls as instructed.
- Pair:** Insert the pairing tool into the pinhole on the wall switch; press and hold any button for 6 seconds.
- Play:** Once paired, each fixture will individually dim down to 10% brightness. All products will be fully functional.



BLT-2X4

TYPE T1B

## 2BLT Volumetric Recessed Lighting 2'x4'

### nLight Platform

nLight embedded fixtures offer:	Customers get:
Manual Dimming	Convenience and visual comfort for occupants
Motion Sensing and/or Daylight Harvesting	Energy savings and code compliance
Fixture or Group Level Control	Ability to configure lighting to the space requirements
Flexibility	Ease of fixture moves, adds and changes
Wireless Wall Switch (nLight AIR Only)	Ease and flexibility of placement
Astronomical and Time of Day Scheduling	Energy savings and building security
Scalable Solution	nLight controls to grow with your business
Future-Ready	nLight platform to set foundation for future upgrades and capabilities

### nLight Air Wireless



#### Simple as 1,2,3

1. Install the nLight<sup>®</sup> AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CLAIRITY app, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome



### nLight Wired Networking



#### Simple as 1,2,3

1. Install the nLight<sup>®</sup> Wired fixtures with embedded control
2. Install the nLight Wired wall switch
3. Connect the fixtures using standard CAT5e cables and the devices will automatically discover each other and work (plug and play)



TYPE T1B

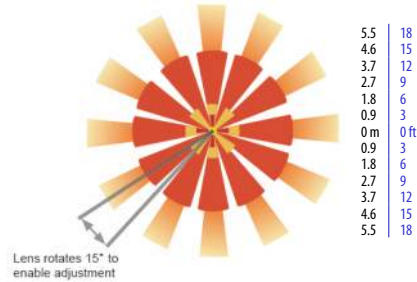
## 2BLT Volumetric Recessed Lighting 2'x4'

Sensor Options					
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking	nLight AIR Networking
		PIR	PDT		
MSD7ADCX	X	X			
MSDPDT7ADCX	X		X		
NES7		X		X	
NES7ADCX	X	X		X	
NESPDT7			X	X	
NESPDT7ADCX	X		X	X	
RES7	X	X			X
RESPDT7	X	X	X		X

### Sensor Coverage Pattern Mini 360° Lens

- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and
- 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor

#### 9 FT Mounting



### Integrated Sensor with Individual Control

The MSD7ADCX PIR occupancy sensor/automatic dimming photocell is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.

The MSDPDT7ADCX PIR/Microphonics Dual Tech occupancy sensor/automatic dimming photocell is ideal for areas with obstructions and where daylight harvesting is desired. Suggested applications include, but not limited to, open offices, private offices, classrooms, public restrooms, and conference rooms.

### nLight AIR Wireless

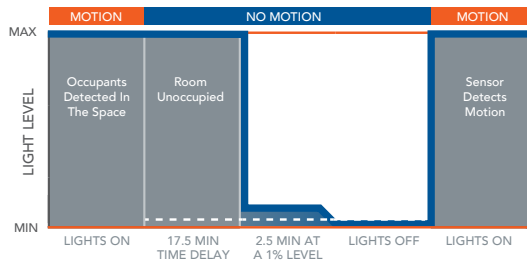
nLight AIR is the ideal solution for retrofit or new construction spaces where adding additional wiring can be labor intensive and nLight AIR is available with or without an integral sensor. The integrated rES7 or rES7PDT smart sensors are part of each luminaire in the nLight AIR network, which can be grouped to control multiple luminaires. The granularity of control with the digital PIR occupancy detection and daylight sensing makes a great solution for any application.

### nLight Wired Networking

The nES7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the nES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

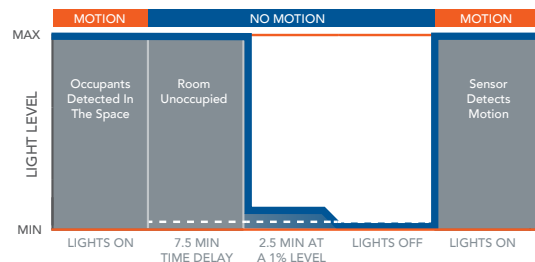
For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy. Additionally, the nESPDT7ADCX includes an integrated photocell, which enables daylight harvesting controls which is ideal for areas where windows are present.

### Sequence of Operation (MSD7 Sensor)



\*The presetting on the automatic dimming photocell is 5fc.

### Sequence of Operation (nES7 and rES7 and Sensor)



\*The presetting on the automatic dimming photocell is 5fc (NES7) and 10fc (RES7).

TYPE T1B

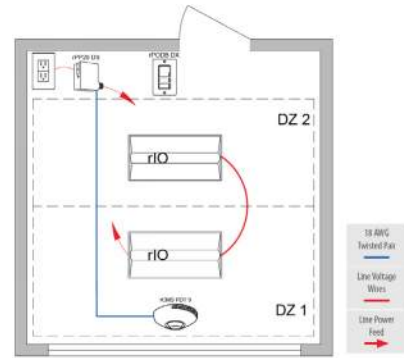
## 2BLT Volumetric Recessed Lighting 2'x4'

### Controls Accessories

<b>nLight® Wired Control Accessories:</b> <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlight">www.acuitybrands.com/products/controls/nlight</a>.</i>			
<b>WallPod stations</b>	<b>Model number</b>	<b>Occupancy sensors</b>	<b>Model number</b>
On/Off	nPODMA [Color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODMA DX [Color]	Large motion 360°, ceiling (PIR / dual tech)	nCM10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD TOUCH [Color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
<b>Photocell controls</b>	<b>Model number</b>	<b>Cat-5 cable (plenum rated)</b>	<b>Model number</b>
Full range dimming	nCM ADCX RJB	10' cable	CATS 10FT J1
		30' cable	CATS 30FT J1

<b>nLight® AIR Control Accessories:</b> <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlightair">www.acuitybrands.com/products/controls/nlightair</a>.</i>	
<b>Wall switches</b>	<b>Model number</b>
On/Off single pole	rPODBA [color] G2
On/Off two pole	rPODB A2P [color] G2
On/Off & raise/lower single pole	rPODBA DX [color] G2
On/Off & raise/lower two pole	rPODBA 2P DX [color] G2

BLT fixtures with integrated rIO devices complement any small office space. Pair them with an rCMS occupancy sensor and the space now has wireless occupancy sensing and dimming capability. For additional configuration options please consult with Tech Support.



rCMS <sup>1</sup>		Example: RCMS PDT 10 AR G2						
Series / Detection	Power Supply <sup>1</sup>	Occupancy Detection	Lens (Required)		Operating Mode		Generation	
RCMS nLight AIR occupancy and daylight sensor	[blank] Power Supply ordered separately PS 150 Standard 150 mA Power Supply	[blank] PIR Detection PDT Dual Tech PIR/ Microphonics	10	Large Motion/ Extended Range 360°	[BLANK]	None	G2	Generation 2 compatibility
			9	Small Motion/ Extended Range 360°	AR	Auxiliary Relay		
			6	High Bay 360° Lens				

**Notes**

<sup>1</sup> RCMS requires low voltage power from either RPP20 DS 24V G2 or PS150.

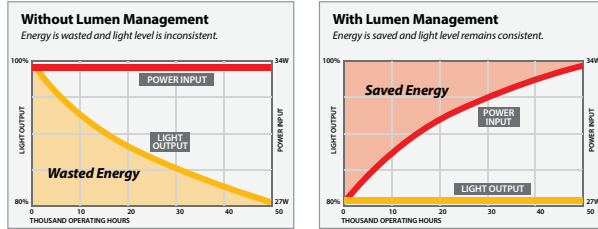


TYPE T1B

## 2BLT Volumetric Recessed Lighting 2'x4'

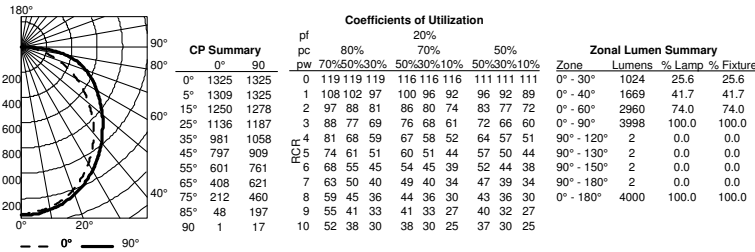
### Constant Lumen Management

Enabled by the embedded nLight control, the BLT actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.

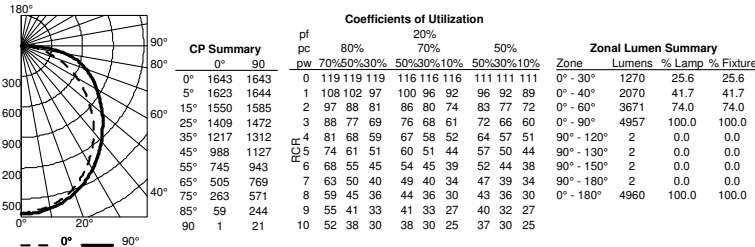


### PHOTOMETRICS

2BLT4 40L ADP LP835, 4000 delivered lumens, test no. ISF36900P109, tested in accordance to IESNA LM-79



2BLT4 48L ADP LP835, 4960 delivered lumens, test no. ISF 36900P117, tested in accordance to IESNA LM-79





TYPE T1B

## 2BLT Volumetric Recessed Lighting 2'x4'

Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT4 30L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	2962	127.31	23.26	Premium	PWJDEMH5
2BLT4 30L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3009.28	129.34	23.26	Premium	P18J5GLD
2BLT4 30L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	2969.16	127.62	23.26	Premium	P3HB2XSG
2BLT4 40L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4000	126.22	31.69	Premium	PDWKYXFD
2BLT4 40L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4063.86	128.23	31.69	Premium	PEYXAZWD
2BLT4 40L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3946.66	124.53	31.69	Premium	PS63CPK6
2BLT4 40L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4009.67	126.52	31.69	Premium	PK79UR9W
2BLT4 48L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4960	130.5	38	Premium	PJ9K6C1
2BLT4 48L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	5039.18	132.58	38	Premium	P9W2R5AK
2BLT4 48L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4893.86	128.76	38	Premium	PPFKZU3U
2BLT4 48L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4971.99	130.82	38	Premium	PC8HMC9
2BLT4 60L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	6016	126.39	47.59	Premium	PSJ6QERM
2BLT4 60L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	6112.04	128.4	47.59	Premium	PVXQXUV
2BLT4 60L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	5935.78	124.7	47.59	Premium	PHT84BW4
2BLT4 60L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	6030.55	126.69	47.59	Premium	PXV55BC8
2BLT4 72L ADP EZ1 (GZ10) LP840 [All Options]	7360.66	125.3	58.74	Premium	P5C22CB
2BLT4 72L ADP GZ1 LP835 [All Options]	7245	119.07	60.84	standard	PISHTCTS
2BLT4 72L ADP GZ1 LP840 [All Options]	7360.66	120.97	60.84	standard	PBERALG7
2BLT4 72L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	7148.4	117.48	60.84	standard	PDQ53CYK
2BLT4 72L ADPT EZ1 (GZ10) LP840 [All Options]	7262.52	123.63	58.74	Premium	P2KKMMVN
2BLT4 72L ADPT GZ1 LP840 [All Options]	7262.52	119.36	60.84	standard	P10DUPC0
2BLT4 85L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	8567	116.43	73.58	standard	PYD2G06V
2BLT4 85L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	8703.77	118.28	73.58	standard	P8Z41V4X
2BLT4 85L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	8452.77	114.87	73.58	standard	PTZEW3QM
2BLT4 85L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	8587.72	116.71	73.58	standard	P01DMEK9
2BLT4 100L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	9837	103.14	95.36	standard	PGDES20R
2BLT4 100L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	9994.04	104.79	95.36	standard	P007CHGX
2BLT4 100L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	9705.84	101.77	95.36	standard	PSZUQY7M
2BLT4 100L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	9860.79	103.39	95.36	standard	P6V6X6HY
2BLT4 120L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	11709	118.18	99.07	standard	PGM4Y7DP
2BLT4 120L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	11895.9	120.07	99.07	standard	POODDCG2
2BLT4 120L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	11552.9	116.61	99.07	standard	PXM0FS09
2BLT4 120L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	11737.3	118.47	99.07	standard	PJ4GEBZM

DLC information is subject to change, for the most up-to-date information please refer to [www.dlc.org](http://www.dlc.org). Above listings do not cover 347v or SLD.

### How to Estimate Delivered Lumens in Emergency Mode

Use the formula below to estimate the delivered lumens in emergency mode

$$\text{Delivered Lumens} = 1.25 \times P \times \text{LPW}$$

P = Output power of emergency driver, P = 10W for E10WLCP option.

LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet. LPW = Lumen per watt rating of the luminaire. LPW information available in Performance Data section.

HE Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT4 30LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	3107	135.17	22.98	Premium	P7KEICW5
2BLT4 30LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3156.6	137.33	22.98	Premium	PD0M06BH
2BLT4 30LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3065.57	133.37	22.98	Premium	P7PZAJDZ
2BLT4 30LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	3114.51	135.5	22.98	Premium	P2N23EBP
2BLT4 40LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4085	138.56	29.48	Premium	P67P65SY
2BLT4 40LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4150.21	140.77	29.48	Premium	P95UQD66
2BLT4 40LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4030.53	136.71	29.48	Premium	PC15DQEC
2BLT4 40LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4094.88	138.89	29.48	Premium	PGRC5J2T
2BLT4 48LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4770	138.16	34.52	Premium	PX8JBG8N
2BLT4 48LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4846.15	140.37	34.52	Premium	P5PQ5RRX
2BLT4 48LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4706.4	136.32	34.52	Premium	P2NK2H33
2BLT4 48LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4781.53	138.5	34.52	Premium	PK8C1321
2BLT4 60LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	5894	135.12	43.61	Premium	PQZN176R
2BLT4 60LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	5988.09	137.28	43.61	Premium	PG5CYJUC
2BLT4 60LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	5815.41	133.32	43.61	Premium	PZ72TAWM
2BLT4 60LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	5908.25	135.45	43.61	Premium	PRC4W72B
2BLT4 72LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	7149	135.94	52.58	Premium	PUB38GEQ
2BLT4 72LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	7263.13	138.11	52.58	Premium	P7GDHZTN
2BLT4 72LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	7053.68	134.12	52.58	Premium	P5CC2VKV
2BLT4 72LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	7166.29	136.26	52.58	Premium	P6P1BKDM
2BLT4 85LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	8158	128.96	63.25	Premium	PRTW6BXW
2BLT4 85LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	8288.24	131.02	63.25	Premium	PGH1V2D6
2BLT4 85LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	8049.22	127.24	63.25	Premium	P1VG5TA3
2BLT4 85LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	8177.73	129.27	63.25	Premium	PN5BKJ6E

DLC information is subject to change, for the most up-to-date information please refer to [www.dlc.org](http://www.dlc.org). Above listings do not cover 347v or SLD.



BLT-2X4



**DIGITAL NAVIGATION**  
[Ordering Tree](#)   [nLight Platform](#)   [Sensor Switch JOT](#)   [Photometrics](#)   [Performance Data](#)

## FEATURES & SPECIFICATIONS

**INTENDED USE** — The BLT Best-in-Value Low Profile LED luminaire features a popular center basket design that offers a clean, versatile style and volumetric distribution. High efficacy LED light engines deliver energy savings and low maintenance compared to traditional sources. An extensive selection of configurations and options make the BLT the perfect choice for many lighting applications including schools, offices and other commercial spaces, retail, hospitals and healthcare facilities. The low profile BLT design (2-3/8") also makes it an excellent choice for renovation projects.

**CONSTRUCTION** — Prior to fabrication, BLT components are coated with a proprietary paint blend and die-formed for dimensional consistency.

The BLT reflector is available in both smooth and ribbed finishes. Choose RB from the fixture style section below for a ribbed finish.

End plates contain easy-to-position integral T-bar clips for securely attaching the luminaire to the T-grid. For additional T-grid security, optional screw on T-bar clips are available.

Diffusers are extruded from impact modified acrylic for increased durability.

LED boards and drivers are accessible from the plenum.

**OPTICS** — Volumetric illumination is achieved by creating an optimal mix of light to walls, partitions and vertical and horizontal work surfaces – rendering the interior space, objects and occupants in a more balanced, complimentary luminous environment. High performance extruded acrylic diffusers conceal LEDs and efficiently deliver light in a volumetric distribution. Four diffuser choices available – curved and square designs with ribbed or a smooth frosted finish.

**ELECTRICAL** — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and quality of illumination for extended service life. 80% LED lumen maintenance at 60,000 hours (L80/60,000). Color Variation within 3-step MacAdam ellipse (3SDCM).

**Non-Configurable BLT:** Generic 0-10 volt dimming driver. Dims to 10%

**Configurable BLT:** available in High Efficiency (HE) versions for applications where a lower wattage (over the standard product) is required. The High Efficiency versions deliver >130 LPW and can be specified via the Lumen Package designations in the Ordering Information below.

eldoLED driver options deliver choice of dimming range, and choices for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Optional integrated nLight® controls make each luminaire addressable – allowing it to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Connection to nLight is simple. It can be accomplished with integrated nLight AIR wireless RIO, RES7 sensors, or through standard Cat-5 cabling. nLight offers unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission. nLight AIR is commissioned easily through an intuitive mobile app.

Lumen Management: Unique lumen management system (option N80) provides on board intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing the energy waste created by the traditional practice of over-lighting.

Step-level dimming option allows system to be switched to 50% power for compliance with common energy codes while maintaining fixture appearance.

**SENSOR** — **Integrated sensor (individual control):** Sensor Switch MSD7ADCX ((Passive infrared (PIR)) or MSDPDT7ADCX ((PIR/Microphonics Dual Tech (PDT))) integrated occupancy sensor/automatic dimming photocell allows the luminaire to power off when the space is unoccupied or enough ambient light is entering the space. See page 4 for more details on the integrated sensor.

**Integrated Sensor (nLight Wired Networking):** This sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired, using CAT-5 cabling, with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 4 for the nLight sensor options.

**Integrated Smart Sensor (nLight Air Wireless Platform):** The RES7 sensor is nLight AIR enabled, meaning it has the ability to communicate over the wireless nLight control platform. It is available with an automatic dimming photocell, and either a digital PIR or a microphonics (PDT) dual technology occupancy sensor. It pairs to other luminaires and wall switches through our mobile app, CLAIRITY, which allows for simple sensor adjustment. See page 4 for more details on the Integrated Smart Sensor.

**Integrated Wireless Sensor (single room control):** Sensor Switch VERTEX JOT or JOTVIX15 luminaire-embedded occupancy and ambient light sensor allows the luminaire to power off when the space is unoccupied or when enough ambient light is entering the space. See page X for more details on the integrated wireless sensor.

**INSTALLATION** — The BLT's low profile design of only 2-3/8" provides increased installation flexibility especially in restrictive plenum applications. The BLT fits into standard 15/16" and narrow 9/16" T-grid ceiling systems.

Suitable for damp location.

For recessed mounting in hard ceiling applications, Drywall Grid Adapters (DGA) are available as an accessory. See Accessories section.

**LISTINGS** — CSA Certified to meet U.S. and Canadian standards. IC rated. Tested in accordance with ISO 14644-1; suitable for ISO Class 5-9 positive and negative pressure clean rooms.

Designlights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at [www.designlights.org/QPL](http://www.designlights.org/QPL) to confirm which versions are qualified.

**BUY AMERICAN** — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.

**WARRANTY** — 5-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

**NOTE:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

TYPE T1C

Catalog Number
Notes
Type



ADP Diffuser Option      2' x 4' LED

Buy American      JUST ONE TOUCH

*Specifications*

Length: 47-3/4 (121.2)	
Width: 23-3/4 (60.3)	
Depth: 2-3/8 (6.0)	
Depth with Air supply/return: 2-3/4 (6.9)	

All dimensions are inches (centimeters) unless otherwise specified.

**Embed nLight controls today. Prepare for tomorrow.**

Now	Tomorrow
User-friendly install	Scalability
Enhanced energy savings	Space configuration
Code compliance	Future-ready

**A+ Capable Luminaire**

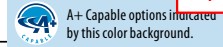
This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® control networks when ordered with drivers marked by a **shaded background\***
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a **shaded background\***

To learn more about A+, visit [www.acuitybrands.com/aplus](http://www.acuitybrands.com/aplus).

\*See ordering tree for details

2BLT Volumetric Recessed Lighting 2'x4'



TYPE T1C

ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: 2BLT4 40L ADP EZ1 LP840

Series	Fixture Style	Air function	Lumens ‡	Diffuser	Voltage	Driver	Color temperature
2BLT4 2x4 BLT	(blank) Smooth Reflector RB Ribbed Reflector	(blank) Static A Air supply/return ‡	Standard efficiency (>100 LPW) 30L 3000 40L 4000 48L 4800 60L 6000 72L 7200 85L 8500 100L 10000 120L 12000 High efficiency (>130 LPW) 30LHE 3000 40LHE 4000 48LHE 4800 60LHE 6000 72LHE 7200 85LHE 8500	ADP Curved, ribbed ADSM Curved, smooth SDP Square, ribbed SDSM Square, smooth Includes trim rings to match sensed version	(blank) MVOLT 120 120V 277 277V 347 347V ‡	EZ1 eldoLED dims to 1% (0-10 volt dimming) GZ1 Dims to 1% (0-10V dimming) ‡ GZ10 Dims to 10% (0-10V dimming) ‡ SLD Step-level dimming ‡	LP830 82CRI, 3000 K LP835 82CRI, 3500 K LP840 82CRI, 4000 K LP850 82CRI, 5000 K LP930 90CRI, 3000K LP935 90CRI, 3500K LP940 90CRI, 4000K LP950 90CRI, 5000K

nLight Interface	Control ‡	Individual Control
<b>nLight Wired</b> (blank) no nLight® interface N80 nLight with 80% lumen management N80EMG nLight with 80% lumen management For use with generator supply EM power ‡ N100 nLight without lumen management N100EMG nLight without lumen management For use with generator supply EM power ‡ <b>nLight Wireless</b> (blank) no nLight® interface NLTAIR2 nLight AIR Generation 2 enabled ‡	<b>nLight Wired ‡</b> (blank) No sensor control NES7 nLight™ nES 7 PIR integral occupancy sensor NESPD7 nLight™ nES PDT 7 dual technology integral occupancy control NES7ADCX nLight™ nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell NESPD7ADCX nLight™ nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell <b>nLight Wireless</b> RES7 nLight AIR PIR integral occupancy sensor with automatic dimming photocell for Networking Capabilities RES7PDT nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell RIO nLight AIR radio module without sensor RES7EM nLight AIR PIR integral occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RES7PDTEM nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RIOEM nLight AIR radio module less sensor, with UL924 Emergency Operation, via power interrupt detection ‡	<b>MSD7ADCX</b> PIR integral occupancy sensor with automatic dimming control photocell ‡ <b>MSDPDT7ADCX</b> PDT integral occupancy sensor with automatic dimming control photocell ‡ <b>JOT</b> Wireless room control with "Just One Touch" pairing ‡ <b>JOTVTX15</b> Wireless occupancy sensor with "Just One Touch" pairing ‡

Standby Mode	Options
NOC NOC Occupancy sensor disabled ‡	<b>BDP Disconnect Plug</b> EL7L 700 lumen battery pack (Noncompliant with CA T20) ‡ EL14L 1400 lumen battery pack (Noncompliant with CA T20) ‡ EL14LSD 1400 lumen battery pack with self-diagnostic testing feature (Noncompliant with CA T20) ‡ E10WLCP EM Self-Diagnostic battery pack, 10W Constant Power, Certified in CA Title 20 MAEDBS ‡ CP Chicago plenum ‡ BGTD Bodine Generator Transfer Device ‡ PWS1836 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit PWS1846 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuit PWS1846 PWSLV Two cables: one 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuits; one 6' pre-wire, 3/8" diameter, 18 gauge ‡ PWS1856LV 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit w/low voltage wires ‡ GLR Fast-blowing fuse ‡ GMF Slow-blowing fuse ‡ NPLT Narrow pallet RRL_ RELOC®-ready luminaire ‡ LATC Earthquake clip DWAM Anti-Microbial paint JP14 Job packaging ‡ JP18 Job packaging ‡ IP5X Gasketed diffuser compartment to meet IP5X rating ‡ BAA Buy America(n) Act Compliant

NOTE: ‡ indicates option value has ordering restrictions. Please reference the Option Value Ordering Restrictions chart on the next page. Options are sorted alphanumerically.

LUMINAIRES WITH "EM" DESIGNATION TO HAVE BATTERY PACK

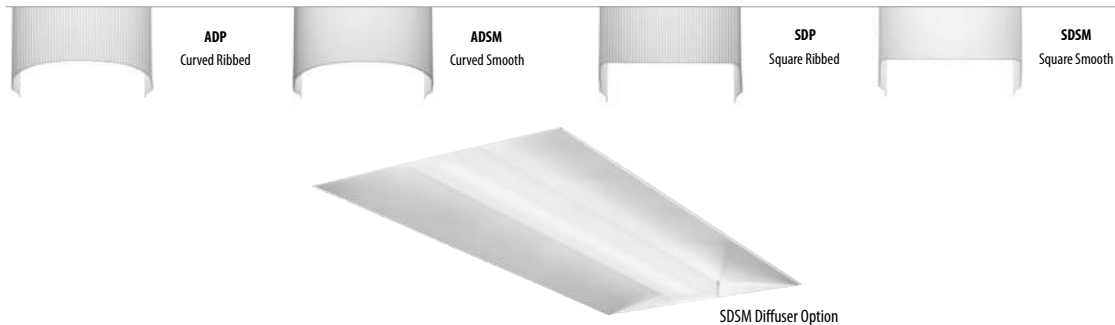
ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES

TYPE T1C

## 2BLT Volumetric Recessed Lighting 2'x4'

‡ Option Value Ordering Restrictions	
Option value	Restriction
347	Not available with SLD, EL7L, EL14L, or E10WLCP options.
A	Not available with RB fixture style, consult factory for air flow data.
BGTD	Not available with TD, JOT, JOTVTX15 sensor options or emergency battery options. Must specify voltage. Requires BSE labeling, voltage specific. Consult factory for options. Example: BGTD BSE10.
Controls	Must specify diffuser with trim rings.
CP	Not available with N80, N80EMG, N100, or N100EMG.
GZ1, GZ10	Not available with any Control or Sensor options except JOT & JOTVTX15
EL14LSD, E10WLCP, EL7L, EL14L	When using pre-wire option, use PWS1846 or PWS1846 PWSLV. For more information, please see the <a href="#">PSSD2 specification sheet</a> .
FAO	EZ1 driver required. Not available with USPOM, FAO or lumen packages > 6000LM. FAO restricts use of external Dimming controls. See chart on page 3 for additional details.
GLR, GMF	Must specify voltage. 120 or 277, with GLR and GMF fusing.
IP5X	Not available with air supply/return or Wired Networking (NES_) and Individual Control (MSD_) sensors.
JOT, JOTVTX15	Not available with standard efficiency 85L, 100L or 120L lumen options. Not available with SLD, nLight, NLTAIR2, NOC, or BGTD options.
JP14	Only available on fixtures with NES7, NESPDT7, NESPDT7ADCX, MSD7ADCX, MSDPDT7ADCX, RES7, RES7PDT, RIO, JOT, JOTVTX15. Not available when air supply/return function and sensor options are combined.
JP18	Not available with option: NES7, NESPDT7, NESPDT7ADCX, MSD7ADCX, MSDPDT7ADCX, RES7, RES7PDT, RIO, JOT, JOTVTX15.
Lumens	Approximate lumen output. For high Efficiency, all versions may not achieve 130+ LPW. Refer to photometry on <a href="http://www.acuitybrands.com">www.acuitybrands.com</a> . Air supply/return option, 90 CRI, and versions with integral sensor trim rings may not achieve 130 LPW.
MSD7ADCX, MSDPDT7ADCX	Only available with EZ1 driver option. 0-10v dimming wires not accessible via access plate.
NES7, NESPDT7, NES7ADCX, NESPDT7ADCX	Requires N80, N80EMG, N100, or N100EMG. Only available with EZ1 driver.
NLTAIR2	Must order with nLight Wireless option from Control section. Only available with EZ1 driver. Not available with 85L, 100L, or 120L options.
NOC	Can only be ordered in conjunction with EZ1, NLTAIR2, RES7/RES7PDT. Occupancy sensor disabled at factory but can be re-enabled upon commissioning.
N80EMG, N100EMG	nLight EMG option requires a connection to existing nLight network. Power is provided from a separate N80 or N100 enabled fixture.
RES7EM, RES7PDTEM, RIOEM	See UL924 Sequence of Operation chart on page 4. Not available with 72L, 72LHE, or 85LHE lumen packages.
RRL	For ordering logic consult: <a href="#">RRL_2013</a> .
SLD	Not available with any nLight Interface or Control options.

### Multiple Diffuser Options



TYPE T1C

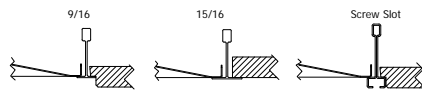
## 2BLT Volumetric Recessed Lighting 2'x4'

### Non-Configurable BLT

Non-Configurable BLT								
Stock/MTO	Catalog Description *	UPC	Lumens	Wattage	LPW	Color Temperature	Voltage	Pallet Qty
Stock	2BLT4 40L ADP LP835	00190887470789	4000	31.69	126.22	3500K/82 CRI	120-277	28
	2BLT4 40L ADP LP840	00190887470765	4063	31.69	128.23	4000K/82CRI	120-277	28
	2BLT4 46L ADP LP835	00190887468656	4960	38	130.5	3500K/82 CRI	120-277	28
	2BLT4 46L ADP LP840	00190887468649	5039.18	38	132.58	4000K/82CRI	120-277	28
	2BLT4 40L ADP EL14L LP835	00190887470925	4000	31.69	126.22	3500K/82 CRI	120-277	28
	2BLT4 40L ADP EL14L LP840	00190887470918	4063	31.69	128.23	4000K/82 CRI	120-277	28
	2BLT4 46L ADP EL14L LP835	00190887468670	4960	38	130.5	3500K/82 CRI	120-277	28
	2BLT4 46L ADP EL14L LP840	00190887468663	5039.18	38	132.58	4000K/82 CRI	120-277	28

\*Generic 0-10V Dimming to 10%.

MOUNTING DATA	
Ceiling Type	Appropriate Trim Type
Exposed grid tee (1' and 9/16")	G
Concealed grid tee	G
Plaster or plasterboard	G*



\*DGA accessory available to provide ceiling trim flange and fixture support for plaster or plasterboard ceiling. Recommended rough-in dimensions for DGA installation is 24-3/4" x 24-3/4" (Tolerance is +1/8", -0").

UL924 Sequence of Operation
For 90 minutes following any complete AC power interruption >200 ms:
<ul style="list-style-type: none"> <li>Digital dimming is commanded to high end trim level.</li> <li>Device ignores wireless lighting control commands.</li> </ul>

### Accessories & Replacement Parts

Accessories: Order as separate catalog number.	
DGA24	Drywall grid adapter for 2x4 recessed fixture
2X4SMKSH PAF	Surface Mount Troffer Kit Post Paint
RK8BDP 2P U	Disconnect Plug (BDP), 2 Pole, Package of 1
RK8BDP 3P U	Disconnect Plug (BDP), 3 Pole, Package of 1
RK8BDP 2P J10	Disconnect Plug (BDP), 2 Pole, Package of 10
RK8BDP 2P J40	Disconnect Plug (BDP), 2 Pole, Package of 40

Replacement Parts: Order as separate catalog number.		
*249P2N	2DBLT48 ADP LENS ASSEMBLY	4 ft. replacement lens
*249P2T	2DBLT48 SDP LENS ASSEMBLY	4 ft. replacement lens
*249P30	2DBLT48 ADSM LENS ASSEMBLY	4 ft. replacement lens
*249P33	2DBLT48 SDSM LENS ASSEMBLY	4 ft. replacement lens
*237LT2	2DBLT48 ADPT LENS ASSEMBLY	4 ft. replacement lens
*237LT4	2DBLT48 SDPT LENS ASSEMBLY	4 ft. replacement lens
*237LT6	2DBLT48 ADSMT LENS ASSEMBLY	4 ft. replacement lens
*237LT8	2DBLT48 SDSMT LENS ASSEMBLY	4 ft. replacement lens
*237LTA	2DBLT48 ADPT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MS2	2DBLT48 SDPT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MSA	2DBLT48 ADSMT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MSL	2DBLT48 SDSMT SENSOR LENS ASSEMBLY	4 ft. replacement lens

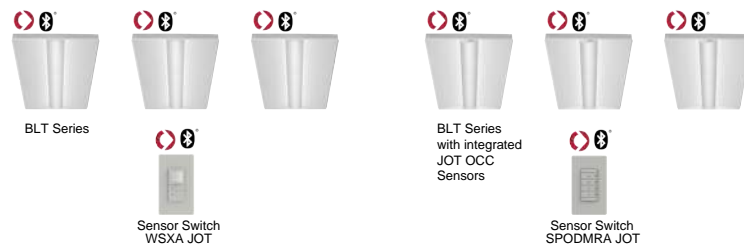
### JOT Wireless



#### Sensor Switch JOT Enabled Wireless Solution

Designed with contractors in mind, the Sensor Switch JOT enabled wireless solution offers a straightforward approach to the installation and pairing of lighting fixtures and controls. Absolutely no 0-10V control wires and no mobile apps are needed with JOT enabled products, allowing for lightning speed installation right out of the box.

- Power:** Install JOT enabled fixtures and controls as instructed.
- Pair:** Insert the pairing tool into the pinhole on the wall switch; press and hold any button for 6 seconds.
- Play:** Once paired, each fixture will individually dim down to 10% brightness. All products will be fully functional.



BLT-2X4

TYPE T1C

## 2BLT Volumetric Recessed Lighting 2'x4'

### nLight Platform

nLight embedded fixtures offer:	Customers get:
Manual Dimming	Convenience and visual comfort for occupants
Motion Sensing and/or Daylight Harvesting	Energy savings and code compliance
Fixture or Group Level Control	Ability to configure lighting to the space requirements
Flexibility	Ease of fixture moves, adds and changes
Wireless Wall Switch (nLight AIR Only)	Ease and flexibility of placement
Astronomical and Time of Day Scheduling	Energy savings and building security
Scalable Solution	nLight controls to grow with your business
Future-Ready	nLight platform to set foundation for future upgrades and capabilities

### nLight Air Wireless



#### Simple as 1,2,3

1. Install the nLight<sup>®</sup> AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CLAIRITY app, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome



### nLight Wired Networking



#### Simple as 1,2,3

1. Install the nLight<sup>®</sup> Wired fixtures with embedded control
2. Install the nLight Wired wall switch
3. Connect the fixtures using standard CAT5e cables and the devices will automatically discover each other and work (plug and play)



TYPE T1C

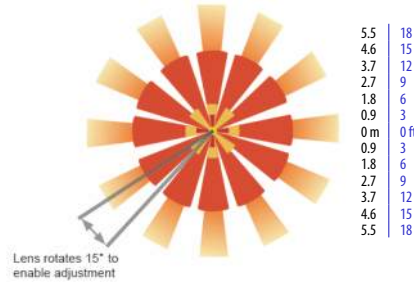
## 2BLT Volumetric Recessed Lighting 2'x4'

Sensor Options					
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking	nLight AIR Networking
		PIR	PDT		
MSD7ADCX	X	X			
MSDPDT7ADCX	X		X		
NES7		X		X	
NES7ADCX	X	X		X	
NESPDT7			X	X	
NESPDT7ADCX	X		X	X	
RES7	X	X			X
RESPDT7	X	X	X		X

### Sensor Coverage Pattern Mini 360° Lens

- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and
- 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor

#### 9 FT Mounting



### Integrated Sensor with Individual Control

The MSD7ADCX PIR occupancy sensor/automatic dimming photocell is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.

The MSPDT7ADCX PIR/Microphonics Dual Tech occupancy sensor/automatic dimming photocell is ideal for areas with obstructions and where daylight harvesting is desired. Suggested applications include, but not limited to, open offices, private offices, classrooms, public restrooms, and conference rooms.

### nLight AIR Wireless

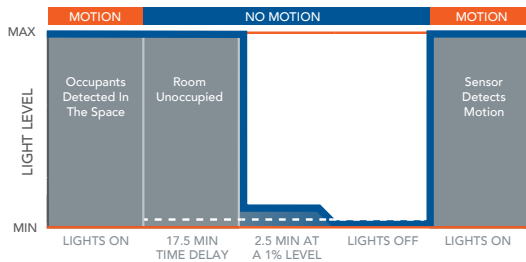
nLight AIR is the ideal solution for retrofit or new construction spaces where adding additional wiring can be labor intensive and nLight AIR is available with or without an integral sensor. The integrated rES7 or rES7PDT smart sensors are part of each luminaire in the nLight AIR network, which can be grouped to control multiple luminaires. The granularity of control with the digital PIR occupancy detection and daylight sensing makes a great solution for any application.

### nLight Wired Networking

The nES7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the nES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

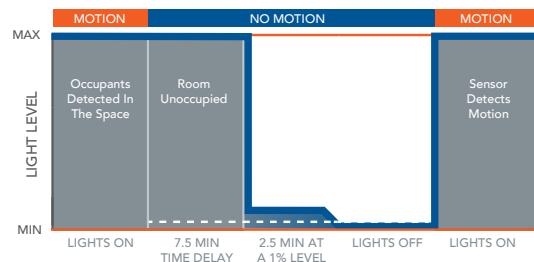
For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy. Additionally, the nESPDT7ADCX includes an integrated photocell, which enables daylight harvesting controls which is ideal for areas where windows are present.

### Sequence of Operation (MSD7 Sensor)



\*The presetting on the automatic dimming photocell is 5fc.

### Sequence of Operation (nES7 and rES7 and Sensor)



\*The presetting on the automatic dimming photocell is 5fc (NES7) and 10fc (RES7).

TYPE T1C

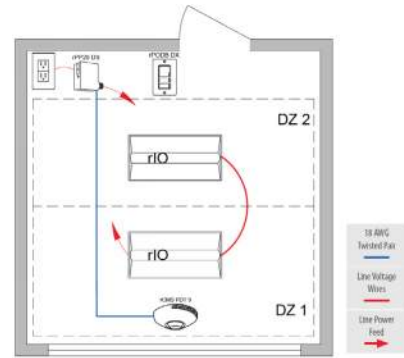
## 2BLT Volumetric Recessed Lighting 2'x4'

### Controls Accessories

<b>nLight® Wired Control Accessories:</b> <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlight">www.acuitybrands.com/products/controls/nlight</a>.</i>			
<b>WallPod stations</b>	<b>Model number</b>	<b>Occupancy sensors</b>	<b>Model number</b>
On/Off	nPODMA [Color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODMA DX [Color]	Large motion 360°, ceiling (PIR / dual tech)	nCM10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD TOUCH [Color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
<b>Photocell controls</b>	<b>Model number</b>	<b>Cat-5 cable (plenum rated)</b>	<b>Model number</b>
Full range dimming	nCM ADCX RJB	10' cable	CAT5 10FT J1
		30' cable	CAT5 30FT J1

<b>nLight® AIR Control Accessories:</b> <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlightair">www.acuitybrands.com/products/controls/nlightair</a>.</i>	
<b>Wall switches</b>	<b>Model number</b>
On/Off single pole	rPODBA [color] G2
On/Off two pole	rPODB A2P [color] G2
On/Off & raise/lower single pole	rPODBA DX [color] G2
On/Off & raise/lower two pole	rPODBA 2P DX [color] G2

BLT fixtures with integrated rIO devices complement any small office space. Pair them with an rCMS occupancy sensor and the space now has wireless occupancy sensing and dimming capability. For additional configuration options please consult with Tech Support.



rCMS <sup>1</sup>		Example: RCMS PDT 10 AR G2							
Series / Detection	Power Supply <sup>1</sup>	Occupancy Detection	Lens (Required)		Operating Mode		Generation		
RCMS nLight AIR occupancy and daylight sensor	[blank] Power Supply ordered separately PS 150 Standard 150 mA Power Supply	[blank] PIR Detection PDT Dual Tech PIR/Microphonics	10 Large Motion/ Extended Range 360°	9 Small Motion/ Extended Range 360°	6 High Bay 360° Lens	[BLANK] None AR Auxiliary Relay	G2	Generation 2 compatibility	

**Notes**

<sup>1</sup> RCMS requires low voltage power from either RPP20 DS 24V G2 or PS150.



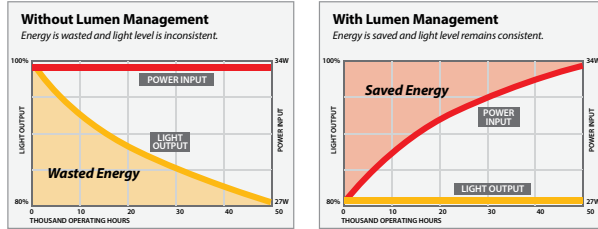


TYPE T1C

## 2BLT Volumetric Recessed Lighting 2'x4'

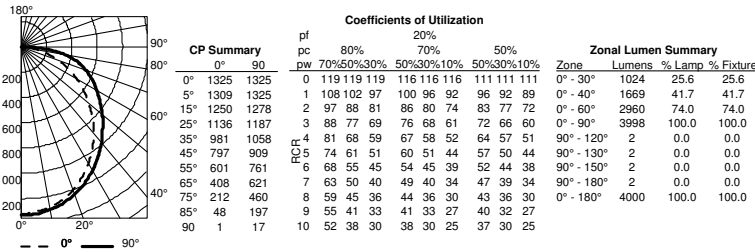
### Constant Lumen Management

Enabled by the embedded nLight control, the BLT actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.

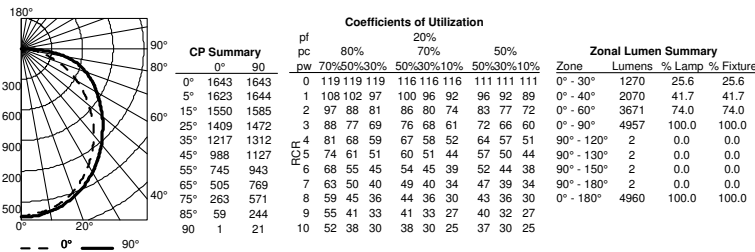


### PHOTOMETRICS

2BLT4 40L ADP LP835, 4000 delivered lumens, test no. ISF36900P109, tested in accordance to IESNA LM-79



2BLT4 48L ADP LP835, 4960 delivered lumens, test no. ISF 36900P117, tested in accordance to IESNA LM-79



TYPE T1C

2BLT Volumetric Recessed Lighting 2'x4'

Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT4 30L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	2962	127.31	23.26	Premium	PWJDEMHS
2BLT4 30L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3009.28	129.34	23.26	Premium	P18J5GLD
2BLT4 30L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	2969.16	127.62	23.26	Premium	P3HB2XSG
2BLT4 40L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4000	126.22	31.69	Premium	PDWKYXFD
2BLT4 40L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4063.86	128.23	31.69	Premium	PEYXAZWD
2BLT4 40L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3946.66	124.53	31.69	Premium	PS63CPK6
2BLT4 40L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4009.67	126.52	31.69	Premium	PK79UR9W
2BLT4 48L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4960	130.5	38	Premium	PJ9K6C1
2BLT4 48L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	5039.18	132.58	38	Premium	P9W2R5AK
2BLT4 48L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4893.86	128.76	38	Premium	PPFKZU3U
2BLT4 48L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4971.99	130.82	38	Premium	PC8HMC9
2BLT4 60L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	6016	126.39	47.59	Premium	PSJ6QERM
2BLT4 60L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	6112.04	128.4	47.59	Premium	PVXQXPUV
2BLT4 60L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	5935.78	124.7	47.59	Premium	PHT84BW4
2BLT4 60L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	6030.55	126.69	47.59	Premium	PXV55BC8
2BLT4 72L ADP EZ1 (GZ10) LP840 [All Options]	7360.66	125.3	58.74	Premium	P5C22CB
2BLT4 72L ADP GZ1 LP835 [All Options]	7245	119.07	60.84	standard	PISHTCTS
2BLT4 72L ADP GZ1 LP840 [All Options]	7360.66	120.97	60.84	standard	PBERALG7
2BLT4 72L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	7148.4	117.48	60.84	standard	PDQ53CYK
2BLT4 72L ADPT EZ1 (GZ10) LP840 [All Options]	7262.52	123.63	58.74	Premium	P2KKMMVN
2BLT4 72L ADPT GZ1 LP840 [All Options]	7262.52	119.36	60.84	standard	P10DUPC0
2BLT4 85L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	8567	116.43	73.58	standard	PYD2G06V
2BLT4 85L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	8703.77	118.28	73.58	standard	P8Z4IV4X
2BLT4 85L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	8452.77	114.87	73.58	standard	PTZEW3QM
2BLT4 85L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	8587.72	116.71	73.58	standard	P01DMEK9
2BLT4 100L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	9837	103.14	95.36	standard	PGDES20R
2BLT4 100L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	9994.04	104.79	95.36	standard	P007CHGX
2BLT4 100L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	9705.84	101.77	95.36	standard	PSZUQY7M
2BLT4 100L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	9860.79	103.39	95.36	standard	P6V6X6HY
2BLT4 120L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	11709	118.18	99.07	standard	PGM4Y7DP
2BLT4 120L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	11895.9	120.07	99.07	standard	POODDCG2
2BLT4 120L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	11552.9	116.61	99.07	standard	PXM0FS09
2BLT4 120L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	11737.3	118.47	99.07	standard	PJ4GEBZM

**How to Estimate Delivered Lumens in Emergency Mode**  
Use the formula below to estimate the delivered lumens in emergency mode  
**Delivered Lumens = 1.25 x P x LPW**  
P = Output power of emergency driver, P = 10W for E10WLCP option.  
LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet. LPW = Lumen per watt rating of the luminaire. LPW information available in Performance Data section.

DLC information is subject to change, for the most up-to-date information please refer to www.dlc.org. Above listings do not cover 347v or SLD.

HE Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT4 30LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	3107	135.17	22.98	Premium	P7KEICW5
2BLT4 30LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3156.6	137.33	22.98	Premium	PD0M06BH
2BLT4 30LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3065.57	133.37	22.98	Premium	P7PZAJDZ
2BLT4 30LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	3114.51	135.5	22.98	Premium	P2N23EBP
2BLT4 40LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4085	138.56	29.48	Premium	P67P65SY
2BLT4 40LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4150.21	140.77	29.48	Premium	P95UQD66
2BLT4 40LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4030.53	136.71	29.48	Premium	PC15DQEC
2BLT4 40LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4094.88	138.89	29.48	Premium	PGRC5J2T
2BLT4 48LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4770	138.16	34.52	Premium	PX8JBG8N
2BLT4 48LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4846.15	140.37	34.52	Premium	P5PQ5RRX
2BLT4 48LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4706.4	136.32	34.52	Premium	P2NK2H33
2BLT4 48LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4781.53	138.5	34.52	Premium	PK8C1321
2BLT4 60LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	5894	135.12	43.61	Premium	PQZN176R
2BLT4 60LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	5988.09	137.28	43.61	Premium	PG5CYJUC
2BLT4 60LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	5815.41	133.32	43.61	Premium	PZ72TAWM
2BLT4 60LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	5908.25	135.45	43.61	Premium	PRC4W72B
2BLT4 72LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	7149	135.94	52.58	Premium	PUB38GEQ
2BLT4 72LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	7263.13	138.11	52.58	Premium	P7GDHZTN
2BLT4 72LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	7053.68	134.12	52.58	Premium	P5CC2VKV
2BLT4 72LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	7166.29	136.26	52.58	Premium	P6P1BKDM
2BLT4 85LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	8158	128.96	63.25	Premium	PRTW6BXW
2BLT4 85LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	8288.24	131.02	63.25	Premium	PGH1V2D6
2BLT4 85LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	8049.22	127.24	63.25	Premium	P1VG5TA3
2BLT4 85LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	8177.73	129.27	63.25	Premium	PN5BKJ6E

DLC information is subject to change, for the most up-to-date information please refer to www.dlc.org. Above listings do not cover 347v or SLD.



BLT-2X4



**DIGITAL NAVIGATION**  
[Ordering Tree](#)   [nLight Platform](#)   [Sensor Switch JOT](#)   [Photometrics](#)   [Performance Data](#)

## FEATURES & SPECIFICATIONS

**INTENDED USE** — The BLT Best-in-Value Low Profile LED luminaire features a popular center basket design that offers a clean, versatile style and volumetric distribution. High efficacy LED light engines deliver energy savings and low maintenance compared to traditional sources. An extensive selection of configurations and options make the BLT the perfect choice for many lighting applications including schools, offices and other commercial spaces, retail, hospitals and healthcare facilities. The low profile BLT design (2-3/8") also makes it an excellent choice for renovation projects.

**CONSTRUCTION** — Prior to fabrication, BLT components are coated with a proprietary paint blend and die-formed for dimensional consistency.

The BLT reflector is available in both smooth and ribbed finishes. Choose RB from the fixture style section below for a ribbed finish.

End plates contain easy-to-position integral T-bar clips for securely attaching the luminaire to the T-grid. For additional T-grid security, optional screw on T-bar clips are available.

Diffusers are extruded from impact modified acrylic for increased durability.

LED boards and drivers are accessible from the plenum.

**OPTICS** — Volumetric illumination is achieved by creating an optimal mix of light to walls, partitions and vertical and horizontal work surfaces – rendering the interior space, objects and occupants in a more balanced, complimentary luminous environment. High performance extruded acrylic diffusers conceal LEDs and efficiently deliver light in a volumetric distribution. Four diffuser choices available – curved and square designs with ribbed or a smooth frosted finish.

**ELECTRICAL** — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and quality of illumination for extended service life. 80% LED lumen maintenance at 60,000 hours (L80/60,000). Color Variation within 3-step MacAdam ellipse (3SDCM).

**Non-Configurable BLT:** Generic 0-10 volt dimming driver. Dims to 10%

**Configurable BLT:** available in High Efficiency (HE) versions for applications where a lower wattage (over the standard product) is required. The High Efficiency versions deliver >130 LPW and can be specified via the Lumen Package designations in the Ordering Information below.

eldoLED driver options deliver choice of dimming range, and choices for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Optional integrated nLight® controls make each luminaire addressable – allowing it to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Connection to nLight is simple. It can be accomplished with integrated nLight AIR wireless RIO, RES7 sensors, or through standard Cat-5 cabling. nLight offers unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission. nLight AIR is commissioned easily through an intuitive mobile app.

Lumen Management: Unique lumen management system (option N80) provides on board intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing the energy waste created by the traditional practice of over-lighting.

Step-level dimming option allows system to be switched to 50% power for compliance with common energy codes while maintaining fixture appearance.

**SENSOR** — Integrated sensor (**individual control**): Sensor Switch MSD7ADCX ((Passive infrared (PIR)) or MSDPDT7ADCX ((PIR/Microphonics Dual Tech (PDT))) integrated occupancy sensor/automatic dimming photocell allows the luminaire to power off when the space is unoccupied or enough ambient light is entering the space. See page 4 for more details on the integrated sensor.

**Integrated Sensor (nLight Wired Networking):** This sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired, using CAT-5 cabling, with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 4 for the nLight sensor options.

**Integrated Smart Sensor (nLight Air Wireless Platform):** The RES7 sensor is nLight AIR enabled, meaning it has the ability to communicate over the wireless nLight control platform. It is available with an automatic dimming photocell, and either a digital PIR or a microphonics (PDT) dual technology occupancy sensor. It pairs to other luminaires and wall switches through our mobile app, CLARITY, which allows for simple sensor adjustment. See page 4 for more details on the Integrated Smart Sensor.

**Integrated Wireless Sensor (single room control):** Sensor Switch VERTEX JOT or JOTVIX15 luminaire-embedded occupancy and ambient light sensor allows the luminaire to power off when the space is unoccupied or when enough ambient light is entering the space. See page X for more details on the integrated wireless sensor.

**INSTALLATION** — The BLT's low profile design of only 2-3/8" provides increased installation flexibility especially in restrictive plenum applications. The BLT fits into standard 15/16" and narrow 9/16" T-grid ceiling systems.

Suitable for damp location.

For recessed mounting in hard ceiling applications, Drywall Grid Adapters (DGA) are available as an accessory. See Accessories section.

**LISTINGS** — CSA Certified to meet U.S. and Canadian standards. IC rated. Tested in accordance with ISO 14644-1; suitable for ISO Class 5-9 positive and negative pressure clean rooms.

Designlights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at [www.designlights.org/QPL](http://www.designlights.org/QPL) to confirm which versions are qualified.

**BUY AMERICAN** — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.

**WARRANTY** — 5-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

**NOTE:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

TYPE T1D

Catalog Number
Notes
Type



ADP Diffuser Option 2' x 4' LED

Ribbed Reflector Option

Buy American JUST ONE TOUCH

*Specifications*

Length: 47-3/4 (121.2)	
Width: 23-3/4 (60.3)	
Depth: 2-3/8 (6.0)	
Depth with Air supply/return: 2-3/4 (6.9)	

All dimensions are inches (centimeters) unless otherwise specified.

### Embed nLight controls today. Prepare for tomorrow.

Now	Tomorrow
User-friendly install	Scalability
Enhanced energy savings	Space configuration
Code compliance	Future-ready

### A+ Capable Luminaire

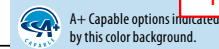
This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® control networks when ordered with drivers marked by a **shaded background**\*
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a **shaded background**\*

To learn more about A+, visit [www.acuitybrands.com/aplus](http://www.acuitybrands.com/aplus).

\*See ordering tree for details

2BLT Volumetric Recessed Lighting 2'x4'



TYPE T1D

ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: 2BLT4 40L ADP EZ1 LP840

Series	Fixture Style	Air function	Lumens ‡	Diffuser	Voltage	Driver	Color temperature	
2BLT4 2x4 BLT	(blank) Smooth Reflector RB Ribbed Reflector	(blank) Static A Air supply/return ‡	<b>Standard efficiency (&gt;100 LPW)</b> 30L 3000 40L 4000 48L 4800 60L 6000 72L 7200 85L 8500 100L 10000 120L 12000	<b>High efficiency ‡ (&gt;130 LPW)</b> 30LHE 3000 40LHE 4000 48LHE 4800 <b>60LHE 6000</b> 72LHE 7200 85LHE 8500	ADP Curved, ribbed ADSM Curved, smooth SDP Square, ribbed SDSM Square, smooth <b>Includes trim rings to match sensed version</b> ADPT Curved, ribbed ADSMT Curved, smooth SDPT Square, ribbed SDSMT Square, smooth	(blank) MVOLT 120 120V 277 277V 347 347V ‡	EZ1 eldoLED dims to 1% (0-10 volt dimming) GZ1 Dims to 1% (0-10V dimming) ‡ GZ10 Dims to 10% (0-10V dimming) ‡ SLD Step-level dimming ‡	LP830 82CRI, 3000 K <b>LP835 82CRI, 3500 K</b> LP840 82CRI, 4000 K LP850 82CRI, 5000 K LP930 90CRI, 3000K LP935 90CRI, 3500K LP940 90CRI, 4000K LP950 90CRI, 5000K

nLight Interface	Control ‡	Individual Control
<b>nLight Wired</b> (blank) no nLight® interface N80 nLight with 80% lumen management N80EMG nLight with 80% lumen management For use with generator supply EM power ‡ N100 nLight without lumen management N100EMG nLight without lumen management For use with generator supply EM power ‡  <b>nLight Wireless</b> (blank) no nLight® interface NLTAIR2 nLight AIR Generation 2 enabled ‡	<b>nLight Wired ‡</b> (blank) No sensor control NES7 nLight™ nES 7 PIR integral occupancy sensor NESPD7 nLight™ nES PDT 7 dual technology integral occupancy control NES7ADCX nLight™ nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell NESPD7ADCX nLight™ nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell  <b>nLight Wireless</b> RES7 nLight AIR PIR integral occupancy sensor with automatic dimming photocell for Networking Capabilities RES7PDT nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell RIO nLight AIR radio module without sensor RES7EM nLight AIR PIR integral occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RES7PDTEM nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RIOEM nLight AIR radio module less sensor, with UL924 Emergency Operation, via power interrupt detection ‡	<b>MSD7ADCX</b> PIR integral occupancy sensor with automatic dimming control photocell ‡ <b>MSDPDT7ADCX</b> PDT integral occupancy sensor with automatic dimming control photocell ‡ <b>JOT</b> Wireless room control with "Just One Touch" pairing ‡ <b>JOTVTX15</b> Wireless occupancy sensor with "Just One Touch" pairing ‡

Standby Mode	Options
NOC NOC Occupancy sensor disabled ‡	<b>BDP Disconnect Plug</b> EL7L 700 lumen battery pack (Noncompliant with CA T20) ‡ <b>EL14L 1400 lumen battery pack (Noncompliant with CA T20) ‡</b> EL14LSD 1400 lumen battery pack with self-diagnostic testing feature (Noncompliant with CA T20) ‡ E10WLCP EM Self-Diagnostic battery pack, 10W Constant Power, Certified in CA Title 20 MAEDBS ‡  CP Chicago plenum ‡ BGTD Bodine Generator Transfer Device ‡ PWS1836 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit PWS1846 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuit PWS1846 PWSLV Two cables: one 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuits; one 6' pre-wire, 3/8" diameter, 18 gauge ‡ PWS1856LV 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit w/low voltage wires ‡  GLR Fast-blowing fuse ‡ GMF Slow-blowing fuse ‡ NPLT Narrow pallet RRL_ RELOC®-ready luminaire ‡ LATC Earthquake clip DWAM Anti-Microbial paint JP14 Job packaging ‡ JP18 Job packaging ‡ IP5X Gasketed diffuser compartment to meet IP5X rating ‡ BAA Buy America(n) Act Compliant

NOTE: ‡ indicates option value has ordering restrictions. Please reference the Option Value Ordering Restrictions chart on the next page. Options are sorted alphanumerically.

LUMINAIRES WITH "EM" DESIGNATION TO HAVE BATTERY PACK

ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES



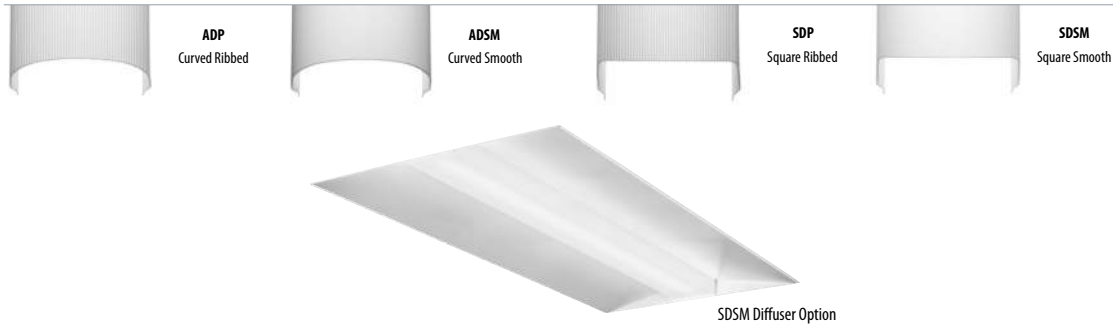
BLT-2X4

TYPE T1D

## 2BLT Volumetric Recessed Lighting 2'x4'

‡ Option Value Ordering Restrictions	
Option value	Restriction
347	Not available with SLD, EL7L, EL14L, or E10WLCP options.
A	Not available with RB fixture style, consult factory for air flow data.
BGTD	Not available with TD, JOT, JOTVTX15 sensor options or emergency battery options. Must specify voltage. Requires BSE labeling, voltage specific. Consult factory for options. Example: BGTD BSE10.
Controls	Must specify diffuser with trim rings.
CP	Not available with N80, N80EMG, N100, or N100EMG.
GZ1, GZ10	Not available with any Control or Sensor options except JOT & JOTVTX15
EL14LSD, E10WLCP, EL7L, EL14L	When using pre-wire option, use PWS1846 or PWS1846 PWSLV. For more information, please see the <a href="#">PSSD2 specification sheet</a> .
FAO	EZ1 driver required. Not available with USPOM, FAO or lumen packages > 6000LM. FAO restricts use of external Dimming controls. See chart on page 3 for additional details.
GLR, GMF	Must specify voltage. 120 or 277, with GLR and GMF fusing.
IP5X	Not available with air supply/return or Wired Networking (NES_) and Individual Control (MSD_) sensors.
JOT, JOTVTX15	Not available with standard efficiency 85L, 100L or 120L lumen options. Not available with SLD, nLight, NLTAIR2, NOC, or BGTD options.
JP14	Only available on fixtures with NES7, NESPDT7, NESPDT7ADCX, MSD7ADCX, MSDPDT7ADCX, RES7, RES7PDT, RIO, JOT, JOTVTX15. Not available when air supply/return function and sensor options are combined.
JP18	Not available with option: NES7, NESPDT7, NESPDT7ADCX, MSD7ADCX, MSDPDT7ADCX, RES7, RES7PDT, RIO, JOT, JOTVTX15.
Lumens	Approximate lumen output. For high Efficiency, all versions may not achieve 130+ LPW. Refer to photometry on <a href="http://www.acuitybrands.com">www.acuitybrands.com</a> . Air supply/return option, 90 CRI, and versions with integral sensor trim rings may not achieve 130 LPW.
MSD7ADCX, MSDPDT7ADCX	Only available with EZ1 driver option. 0-10v dimming wires not accessible via access plate.
NES7, NESPDT7, NES7ADCX, NESPDT7ADCX	Requires N80, N80EMG, N100, or N100EMG. Only available with EZ1 driver.
NLTAIR2	Must order with nLight Wireless option from Control section. Only available with EZ1 driver. Not available with 85L, 100L, or 120L options.
NOC	Can only be ordered in conjunction with EZ1, NLTAIR2, RES7/RES7PDT. Occupancy sensor disabled at factory but can be re-enabled upon commissioning.
N80EMG, N100EMG	nLight EMG option requires a connection to existing nLight network. Power is provided from a separate N80 or N100 enabled fixture.
RES7EM, RES7PDTEM, RIOEM	See UL924 Sequence of Operation chart on page 4. Not available with 72L, 72LHE, or 85LHE lumen packages.
RRL	For ordering logic consult: <a href="#">RRL_2013</a> .
SLD	Not available with any nLight Interface or Control options.

### Multiple Diffuser Options



TYPE T1D

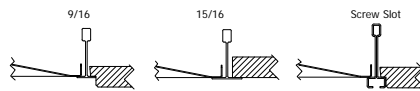
## 2BLT Volumetric Recessed Lighting 2'x4'

### Non-Configurable BLT

Non-Configurable BLT								
Stock/MTO	Catalog Description *	UPC	Lumens	Wattage	LPW	Color Temperature	Voltage	Pallet Qty
Stock	2BLT4 40L ADP LP835	00190887470789	4000	31.69	126.22	3500K/82 CRI	120-277	28
	2BLT4 40L ADP LP840	00190887470765	4063	31.69	128.23	4000K/82CRI	120-277	28
	2BLT4 46L ADP LP835	00190887468656	4960	38	130.5	3500K/82 CRI	120-277	28
	2BLT4 46L ADP LP840	00190887468649	5039.18	38	132.58	4000K/82CRI	120-277	28
	2BLT4 40L ADP EL14L LP835	00190887470925	4000	31.69	126.22	3500K/82 CRI	120-277	28
	2BLT4 40L ADP EL14L LP840	00190887470918	4063	31.69	128.23	4000K/82 CRI	120-277	28
	2BLT4 46L ADP EL14L LP835	00190887468670	4960	38	130.5	3500K/82 CRI	120-277	28
	2BLT4 46L ADP EL14L LP840	00190887468663	5039.18	38	132.58	4000K/82 CRI	120-277	28

\*Generic 0-10V Dimming to 10%.

MOUNTING DATA	
Ceiling Type	Appropriate Trim Type
Exposed grid tee (1' and 9/16")	G
Concealed grid tee	G
Plaster or plasterboard	G*



\*DGA accessory available to provide ceiling trim flange and fixture support for plaster or plasterboard ceiling. Recommended rough-in dimensions for DGA installation is 24-3/4" x 24-3/4" (Tolerance is +1/8", -0").

UL924 Sequence of Operation
For 90 minutes following any complete AC power interruption >200 ms:
<ul style="list-style-type: none"> <li>Digital dimming is commanded to high end trim level.</li> <li>Device ignores wireless lighting control commands.</li> </ul>

### Accessories & Replacement Parts

Accessories: Order as separate catalog number.	
DGA24	Drywall grid adapter for 2x4 recessed fixture
2X4SMKSH PAF	Surface Mount Troffer Kit Post Paint
RK8BDP 2P U	Disconnect Plug (BDP), 2 Pole, Package of 1
RK8BDP 3P U	Disconnect Plug (BDP), 3 Pole, Package of 1
RK8BDP 2P J10	Disconnect Plug (BDP), 2 Pole, Package of 10
RK8BDP 2P J40	Disconnect Plug (BDP), 2 Pole, Package of 40

Replacement Parts: Order as separate catalog number.		
*249P2N	2DBLT48 ADP LENS ASSEMBLY	4 ft. replacement lens
*249P2T	2DBLT48 SDP LENS ASSEMBLY	4 ft. replacement lens
*249P30	2DBLT48 ADSM LENS ASSEMBLY	4 ft. replacement lens
*249P33	2DBLT48 SDSM LENS ASSEMBLY	4 ft. replacement lens
*237LT2	2DBLT48 ADPT LENS ASSEMBLY	4 ft. replacement lens
*237LT4	2DBLT48 SDPT LENS ASSEMBLY	4 ft. replacement lens
*237LT6	2DBLT48 ADSMT LENS ASSEMBLY	4 ft. replacement lens
*237LT8	2DBLT48 SDSMT LENS ASSEMBLY	4 ft. replacement lens
*237LTA	2DBLT48 ADPT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MS2	2DBLT48 SDPT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MSA	2DBLT48 ADSMT SENSOR LENS ASSEMBLY	4 ft. replacement lens
*237MSL	2DBLT48 SDSMT SENSOR LENS ASSEMBLY	4 ft. replacement lens

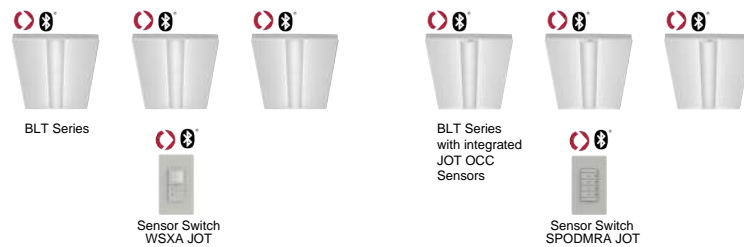
### JOT Wireless



#### Sensor Switch JOT Enabled Wireless Solution

Designed with contractors in mind, the Sensor Switch JOT enabled wireless solution offers a straightforward approach to the installation and pairing of lighting fixtures and controls. Absolutely no 0-10V control wires and no mobile apps are needed with JOT enabled products, allowing for lightning speed installation right out of the box.

- Power:** Install JOT enabled fixtures and controls as instructed.
- Pair:** Insert the pairing tool into the pinhole on the wall switch; press and hold any button for 6 seconds.
- Play:** Once paired, each fixture will individually dim down to 10% brightness. All products will be fully functional.



BLT-2X4

TYPE T1D

## 2BLT Volumetric Recessed Lighting 2'x4'

### nLight Platform

nLight embedded fixtures offer:	Customers get:
Manual Dimming	Convenience and visual comfort for occupants
Motion Sensing and/or Daylight Harvesting	Energy savings and code compliance
Fixture or Group Level Control	Ability to configure lighting to the space requirements
Flexibility	Ease of fixture moves, adds and changes
Wireless Wall Switch (nLight AIR Only)	Ease and flexibility of placement
Astronomical and Time of Day Scheduling	Energy savings and building security
Scalable Solution	nLight controls to grow with your business
Future-Ready	nLight platform to set foundation for future upgrades and capabilities

### nLight Air Wireless



#### Simple as 1,2,3

1. Install the nLight<sup>®</sup> AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CLAIRITY app, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome



### nLight Wired Networking



#### Simple as 1,2,3

1. Install the nLight<sup>®</sup> Wired fixtures with embedded control
2. Install the nLight Wired wall switch
3. Connect the fixtures using standard CAT5e cables and the devices will automatically discover each other and work (plug and play)



TYPE T1D

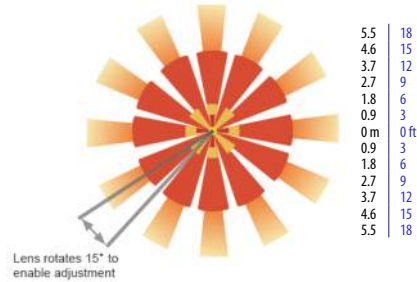
## 2BLT Volumetric Recessed Lighting 2'x4'

Sensor Options					
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking	nLight AIR Networking
		PIR	PDT		
MSD7ADCX	X	X			
MSDPDT7ADCX	X		X		
NES7		X		X	
NES7ADCX	X	X		X	
NESPDT7			X	X	
NESPDT7ADCX	X		X	X	
RES7	X	X			X
RESPDT7	X	X	X		X

### Sensor Coverage Pattern Mini 360° Lens

- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and
- 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor

#### 9 FT Mounting



### Integrated Sensor with Individual Control

The MSD7ADCX PIR occupancy sensor/automatic dimming photocell is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.

The MSDPDT7ADCX PIR/Microphonics Dual Tech occupancy sensor/automatic dimming photocell is ideal for areas with obstructions and where daylight harvesting is desired. Suggested applications include, but not limited to, open offices, private offices, classrooms, public restrooms, and conference rooms.

### nLight AIR Wireless

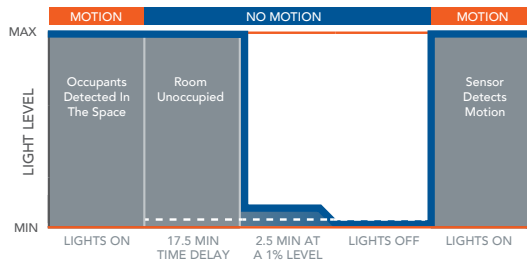
nLight AIR is the ideal solution for retrofit or new construction spaces where adding additional wiring can be labor intensive and nLight AIR is available with or without an integral sensor. The integrated rES7 or rES7PDT smart sensors are part of each luminaire in the nLight AIR network, which can be grouped to control multiple luminaires. The granularity of control with the digital PIR occupancy detection and daylight sensing makes a great solution for any application.

### nLight Wired Networking

The nES7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the nES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

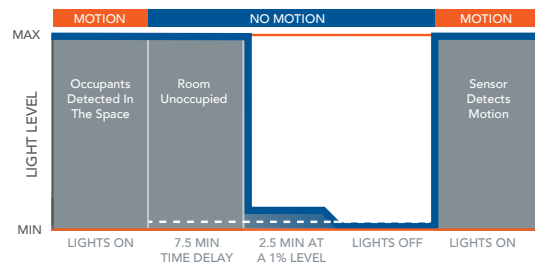
For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy. Additionally, the nESPDT7ADCX includes an integrated photocell, which enables daylight harvesting controls which is ideal for areas where windows are present.

### Sequence of Operation (MSD7 Sensor)



\*The presetting on the automatic dimming photocell is 5fc.

### Sequence of Operation (nES7 and rES7 and Sensor)



\*The presetting on the automatic dimming photocell is 5fc (NES7) and 10fc (RES7).



TYPE T1D

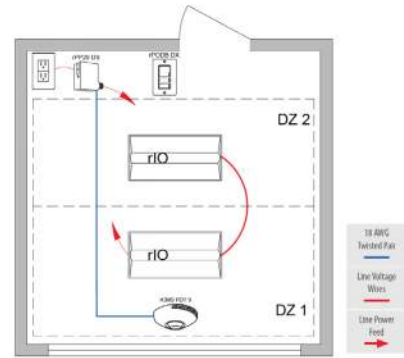
## 2BLT Volumetric Recessed Lighting 2'x4'

### Controls Accessories

<b>nLight® Wired Control Accessories:</b> <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlight">www.acuitybrands.com/products/controls/nlight</a>.</i>			
<b>WallPod stations</b>	<b>Model number</b>	<b>Occupancy sensors</b>	<b>Model number</b>
On/Off	nPODMA [Color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODMA DX [Color]	Large motion 360°, ceiling (PIR / dual tech)	nCM10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD TOUCH [Color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
<b>Photocell controls</b>	<b>Model number</b>	<b>Cat-5 cable (plenum rated)</b>	<b>Model number</b>
Full range dimming	nCM ADCX RJB	10' cable	CAT5 10FT J1
		30' cable	CAT5 30FT J1

<b>nLight® AIR Control Accessories:</b> <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlightair">www.acuitybrands.com/products/controls/nlightair</a>.</i>	
<b>Wall switches</b>	<b>Model number</b>
On/Off single pole	rPODBA [color] G2
On/Off two pole	rPODB A2P [color] G2
On/Off & raise/lower single pole	rPODBA DX [color] G2
On/Off & raise/lower two pole	rPODBA 2P DX [color] G2

BLT fixtures with integrated rIO devices complement any small office space. Pair them with an rCMS occupancy sensor and the space now has wireless occupancy sensing and dimming capability. For additional configuration options please consult with Tech Support.



rCMS <sup>1</sup>		Example: RCMS PDT 10 AR G2						
Series / Detection	Power Supply <sup>1</sup>	Occupancy Detection	Lens (Required)		Operating Mode		Generation	
RCMS nLight AIR occupancy and daylight sensor	[blank] Power Supply ordered separately PS 150 Standard 150 mA Power Supply	[blank] PIR Detection PDT Dual Tech PIR/ Microphonics	10	Large Motion/ Extended Range 360°	[BLANK] None		G2	Generation 2 compatibility
			9	Small Motion/ Extended Range 360°	AR	Auxiliary Relay		
			6	High Bay 360° Lens				

**Notes**

<sup>1</sup> RCMS requires low voltage power from either RPP20 DS 24V G2 or PS150.

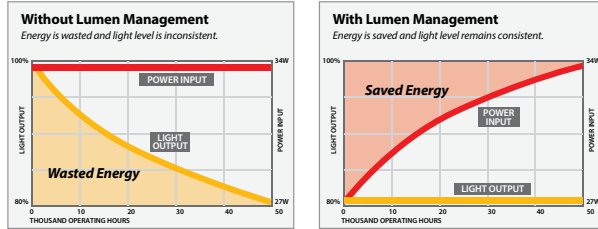


TYPE T1D

## 2BLT Volumetric Recessed Lighting 2'x4'

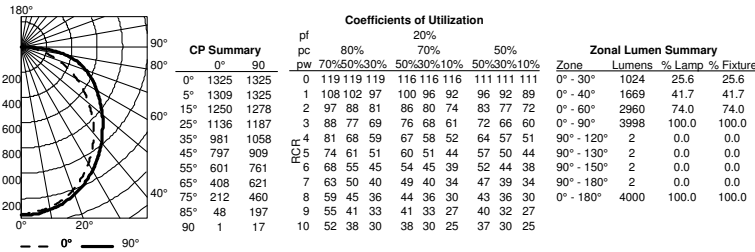
### Constant Lumen Management

Enabled by the embedded nLight control, the BLT actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.

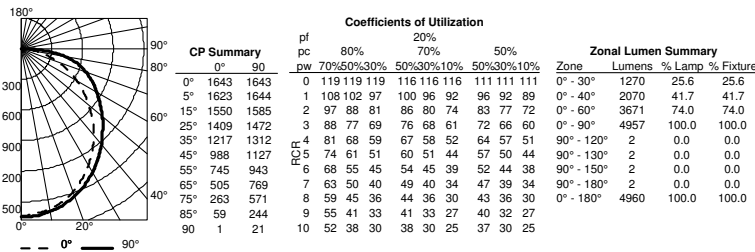


### PHOTOMETRICS

2BLT4 40L ADP LP835, 4000 delivered lumens, test no. ISF36900P109, tested in accordance to IESNA LM-79



2BLT4 48L ADP LP835, 4960 delivered lumens, test no. ISF 36900P117, tested in accordance to IESNA LM-79



TYPE T1D

2BLT Volumetric Recessed Lighting 2'x4'

Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT4 30L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	2962	127.31	23.26	Premium	PWJDEMHS
2BLT4 30L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3009.28	129.34	23.26	Premium	P18J5GLD
2BLT4 30L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	2969.16	127.62	23.26	Premium	P3HB2XSG
2BLT4 40L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4000	126.22	31.69	Premium	PDWKYXFD
2BLT4 40L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4063.86	128.23	31.69	Premium	PEYXAZWD
2BLT4 40L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3946.66	124.53	31.69	Premium	PS63CPK6
2BLT4 40L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4009.67	126.52	31.69	Premium	PK79UR9W
2BLT4 48L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4960	130.5	38	Premium	PJ9K6C1
2BLT4 48L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	5039.18	132.58	38	Premium	P9W2R5AK
2BLT4 48L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4893.86	128.76	38	Premium	PPFKZJU3U
2BLT4 48L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4971.99	130.82	38	Premium	PC8HMC9
2BLT4 60L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	6016	126.39	47.59	Premium	PSJ6QERM
2BLT4 60L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	6112.04	128.4	47.59	Premium	PVXQXUV
2BLT4 60L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	5935.78	124.7	47.59	Premium	PHT84BW4
2BLT4 60L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	6030.55	126.69	47.59	Premium	PXV55BC8
2BLT4 72L ADP EZ1 (GZ10) LP840 [All Options]	7360.66	125.3	58.74	Premium	P5CZ22CB
2BLT4 72L ADP GZ1 LP835 [All Options]	7245	119.07	60.84	standard	PISHTCTS
2BLT4 72L ADP GZ1 LP840 [All Options]	7360.66	120.97	60.84	standard	PBERALG7
2BLT4 72L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	7148.4	117.48	60.84	standard	PDQ53CYK
2BLT4 72L ADPT EZ1 (GZ10) LP840 [All Options]	7262.52	123.63	58.74	Premium	P2KKMMVN
2BLT4 72L ADPT GZ1 LP840 [All Options]	7262.52	119.36	60.84	standard	P10DUPC0
2BLT4 85L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	8567	116.43	73.58	standard	PYD2G06V
2BLT4 85L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	8703.77	118.28	73.58	standard	P8Z41V4X
2BLT4 85L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	8452.77	114.87	73.58	standard	PTZEW3QM
2BLT4 85L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	8587.72	116.71	73.58	standard	P01DMEK9
2BLT4 100L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	9837	103.14	95.36	standard	PGDES20R
2BLT4 100L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	9994.04	104.79	95.36	standard	P007CHGX
2BLT4 100L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	9705.84	101.77	95.36	standard	PSZUQY7M
2BLT4 100L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	9860.79	103.39	95.36	standard	P6V6X6HY
2BLT4 120L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	11709	118.18	99.07	standard	PGM4Y7DP
2BLT4 120L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	11895.9	120.07	99.07	standard	POODDCG2
2BLT4 120L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	11552.9	116.61	99.07	standard	PXM0FS09
2BLT4 120L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	11737.3	118.47	99.07	standard	PJ4GEBZM

**How to Estimate Delivered Lumens in Emergency Mode**  
Use the formula below to estimate the delivered lumens in emergency mode  
**Delivered Lumens = 1.25 x P x LPW**  
P = Output power of emergency driver, P = 10W for E10WLCP option.  
LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet. LPW = Lumen per watt rating of the luminaire. LPW information available in Performance Data section.

DLC information is subject to change, for the most up-to-date information please refer to www.dlc.org. Above listings do not cover 347v or SLD.

HE Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT4 30LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	3107	135.17	22.98	Premium	P7KEICW5
2BLT4 30LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3156.6	137.33	22.98	Premium	PD0M06BH
2BLT4 30LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3065.57	133.37	22.98	Premium	P7PZAJDZ
2BLT4 30LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	3114.51	135.5	22.98	Premium	P2N23EBP
2BLT4 40LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4085	138.56	29.48	Premium	P67P65SY
2BLT4 40LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4150.21	140.77	29.48	Premium	P95UQD66
2BLT4 40LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4030.53	136.71	29.48	Premium	PC15DQEC
2BLT4 40LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4094.88	138.89	29.48	Premium	PGRCJSJ2T
2BLT4 48LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4770	138.16	34.52	Premium	PXB8JBG8
2BLT4 48LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4846.15	140.37	34.52	Premium	P5PQ5RRX
2BLT4 48LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4706.4	136.32	34.52	Premium	P2NK2H33
2BLT4 48LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4781.53	138.5	34.52	Premium	PK8C1321
2BLT4 60LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	5894	135.12	43.61	Premium	PQZN176R
2BLT4 60LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	5988.09	137.28	43.61	Premium	PG5CYJUC
2BLT4 60LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	5815.41	133.32	43.61	Premium	PZ72TAWM
2BLT4 60LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	5908.25	135.45	43.61	Premium	PRC4W72B
2BLT4 72LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	7149	135.94	52.58	Premium	PUB38GEQ
2BLT4 72LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	7263.13	138.11	52.58	Premium	P7GDHZTN
2BLT4 72LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	7053.68	134.12	52.58	Premium	P5CC2VKV
2BLT4 72LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	7166.29	136.26	52.58	Premium	P6P1BKDM
2BLT4 85LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	8158	128.96	63.25	Premium	PRTW6BXW
2BLT4 85LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	8288.24	131.02	63.25	Premium	PGH1V2D6
2BLT4 85LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	8049.22	127.24	63.25	Premium	P1VG5TA3
2BLT4 85LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	8177.73	129.27	63.25	Premium	PN5BKJ6E

DLC information is subject to change, for the most up-to-date information please refer to www.dlc.org. Above listings do not cover 347v or SLD.



BLT-2X4



**DIGITAL NAVIGATION**

[Ordering Tree](#) [nLight Platform](#) [Sensor Switch JOT](#) [Photometrics](#) [Performance Data](#)

**FEATURES & SPECIFICATIONS**

**INTENDED USE** — The BLT Best-in-Value Low Profile LED luminaire features a popular center basket design that offers a clean, versatile style and volumetric distribution. High efficacy LED light engines deliver energy savings and low maintenance compared to traditional sources. An extensive selection of configurations and options make the BLT the perfect choice for many lighting applications including schools, offices and other commercial spaces, retail, hospitals and healthcare facilities. The low profile BLT design (2-3/8") also makes it an excellent choice for renovation projects.

**CONSTRUCTION** — Prior to fabrication, BLT components are coated with a proprietary paint blend and die-formed for dimensional consistency.

The BLT reflector is available in both smooth and ribbed finishes. Choose RB from the fixture style section below for a ribbed finish.

End plates contain easy-to-position integral T-bar clips for securely attaching the luminaire to the T-grid. For additional T-grid security, optional screw on T-bar clips are available.

Diffusers are extruded from impact modified acrylic for increased durability.

LED boards and drivers are accessible from the plenum.

**OPTICS** — Volumetric illumination is achieved by creating an optimal mix of light to walls, partitions and vertical and horizontal work surfaces – rendering the interior space, objects and occupants in a more balanced, complimentary luminous environment. High performance extruded acrylic diffusers conceal LEDs and efficiently deliver light in a volumetric distribution. Four diffuser choices available – curved and square designs with ribbed or a smooth frosted finish.

**ELECTRICAL** — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and quality of illumination for extended service life. 80% LED lumen maintenance at 60,000 hours (L80/60,000). Color Variation within 3-step MacAdam ellipse (3SDCM).

**Non-Configurable BLT:** Generic 0-10 volt dimming driver. Dims to 10%

**Configurable BLT:** available in High Efficiency (HE) versions for applications where a lower wattage (over the standard product) is required. The High Efficiency versions deliver >130 LPW and can be specified via the Lumen Package designations in the Ordering Information below.

eldoLED driver options deliver choice of dimming range, and choices for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Optional integrated nLight® controls make each luminaire addressable - allowing them to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Connection to nLight is simple. It can be accomplished with integrated nLight AIR wireless r10 and rE57 sensors, or through standard Cat-5 cabling. nLight offers unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission. nLight AIR is commissioned easily through an intuitive model app.

Lumen Management: Unique lumen management system (option N80) provides on board intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing the energy waste created by the traditional practice of over-lighting.

Step-level dimming option allows system to be switched to 50% power for compliance with common energy codes while maintaining fixture appearance.

**SENSOR** — **Integrated sensor (individual control):** Sensor Switch MSD7ADCX ((Passive infrared (PIR)) or MSDPDT7ADCX ((PIR/Microphonics Dual Tech (PDT)) integrated occupancy sensor/automatic dimming photocell allows the luminaire to power off when the space is unoccupied or enough ambient light is entering the space. See page 4 for more details on the integrated sensor.

**Integrated Sensor (nLight Wired Networking):** This sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired, using CAT-5 cabling, with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 4 for the nLight sensor options.

**Integrated Smart Sensor (nLight Air Wireless Platform):** The RES7 sensor is nLight AIR enabled, meaning it has the ability to communicate over the wireless nLight control platform. It is available with an automatic dimming photocell, and either a digital PIR or a microphonics (PDT) dual technology occupancy sensor. It pairs to other luminaires and wall switches through our mobile app, *CLARITY*, which allows for simple sensor adjustment. See page 4 for more details on the Integrated Smart Sensor.

**Integrated Wireless Sensor (single room control):** Sensor Switch VERTEX.JOT or JOTVIX15 luminaire-embedded occupancy and ambient light sensor allows the luminaire to power off when the space is unoccupied or when enough ambient light is entering the space. See page X for more details on the integrated wireless sensor.

**INSTALLATION** — The BLT's low profile design of only 2-3/8" provides increased installation flexibility especially in restrictive plenum applications. The BLT fits into standard 15/16" and narrow 9/16" T-grid ceiling systems.

Suitable for damp location.

For recessed mounting in hard ceiling applications, Drywall Grid Adapters (DGA) are available as an accessory. See Accessories section.

**LISTINGS** — CSA Certified to meet U.S. and Canadian standards. IC rated. Tested in accordance with ISO 14644-1; suitable for ISO Class 5-9 positive and negative pressure clean rooms.

Designlights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at [www.designlights.org/QPL](http://www.designlights.org/QPL) to confirm which versions are qualified.

**BUY AMERICAN** — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.

**WARRANTY** — 5-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

**NOTE:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

Catalog Number	TYPE T2A
Notes	
Type	



ADP Diffuser Option

BLT Series LED

**2BLT2**

2' x 2'  
LED



Ribbed Reflector Option



*Specifications*

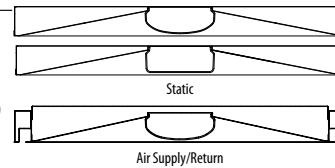
Length: 23-3/4 (60.3)

Width: 23-3/4 (60.3)

Depth: 2-3/8 (6.0)

Depth with Air supply/return: 2-3/4 (6.9)

All dimensions are inches (centimeters) unless otherwise specified.



**Embed nLight controls today. Prepare for tomorrow.**

**Now**

- User-friendly install
- Enhanced energy savings
- Code compliance

**Tomorrow**

- Scalability
- Space configuration
- Future-ready

**Capable Luminaire**

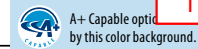
This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® control networks when ordered with drivers marked by a **shaded background**\*
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a **shaded background**\*

To learn more about A+, visit [www.acuitybrands.com/aplus](http://www.acuitybrands.com/aplus).

\*See ordering tree for details

## 2BLT Volumetric Recessed Lighting 2'x2'



TYPE T2A

### ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: 2BLT2 33L ADP EZ1 LP835

Series	Fixture Style	Air function	Lumens ‡	Diffuser	Voltage	Driver	Color temperature
2BLT2 2X2 BLT	(blank) Smooth Reflector RB Ribbed Reflector	(blank) Static A Air supply/return ‡	<b>Standard efficiency ‡ (&gt;125 LPW)</b> 20L 2000 33L 3300 40L 4000 48L 4800  <b>High efficiency ‡ (&gt;130 LPW)</b> 20LHE 2000 33LHE 3300 40LHE 4000 48LHE 4800	ADP Curved, ribbed ADSM Curved, smooth SDP Square, ribbed SDSM Square, smooth ADPT Curved, ribbed ADSMT Curved, smooth SDPT Square, ribbed SDSMT Square, smooth	(blank) MVOLT 120 120V 277 277V 347 347V ‡	EZ1 eldoLED dims to 1% (0-10 volt dimming) GZ1 Dims to 1% (0-10V dimming) ‡ GZ10 Dims to 10% (0-10V dimming) ‡ SLD Step-level dimming ‡	LP830 82CRI, 3000 K LP835 82CRI, 3500 K LP840 82CRI, 4000 K LP850 82CRI, 5000 K LP930 90CRI, 3000K LP935 90CRI, 3500K LP940 90CRI, 4000K LP950 90CRI, 5000K

nLight Interface	Control ‡	Individual Control
<b>nLight Wired</b> (blank) no nLight ® interface N80 nLight with 80% lumen management N80EMG nLight with 80% lumen management For use with generator supply EM power ‡ N100 nLight without lumen management N100EMG nLight without lumen management For use with generator supply EM power ‡  <b>nLight Wireless</b> (blank) no nLight ® interface NLTAIR2 nLight AIR Generation 2 enabled ‡	<b>nLight Wired</b> (blank) No sensor control NES7 nLight™ nES 7 PIR integral occupancy sensor ‡ NESPD7 nLight™ nES PDT 7 dual technology integral occupancy control ‡ NES7ADCX nLight™ nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell ‡ NESPD7ADCX nLight™ nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell ‡  <b>nLight Wireless</b> RES7 nLight AIR PIR integral occupancy sensor with automatic dimming photocell for Networking Capabilities RES7PDT nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell RIO nLight AIR radio module without sensor RES7EM nLight AIR PIR integral occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RES7PDTEM nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RIOEM nLight AIR radio module less sensor, with UL924 Emergency Operation, via power interrupt detection ‡	MSD7ADCX PIR integral occupancy sensor with automatic dimming control photocell ‡ MSDPD7ADCX PDT integral occupancy sensor with automatic dimming control photocell ‡ JOT Wireless room control with "Just One Touch" pairing ‡ JOTVTX15 Wireless occupancy sensor with "Just One Touch" pairing ‡

Standby Mode	Options
NOC NOC Occupancy sensor disabled ‡	<b>BDP Disconnect Plug</b> EL7L 700 lumen battery pack (Noncompliant with CA T20) ‡ EL14L 1400 lumen battery pack (Noncompliant with CA T20) ‡ EL14LSD 1400 lumen battery pack with self-diagnostic testing feature (Noncompliant with CA T20) ‡ E10WLCP EM Self-Diagnostic battery pack, 10W Constant Power, Certified in CA Title 20 MAEDBS ‡  CP Chicago plenum ‡ BGTD Bodine Generator Transfer Device ‡ PWS1836 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit PWS1846 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuit PWS1846 PWSLV Two cables: one 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuits; one 6' pre-wire, 3/8" diameter, 18 gauge ‡ PWS1856LV 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit w/low voltage wires ‡  GLR Fast-blowing fuse ‡ GMF Slow-blowing fuse ‡ NPLT Narrow pallet RRL_ RELOC®-ready luminaire ‡ LATC Earthquake clip DWAM Anti-Microbial paint JP28 Job packaging ‡ JP36 Job packaging IPSX Gasketed diffuser compartment to meet IPSX rating ‡ BAA Buy America(n) Act Compliant

NOTE: ‡ indicates option value has ordering restrictions. Please reference the Option Value Ordering Restrictions chart on the next page. Options are sorted alphanumerically.

LUMINAIRES WITH "EM" DESIGNATION TO HAVE BATTERY PACK

ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES



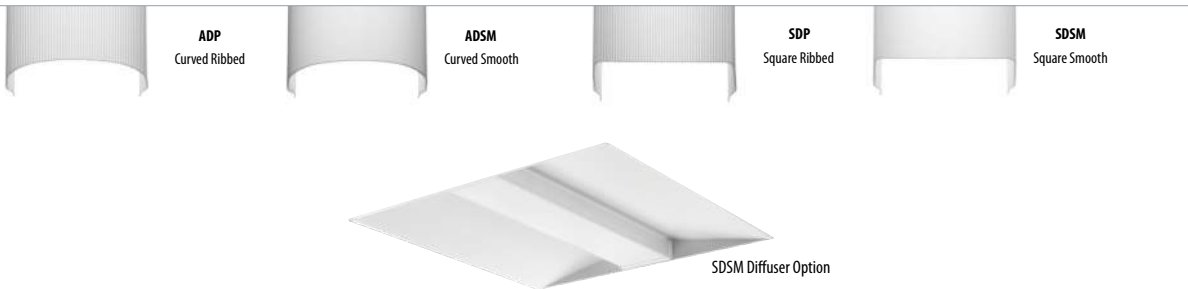
BLT-2X2

TYPE T2A

## 2BLT Volumetric Recessed Lighting 2'x2'

‡ Option Value Ordering Restrictions	
Option value	Restriction
347	Not available with SLD, EL7L, EL14L, or E10WLCP options.
A	Not available with RB fixture style, consult factory for air flow data.
BGTD	Not available with JOT, JOTVTX15 sensor options or emergency battery options. Must specify voltage. Requires BSE labeling, voltage specific. Consult factory for options. Example: BGTD BSE10.
Control	Must specify diffuser with trim rings.
CP	Not available with N80, N80EMG, N100, or N100EMG.
GZ1, GZ10	Not available with any Control or Sensor options except JOT & JOTVTX15
EL7L, EL14L, EL14LSD, E10WLCP	When using pre-wire option, use PWS1846 or PWS1846 PWSLV. For more information on the EL14LSD, please see the <a href="#">PSSD2 specification sheet</a> .
GLR, GMF	Must specify voltage. 120 or 277, with GLR and GMF fusing.
IP5X	Not available with air supply/return or Wired Networking (NES_) and Individual Control (MSD_) sensors.
JOT, JOTVTX15	Not available with SLD, nLight, NLTAIR2, NOC, or BGTD options.
JP28	Only available with options: NES7, NESPDT7, NES7ADCX, NESPDT7ADCX, MSD7ADCX, MSDPDT7ADCX, RES7, RES7PDT, RIO. Not available when sensor options combined with air supply return option.
Lumens	Approximate lumen output. For high Efficiency, all versions may not achieve 130+ LPW. Refer to photometry on <a href="http://www.acuitybrands.com">www.acuitybrands.com</a> . Air supply/return option, 90 CRI, and versions with integral sensor trim rings may not achieve 130 LPW.
MSD7ADCX, MSDPDT7ADCX	Only available with EZ1 driver option. 0-10v dimming wires not accessible via access plate.
NES7, NESPDT7, NES7ADCX, NESPDT7ADCX	Requires N80, N80EMG, N100, or N100EMG. Only available with EZ1 driver.
NLTAIR2	Must order with nLight Wireless option from Control section. Only available with EZ1 driver.
NOC	Can only be ordered in conjunction with EZ1, NLTAIR2, RES7/RES7PDT. Occupancy sensor disabled at factory but can be re-enabled upon commissioning.
N80EMG, N100EMG	nLight EMG option requires a connection to existing nLight network. Power is provided from a separate N80 or N100 enabled fixture.
PWS1846 PWSLV, PWS1856LV	Not available with nLIGHT wired network or individual controls
RES7EM, RES7PDTM, RIOEM	See UL924 Sequence of Operation chart on page 3.
RRL_	For ordering logic consult: <a href="#">RRL_2013</a> .
SLD	Not available with with any nLight Interface or Control options.

### Multiple Diffuser Options

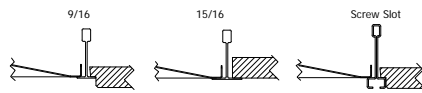


### Non-Configurable BLT

Stock/MTO	Catalog Description *	UPC	Lumens	Wattage	LPW	Color Temperature	Voltage	Pallet Qty
Stock	2BLT2 33L ADP LP835	190887529708	3332	26.67	124.92	3500K/82 CRI	120-277	56
	2BLT2 33L ADP LP840	190887529739	3385	26.67	126.91	4000K/82CRI	120-277	56
	2BLT2 33L ADP EL14L LP835	190887529890	3332	26.67	124.92	3500K/82CRI	120-277	56
	2BLT2 33L ADP EL14L LP840	190887529937	3385	26.67	126.91	4000K/82CRI	120-277	56

\*Generic 0-10V Dimming to 10%.

MOUNTING DATA	
Ceiling Type	Appropriate Trim Type
Exposed grid tee (1" and 9/16")	G
Concealed grid tee	G
Plaster or plasterboard	G*



\*DGA accessory available to provide ceiling trim flange and fixture support for plaster or plasterboard ceiling. Recommended rough-in dimensions for DGA installation is 24-3/4" x 24-3/4" (Tolerance is +1/8", -0").

UL924 Sequence of Operation
For 90 minutes following any complete AC power interruption >200 ms: <ul style="list-style-type: none"> <li>Digital dimming is commanded to high end trim level.</li> <li>Device ignores wireless lighting control commands.</li> </ul>



BLT-2X2

## 2BLT Volumetric Recessed Lighting 2'x2'

TYPE T2A

### Accessories & Replacement Parts

Accessories: Order as separate catalog number.	
DGA22	Drywall grid adapter for 2x2 recessed fixture
2X2SMKSH PAF	Surface Mount Troffer Kit Post Paint
RK8BDP 2P U	Disconnect Plug (BDP), 2 Pole, Package of 1
RK8BDP 3P U	Disconnect Plug (BDP), 3 Pole, Package of 1
RK8BDP 2P J10	Disconnect Plug (BDP), 2 Pole, Package of 10
RK8BDP 2P J40	Disconnect Plug (BDP), 2 Pole, Package of 40

Replacement Parts: Order as separate catalog number.		
*247WJV	2DBLT24 ADP LENS ASSEMBLY	2 ft. replacement lens
*249P2P	2DBLT24 SDP LENS ASSEMBLY	2 ft. replacement lens
*249P2W	2DBLT24 ADSM LENS ASSEMBLY	2 ft. replacement lens
*249P32	2DBLT24 SDSM LENS ASSEMBLY	2 ft. replacement lens
*237LT1	2DBLT24 ADPT LENS ASSEMBLY	2 ft. replacement lens
*237LT3	2DBLT24 SDPT LENS ASSEMBLY	2 ft. replacement lens
*237LT5	2DBLT24 ADSMT LENS ASSEMBLY	2 ft. replacement lens
*237LT7	2DBLT24 SDSMT LENS ASSEMBLY	2 ft. replacement lens
*237LT9	2DBLT24 ADPT SENSOR LENS ASSEMBLY	2 ft. replacement lens
*237M4Y	2DBLT24 SDPT SENSOR LENS ASSEMBLY	2 ft. replacement lens
*237M57	2DBLT24 ADSMT SENSOR LENS ASSEMBLY	2 ft. replacement lens
*237M5H	2DBLT24 SDSMT SENSOR LENS ASSEMBLY	2 ft. replacement lens

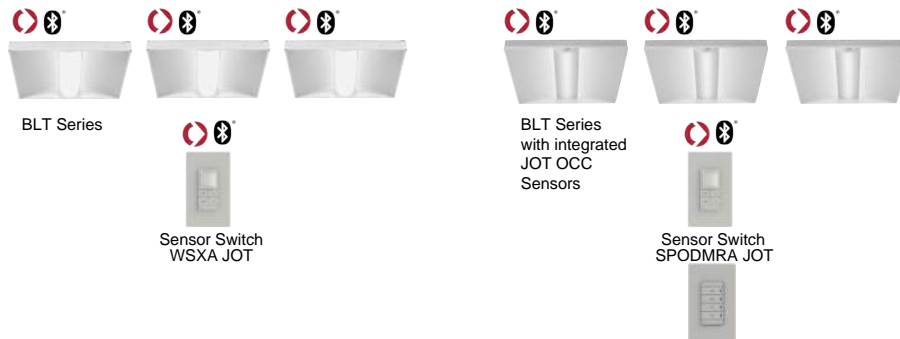
### JOT Wireless



#### Sensor Switch JOT Enabled Wireless Solution

Designed with contractors in mind, the Sensor Switch JOT enabled wireless solution offers a straightforward approach to the installation and pairing of lighting fixtures and controls. Absolutely no 0-10V control wires and no mobile apps are needed with JOT enabled products, allowing for lightning speed installation right out of the box.

- 1. Power:** Install JOT enabled fixtures and controls as instructed.
- 2. Pair:** Insert the pairing tool into the pinhole on the wall switch; press and hold any button for 6 seconds.
- 3. Play:** Once paired, each fixture will individually dim down to 10% brightness. All products will be fully functional.



TYPE T2A

## 2BLT Volumetric Recessed Lighting 2'x2'

### nLight Platform

nLight embedded fixtures offer:	Customers get:
Manual Dimming	Convenience and visual comfort for occupants
Motion Sensing and/or Daylight Harvesting	Energy savings and code compliance
Fixture or Group Level Control	Ability to configure lighting to the space requirements
Flexibility	Ease of fixture moves, adds and changes
Wireless Wall Switch (nLight AIR Only)	Ease and flexibility of placement
Astronomical and Time of Day Scheduling	Energy savings and building security
Scalable Solution	nLight controls to grow with your business
Future-Ready	nLight platform to set foundation for future upgrades and capabilities

### nLight Air Wireless



#### Simple as 1,2,3

1. Install the nLight™ AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CLAIRITY app, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome



### nLight Wired Networking



#### Simple as 1,2,3

1. Install the nLight™ Wired fixtures with embedded control
2. Install the nLight Wired wall switch
3. Connect the fixtures using standard CAT5e cables and the devices will automatically discover each other and work (plug and play)





TYPE T2A

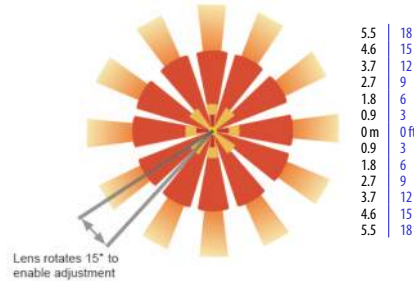
## 2BLT Volumetric Recessed Lighting 2'x2'

Sensor Options					
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking	nLight AIR Networking
		PIR	PDT		
MSD7ADCX	X	X			
MSDPDT7ADCX	X		X		
NES7		X		X	
NES7ADCX	X	X		X	
NESPDT7			X	X	
NESPDT7ADCX	X		X	X	
RES7	X	X			X
RESPDT7	X	X	X		X

### Sensor Coverage Pattern Mini 360° Lens

- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and
- 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor

#### 9 FT Mounting



### Integrated Sensor with Individual Control

The MSD7ADCX PIR occupancy sensor/automatic dimming photocell is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.

The MSDPDT7ADCX PIR/Microphonics Dual Tech occupancy sensor/automatic dimming photocell is ideal for areas with obstructions and where daylight harvesting is desired. Suggested applications include, but not limited to, open offices, private offices, classrooms, public restrooms, and conference rooms.

### nLight AIR Wireless

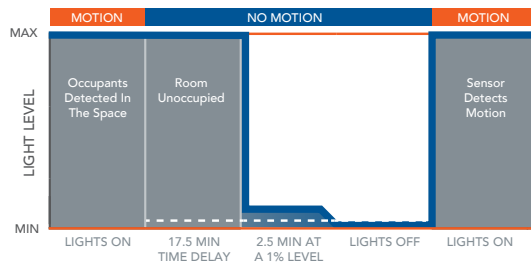
nLight AIR is the ideal solution for retrofit or new construction spaces where adding additional wiring can be labor intensive and nLight AIR is available with or without an integral sensor. The integrated rES7 or rES7PDT smart sensors are part of each luminaire in the nLight AIR network, which can be grouped to control multiple luminaires. The granularity of control with the digital PIR occupancy detection and daylight sensing makes a great solution for any application.

### nLight Wired Networking

The nES7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the nES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

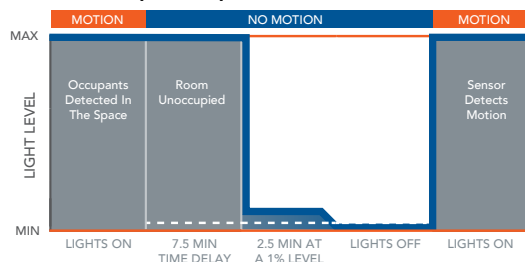
For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy. Additionally, the nESPDT7ADCX includes an integrated photocell, which enables daylight harvesting controls which is ideal for areas where windows are present.

### Sequence of Operation (MSD7 Sensor)



\*The presetting on the automatic dimming photocell is 5fc.

### Sequence of Operation (nES7 and rES7 and Sensor)



\*The presetting on the automatic dimming photocell is 5fc (NES7) and 10fc (RES7).

TYPE T2A

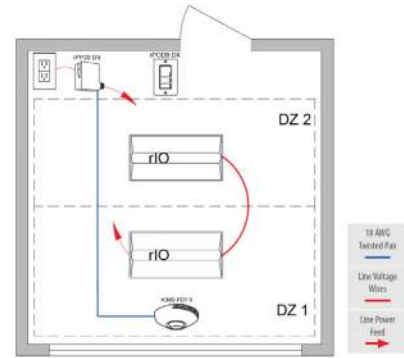
## 2BLT Volumetric Recessed Lighting 2'x2'

### Controls Accessories

nLight® Wired Control Accessories: <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlight">www.acuitybrands.com/products/controls/nlight</a>.</i>			
<b>WallPod stations</b>	<b>Model number</b>	<b>Occupancy sensors</b>	<b>Model number</b>
On/Off	nPODMA [Color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODMA DX [Color]	Large motion 360°, ceiling (PIR / dual tech)	nCM 10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD TOUCH [Color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
<b>Photocell controls</b>	<b>Model number</b>	<b>Cat-5 cable (plenum rated)</b>	<b>Model number</b>
Full range dimming	nCM ADCX RJB	10' cable	CATS 10FT J1
		30' cable	CATS 30FT J1

nLight® AIR Control Accessories: <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlightair">www.acuitybrands.com/products/controls/nlightair</a>.</i>	
<b>Wall switches</b>	<b>Model number</b>
On/Off single pole	rPODBA [color] G2
On/Off two pole	rPODB A2P [color] G2
On/Off & raise/lower single pole	rPODBA DX [color] G2
On/Off & raise/lower two pole	rPODBA 2P DX [color] G2

BLT fixtures with integrated rIO devices complement any small office space. Pair them with an rCMS occupancy sensor and the space now has wireless occupancy sensing and dimming capability. For additional configuration options please consult with Tech Support.



rCMS <sup>1</sup>		Example: RCMS PDT 10 AR G2						
Series / Detection	Power Supply <sup>1</sup>	Occupancy Detection	Lens (Required)		Operating Mode		Generation	
RCMS nLight AIR occupancy and daylight sensor	[blank] Power Supply ordered separately	[blank] PIR Detection PDT Dual Tech PIR/ Microphonics	10	Large Motion/ Extended Range 360°	[BLANK] None AR Auxiliary Relay	G2	Generation 2 compatibility	
	PS 150 Standard 150 mA Power Supply		9	Small Motion/ Extended Range 360°				
			6	High Bay 360° Lens				

**Notes**

<sup>1</sup> RCMS requires low voltage power from either RPP20 DS 24V G2 or PS150.

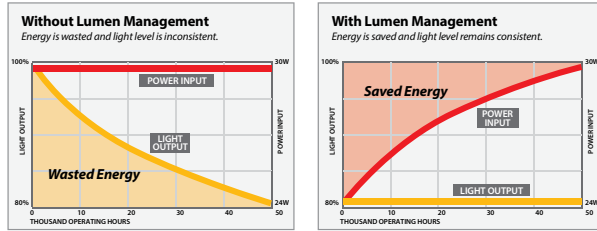


TYPE T2A

## 2BLT Volumetric Recessed Lighting 2'x2'

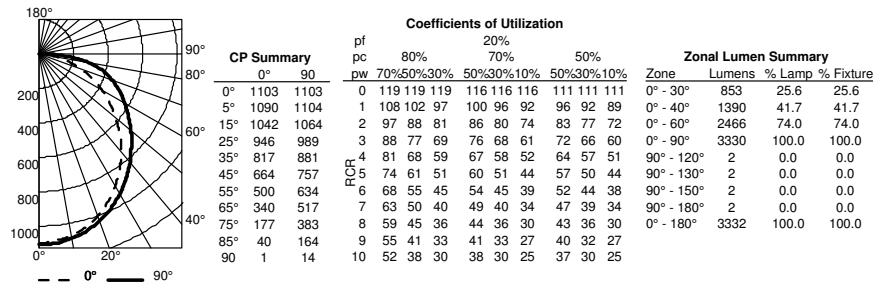
### Constant Lumen Management

Enabled by the embedded nLight control, the BLT actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.

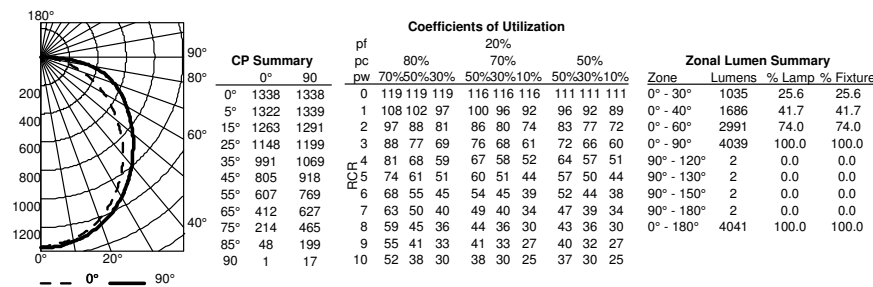


### PHOTOMETRICS

2BLT2 33L ADP LP835, 3332 delivered lumens, test no. ISF36900P19, tested in accordance to IESNA LM-79



2BLT2 40L ADP LP835, 4041 delivered lumens, test no. ISF36900P35, tested in accordance to IESNA LM-79



BLT-2X2

2BLT Volumetric Recessed Lighting 2'x2'

TYPE T2A

Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT2 20L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	2065.45	124.06	16.64	Premium	PM92196A
2BLT2 20L ADP EZ1 (GZ10) LP835 [All Options]	2033	126.58	16.06	Premium	P6445JVD
2BLT2 20L ADP GZ1 LP835 [All Options]	2033	122.11	16.64	standard	PLNK6MX8
2BLT2 20L ADPT EZ1 (GZ10) LP840 [All Options]	2037.91	126.89	16.06	Premium	PYX15QEQ
2BLT2 20L ADPT GZ1 LP835 [All Options]	2005.89	120.49	16.64	standard	P40HQGLB
2BLT2 20L ADPT GZ1 LP840 [All Options]	2037.91	122.41	16.64	standard	PB3HB9AK
2BLT2 33L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	3332	124.92	26.67	Premium	PHSXHE8F
2BLT2 33L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3385.19	126.91	26.67	Premium	PD18CKQ8
2BLT2 33L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	3340.05	125.22	26.67	Premium	PF98CZ2H
2BLT2 33L ADPT EZ1 (GZ10) LP835 [All Options]	3287.57	125.14	26.27	Premium	PTKZR9WQ
2BLT2 33L ADPT GZ1 LP835 [All Options]	3287.57	123.25	26.67	standard	PTN5O23N
2BLT2 40L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4041	127.35	31.73	Premium	P1XWW9GV
2BLT2 40L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4105.51	129.38	31.73	Premium	PHCQ2CQF
2BLT2 40L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3987.12	125.65	31.73	Premium	PW6RMMJ4
2BLT2 40L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4050.77	127.65	31.73	Premium	PSYYDA8
2BLT2 48L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4800	109.9	43.67	standard	PJRHR1G
2BLT2 48L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4876.63	111.66	43.67	standard	P8G93YOK
2BLT2 48L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4736	108.44	43.67	standard	PITU3V6X
2BLT2 48L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4811.61	110.17	43.67	standard	PSX2XU76

DLC information is subject to change, for the most up-to-date information please refer to www.dlc.org. Above listings do not cover 347v or SLD.

HE Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT2 20LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	1948	130.59	14.91	Premium	PUQCZNI
2BLT2 20LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	1979.1	132.67	14.91	Premium	PJCZRW21
2BLT2 20LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	1952.71	130.9	14.91	Premium	PLCARF4L
2BLT2 33LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	3392	137.3	24.7	Premium	PXXZN9PH
2BLT2 33LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3446.15	139.5	24.7	Premium	PKPIY9RF
2BLT2 33LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3346.77	135.47	24.7	Premium	PZC8BZSS
2BLT2 33LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	3400.2	137.64	24.7	Premium	PMS68AFU
2BLT2 40LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4118	133.71	30.79	Premium	PJ55XFFP
2BLT2 40LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4183.74	135.85	30.79	Premium	PEGFHPZD
2BLT2 40LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4063.09	131.93	30.79	Premium	P8E16E9B
2BLT2 40LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4127.96	134.04	30.79	Premium	PFSSSSVG
2BLT2 48LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4845	128	37.85	Premium	P558XUZP
2BLT2 48LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4922.35	130.04	37.85	Premium	P1863H56
2BLT2 48LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4780.4	126.29	37.85	Premium	PHPTG5M8
2BLT2 48LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4856.71	128.31	37.85	Premium	PBKN954Z

DLC information is subject to change, for the most up-to-date information please refer to www.dlc.org. Above listings do not cover 347v or SLD.

**How to Estimate Delivered Lumens in Emergency Mode**  
Use the formula below to estimate the delivered lumens in emergency mode  
**Delivered Lumens = 1.25 x P x LPW**  
P = Output power of emergency driver. P = 10W for E10WLCP option.  
LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet. LPW = Lumen per watt rating of the luminaire. LPW information available in Performance Data section.



BLT-2X2



**DIGITAL NAVIGATION**

[Ordering Tree](#) [nLight Platform](#) [Sensor Switch JOT](#) [Photometrics](#) [Performance Data](#)

**FEATURES & SPECIFICATIONS**

**INTENDED USE** — The BLT Best-in-Value Low Profile LED luminaire features a popular center basket design that offers a clean, versatile style and volumetric distribution. High efficacy LED light engines deliver energy savings and low maintenance compared to traditional sources. An extensive selection of configurations and options make the BLT the perfect choice for many lighting applications including schools, offices and other commercial spaces, retail, hospitals and healthcare facilities. The low profile BLT design (2-3/8") also makes it an excellent choice for renovation projects.

**CONSTRUCTION** — Prior to fabrication, BLT components are coated with a proprietary paint blend and die-formed for dimensional consistency.

The BLT reflector is available in both smooth and ribbed finishes. Choose RB from the fixture style section below for a ribbed finish.

End plates contain easy-to-position integral T-bar clips for securely attaching the luminaire to the T-grid. For additional T-grid security, optional screw on T-bar clips are available.

Diffusers are extruded from impact modified acrylic for increased durability.

LED boards and drivers are accessible from the plenum.

**OPTICS** — Volumetric illumination is achieved by creating an optimal mix of light to walls, partitions and vertical and horizontal work surfaces – rendering the interior space, objects and occupants in a more balanced, complimentary luminous environment. High performance extruded acrylic diffusers conceal LEDs and efficiently deliver light in a volumetric distribution. Four diffuser choices available – curved and square designs with ribbed or a smooth frosted finish.

**ELECTRICAL** — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and quality of illumination for extended service life. 80% LED lumen maintenance at 60,000 hours (L80/60,000). Color Variation within 3-step MacAdam ellipse (3SDCM).

**Non-Configurable BLT:** Generic 0-10 volt dimming driver. Dims to 10%

**Configurable BLT:** available in High Efficiency (HE) versions for applications where a lower wattage (over the standard product) is required. The High Efficiency versions deliver >130 LPW and can be specified via the Lumen Package designations in the Ordering Information below.

eldoLED driver options deliver choice of dimming range, and choices for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Optional integrated nLight® controls make each luminaire addressable - allowing them to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Connection to nLight is simple. It can be accomplished with integrated nLight AIR wireless r10 and rE57 sensors, or through standard Cat-5 cabling. nLight offers unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission. nLight AIR is commissioned easily through an intuitive model app.

Lumen Management: Unique lumen management system (option N80) provides on board intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing the energy waste created by the traditional practice of over-lighting.

Step-level dimming option allows system to be switched to 50% power for compliance with common energy codes while maintaining fixture appearance.

**SENSOR** — **Integrated sensor (individual control):** Sensor Switch MSD7ADCX ((Passive infrared (PIR)) or MSDPDT7ADCX ((PIR/Microphonics Dual Tech (PDT)) integrated occupancy sensor/automatic dimming photocell allows the luminaire to power off when the space is unoccupied or enough ambient light is entering the space. See page 4 for more details on the integrated sensor.

**Integrated Sensor (nLight Wired Networking):** This sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired, using CAT-5 cabling, with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 4 for the nLight sensor options.

**Integrated Smart Sensor (nLight Air Wireless Platform):** The RES7 sensor is nLight AIR enabled, meaning it has the ability to communicate over the wireless nLight control platform. It is available with an automatic dimming photocell, and either a digital PIR or a microphonics (PDT) dual technology occupancy sensor. It pairs to other luminaires and wall switches through our mobile app, *CLARITY*, which allows for simple sensor adjustment. See page 4 for more details on the Integrated Smart Sensor.

**Integrated Wireless Sensor (single room control):** Sensor Switch VERTEX JOT or JOTVIX15 luminaire-embedded occupancy and ambient light sensor allows the luminaire to power off when the space is unoccupied or when enough ambient light is entering the space. See page X for more details on the integrated wireless sensor.

**INSTALLATION** — The BLT's low profile design of only 2-3/8" provides increased installation flexibility especially in restrictive plenum applications. The BLT fits into standard 15/16" and narrow 9/16" T-grid ceiling systems.

Suitable for damp location.

For recessed mounting in hard ceiling applications, Drywall Grid Adapters (DGA) are available as an accessory. See Accessories section.

**LISTINGS** — CSA Certified to meet U.S. and Canadian standards. IC rated. Tested in accordance with ISO 14644-1; suitable for ISO Class 5-9 positive and negative pressure clean rooms.

Designlights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at [www.designlights.org/QPL](http://www.designlights.org/QPL) to confirm which versions are qualified.

**BUY AMERICAN** — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.

**WARRANTY** — 5-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

**NOTE:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

Catalog Number	TYPE T2B
Notes	
Type	

BLT Series LED



ADP Diffuser Option

**2BLT2**

2' x 2'  
LED



Ribbed Reflector Option



*Specifications*

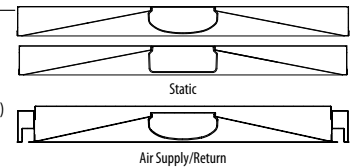
Length: 23-3/4 (60.3)

Width: 23-3/4 (60.3)

Depth: 2-3/8 (6.0)

Depth with Air supply/return: 2-3/4 (6.9)

All dimensions are inches (centimeters) unless otherwise specified.



**Embed nLight controls today. Prepare for tomorrow.**

**Now**

- User-friendly install
- Enhanced energy savings
- Code compliance

**Tomorrow**

- Scalability
- Space configuration
- Future-ready

**Capable Luminaire**

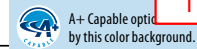
This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® control networks when ordered with drivers marked by a shaded background\*
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a shaded background\*

To learn more about A+, visit [www.acuitybrands.com/aplus](http://www.acuitybrands.com/aplus).

\*See ordering tree for details

2BLT Volumetric Recessed Lighting 2'x2'



TYPE T2B

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative.

Example: 2BLT2 33L ADP EZ1 LP835

Series	Fixture Style	Air function	Lumens ‡	Diffuser	Voltage	Driver	Color temperature										
2BLT2 2X2 BLT	(blank) Smooth Reflector RB Ribbed Reflector	(blank) Static A Air supply/return ‡	<table border="1"> <tr> <th>Standard efficiency ‡ (&gt;125 LPW)</th> <th>High efficiency ‡ (&gt;130 LPW)</th> </tr> <tr> <td>20L 2000</td> <td>20LHE 2000</td> </tr> <tr> <td>33L 3300</td> <td>33LHE 3300</td> </tr> <tr> <td>40L 4000</td> <td>40LHE 4000</td> </tr> <tr> <td>48L 4800</td> <td>48LHE 4800</td> </tr> </table>	Standard efficiency ‡ (>125 LPW)	High efficiency ‡ (>130 LPW)	20L 2000	20LHE 2000	33L 3300	33LHE 3300	40L 4000	40LHE 4000	48L 4800	48LHE 4800	ADP Curved, ribbed ADSM Curved, smooth SDP Square, ribbed SDSM Square, smooth ADPT Curved, ribbed ADSMT Curved, smooth SDPT Square, ribbed SDSMT Square, smooth	(blank) MVOLT 120 120V 277 277V 347 347V ‡	EZ1 eldoLED dims to 1% (0-10 volt dimming) GZ1 Dims to 1% (0-10V dimming) ‡ GZ10 Dims to 10% (0-10V dimming) ‡ SLD Step-level dimming ‡	LP830 82CRI, 3000 K LP835 82CRI, 3500 K LP840 82CRI, 4000 K LP850 82CRI, 5000 K LP930 90CRI, 3000K LP935 90CRI, 3500K LP940 90CRI, 4000K LP950 90CRI, 5000K
Standard efficiency ‡ (>125 LPW)	High efficiency ‡ (>130 LPW)																
20L 2000	20LHE 2000																
33L 3300	33LHE 3300																
40L 4000	40LHE 4000																
48L 4800	48LHE 4800																

nLight Interface	Control ‡	Individual Control
<b>nLight Wired</b> (blank) no nLight ® interface N80 nLight with 80% lumen management N80EMG nLight with 80% lumen management For use with generator supply EM power ‡ N100 nLight without lumen management N100EMG nLight without lumen management For use with generator supply EM power ‡ <b>nLight Wireless</b> (blank) no nLight ® interface NLTAIR2 nLight AIR Generation 2 enabled ‡	<b>nLight Wired</b> (blank) No sensor control NES7 nLight™ nES7 PIR integral occupancy sensor ‡ NESPD7 nLight™ nES PDT 7 dual technology integral occupancy control ‡ NES7ADCX nLight™ nES7 ADCX PIR integral occupancy sensor with automatic dimming photocell ‡ NESPD7ADCX nLight™ nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell ‡ <b>nLight Wireless</b> RES7 nLight AIR PIR integral occupancy sensor with automatic dimming photocell for Networking Capabilities RES7PDT nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell RIO nLight AIR radio module without sensor RES7EM nLight AIR PIR integral occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RES7PDTEM nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RIOEM nLight AIR radio module less sensor, with UL924 Emergency Operation, via power interrupt detection ‡	<b>MSD7ADCX</b> PIR integral occupancy sensor with automatic dimming control photocell ‡ <b>MSDPDT7ADCX</b> PDT integral occupancy sensor with automatic dimming control photocell ‡ <b>JOT</b> Wireless room control with "Just One Touch" pairing ‡ <b>JOTVTX15</b> Wireless occupancy sensor with "Just One Touch" pairing ‡

Standby Mode	Options																																	
NOC NOC Occupancy sensor disabled ‡	<table border="1"> <tr> <th>BDP Disconnect Plug</th> <th>CP</th> <th>GLR</th> </tr> <tr> <td>EL7L 700 lumen battery pack (Noncompliant with CA T20) ‡</td> <td>Chicago plenum ‡</td> <td>Fast-blowing fuse ‡</td> </tr> <tr> <td>EL14L 1400 lumen battery pack (Noncompliant with CA T20) ‡</td> <td>BGTD Bodine Generator Transfer Device ‡</td> <td>GMF Slow-blowing fuse ‡</td> </tr> <tr> <td>EL14LSD 1400 lumen battery pack with self-diagnostic testing feature (Noncompliant with CA T20) ‡</td> <td>PWS1836 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit</td> <td>NPLT Narrow pallet</td> </tr> <tr> <td>E10WLCP EM Self-Diagnostic battery pack, 10W Constant Power, Certified in CA Title 20 MAEDBS ‡</td> <td>PWS1846 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuit</td> <td>RRL_ RELOC®-ready luminaire ‡</td> </tr> <tr> <td></td> <td>PWS1846 PWSLV Two cables: one 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuits; one 6' pre-wire, 3/8" diameter, 18 gauge ‡</td> <td>LATC Earthquake clip</td> </tr> <tr> <td></td> <td>PWS1856LV 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit w/low voltage wires ‡</td> <td>DWAM Anti-Microbial paint</td> </tr> <tr> <td></td> <td></td> <td>JP28 Job packaging ‡</td> </tr> <tr> <td></td> <td></td> <td>JP36 Job packaging</td> </tr> <tr> <td></td> <td></td> <td>IP5X Gasketed diffuser compartment to meet IP5X rating ‡</td> </tr> <tr> <td></td> <td></td> <td>BAA Buy America(n) Act Compliant</td> </tr> </table>	BDP Disconnect Plug	CP	GLR	EL7L 700 lumen battery pack (Noncompliant with CA T20) ‡	Chicago plenum ‡	Fast-blowing fuse ‡	EL14L 1400 lumen battery pack (Noncompliant with CA T20) ‡	BGTD Bodine Generator Transfer Device ‡	GMF Slow-blowing fuse ‡	EL14LSD 1400 lumen battery pack with self-diagnostic testing feature (Noncompliant with CA T20) ‡	PWS1836 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit	NPLT Narrow pallet	E10WLCP EM Self-Diagnostic battery pack, 10W Constant Power, Certified in CA Title 20 MAEDBS ‡	PWS1846 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuit	RRL_ RELOC®-ready luminaire ‡		PWS1846 PWSLV Two cables: one 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuits; one 6' pre-wire, 3/8" diameter, 18 gauge ‡	LATC Earthquake clip		PWS1856LV 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit w/low voltage wires ‡	DWAM Anti-Microbial paint			JP28 Job packaging ‡			JP36 Job packaging			IP5X Gasketed diffuser compartment to meet IP5X rating ‡			BAA Buy America(n) Act Compliant
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NOTE: ‡ indicates option value has ordering restrictions. Please reference the Option Value Ordering Restrictions chart on the next page. Options are sorted alphanumerically.

LUMINAIRES WITH "EM" DESIGNATION TO HAVE BATTERY PACK

ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES



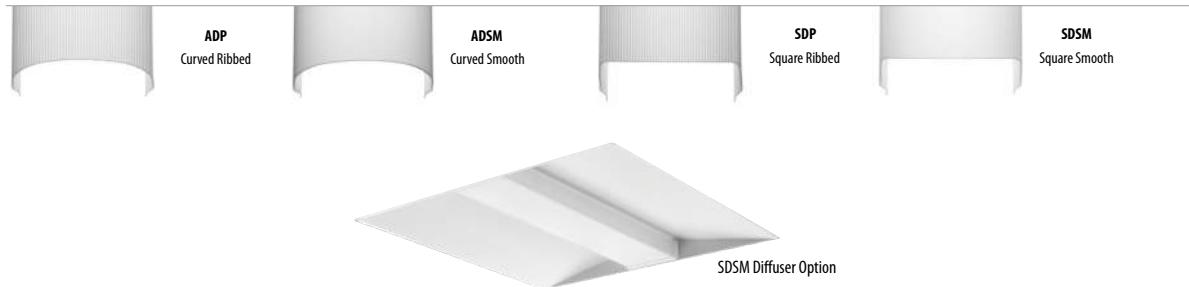
BLT-2X2

TYPE T2B

## 2BLT Volumetric Recessed Lighting 2'x2'

‡ Option Value Ordering Restrictions	
Option value	Restriction
347	Not available with SLD, EL7L, EL14L, or E10WLCP options.
A	Not available with RB fixture style, consult factory for air flow data.
BGTD	Not available with JOT, JOTVTX15 sensor options or emergency battery options. Must specify voltage. Requires BSE labeling, voltage specific. Consult factory for options. Example: BGTD BSE10.
Control	Must specify diffuser with trim rings.
CP	Not available with N80, N80EMG, N100, or N100EMG.
GZ1, GZ10	Not available with any Control or Sensor options except JOT & JOTVTX15
EL7L, EL14L, EL14LSD, E10WLCP	When using pre-wire option, use PWS1846 or PWS1846 PWSLV. For more information on the EL14LSD, please see the <a href="#">PSSD2 specification sheet</a> .
GLR, GMF	Must specify voltage. 120 or 277, with GLR and GMF fusing.
IP5X	Not available with air supply/return or Wired Networking (NES_) and Individual Control (MSD_) sensors.
JOT, JOTVTX15	Not available with SLD, nLight, NLTAIR2, NOC, or BGTD options.
JP28	Only available with options: NES7, NESPDT7, NES7ADCX, NESPDT7ADCX, MSD7ADCX, MSDPDT7ADCX, RES7, RES7PDT, RIO. Not available when sensor options combined with air supply return option.
Lumens	Approximate lumen output. For high Efficiency, all versions may not achieve 130+ LPW. Refer to photometry on <a href="http://www.acuitybrands.com">www.acuitybrands.com</a> . Air supply/return option, 90 CRI, and versions with integral sensor trim rings may not achieve 130 LPW.
MSD7ADCX, MSDPDT7ADCX	Only available with EZ1 driver option. 0-10v dimming wires not accessible via access plate.
NES7, NESPDT7, NES7ADCX, NESPDT7ADCX	Requires N80, N80EMG, N100, or N100EMG. Only available with EZ1 driver.
NLTAIR2	Must order with nLight Wireless option from Control section. Only available with EZ1 driver.
NOC	Can only be ordered in conjunction with EZ1, NLTAIR2, RES7/RES7PDT. Occupancy sensor disabled at factory but can be re-enabled upon commissioning.
N80EMG, N100EMG	nLight EMG option requires a connection to existing nLight network. Power is provided from a separate N80 or N100 enabled fixture.
PWS1846 PWSLV, PWS1856LV	Not available with nLIGHT wired network or individual controls
RES7EM, RES7PDTM, RIOEM	See UL924 Sequence of Operation chart on page 3.
RRL_	For ordering logic consult: <a href="#">RRL_2013</a> .
SLD	Not available with with any nLight Interface or Control options.

### Multiple Diffuser Options

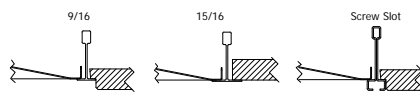


### Non-Configurable BLT

Stock/MTO	Catalog Description *	UPC	Lumens	Wattage	LPW	Color Temperature	Voltage	Pallet Qty
Stock	2BLT2 33L ADP LP835	190887529708	3332	26.67	124.92	3500K/82 CRI	120-277	56
	2BLT2 33L ADP LP840	190887529739	3385	26.67	126.91	4000K/82CRI	120-277	56
	2BLT2 33L ADP EL14L LP835	190887529890	3332	26.67	124.92	3500K/82CRI	120-277	56
	2BLT2 33L ADP EL14L LP840	190887529937	3385	26.67	126.91	4000K/82CRI	120-277	56

\*Generic 0-10V Dimming to 10%.

MOUNTING DATA	
Ceiling Type	Appropriate Trim Type
Exposed grid tee (1' and 9/16")	G
Concealed grid tee	G
Plaster or plasterboard	G*



\*DGA accessory available to provide ceiling trim flange and fixture support for plaster or plasterboard ceiling. Recommended rough-in dimensions for DGA installation is 24-3/4" x 24-3/4" (Tolerance is +1/8", -0").

UL924 Sequence of Operation
For 90 minutes following any complete AC power interruption >200 ms: <ul style="list-style-type: none"> <li>Digital dimming is commanded to high end trim level.</li> <li>Device ignores wireless lighting control commands.</li> </ul>



BLT-2X2

## 2BLT Volumetric Recessed Lighting 2'x2'

TYPE T2B

### Accessories & Replacement Parts

Accessories: Order as separate catalog number.	
DGA22	Drywall grid adapter for 2x2 recessed fixture
2X2SMKSH PAF	Surface Mount Troffer Kit Post Paint
RK8BDP 2P U	Disconnect Plug (BDP), 2 Pole, Package of 1
RK8BDP 3P U	Disconnect Plug (BDP), 3 Pole, Package of 1
RK8BDP 2P J10	Disconnect Plug (BDP), 2 Pole, Package of 10
RK8BDP 2P J40	Disconnect Plug (BDP), 2 Pole, Package of 40

Replacement Parts: Order as separate catalog number.		
*247WJV	2DBLT24 ADP LENS ASSEMBLY	2 ft. replacement lens
*249P2P	2DBLT24 SDP LENS ASSEMBLY	2 ft. replacement lens
*249P2W	2DBLT24 ADSM LENS ASSEMBLY	2 ft. replacement lens
*249P32	2DBLT24 SDSM LENS ASSEMBLY	2 ft. replacement lens
*237LT1	2DBLT24 ADPT LENS ASSEMBLY	2 ft. replacement lens
*237LT3	2DBLT24 SDPT LENS ASSEMBLY	2 ft. replacement lens
*237LT5	2DBLT24 ADSMT LENS ASSEMBLY	2 ft. replacement lens
*237LT7	2DBLT24 SDSMT LENS ASSEMBLY	2 ft. replacement lens
*237LT9	2DBLT24 ADPT SENSOR LENS ASSEMBLY	2 ft. replacement lens
*237M4Y	2DBLT24 SDPT SENSOR LENS ASSEMBLY	2 ft. replacement lens
*237M57	2DBLT24 ADSMT SENSOR LENS ASSEMBLY	2 ft. replacement lens
*237M5H	2DBLT24 SDSMT SENSOR LENS ASSEMBLY	2 ft. replacement lens

### JOT Wireless



#### Sensor Switch JOT Enabled Wireless Solution

Designed with contractors in mind, the Sensor Switch JOT enabled wireless solution offers a straightforward approach to the installation and pairing of lighting fixtures and controls. Absolutely no 0-10V control wires and no mobile apps are needed with JOT enabled products, allowing for lightning speed installation right out of the box.

- 1. Power:** Install JOT enabled fixtures and controls as instructed.
- 2. Pair:** Insert the pairing tool into the pinhole on the wall switch; press and hold any button for 6 seconds.
- 3. Play:** Once paired, each fixture will individually dim down to 10% brightness. All products will be fully functional.



BLT Series



Sensor Switch  
WSXA JOT



BLT Series  
with integrated  
JOT OCC  
Sensors



Sensor Switch  
SPODMRA JOT



TYPE T2B

## 2BLT Volumetric Recessed Lighting 2'x2'

### nLight Platform

nLight embedded fixtures offer:	Customers get:
Manual Dimming	Convenience and visual comfort for occupants
Motion Sensing and/or Daylight Harvesting	Energy savings and code compliance
Fixture or Group Level Control	Ability to configure lighting to the space requirements
Flexibility	Ease of fixture moves, adds and changes
Wireless Wall Switch (nLight AIR Only)	Ease and flexibility of placement
Astronomical and Time of Day Scheduling	Energy savings and building security
Scalable Solution	nLight controls to grow with your business
Future-Ready	nLight platform to set foundation for future upgrades and capabilities

### nLight Air Wireless



#### Simple as 1,2,3

1. Install the nLight™ AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CLAIRITY app, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome



### nLight Wired Networking



#### Simple as 1,2,3

1. Install the nLight™ Wired fixtures with embedded control
2. Install the nLight Wired wall switch
3. Connect the fixtures using standard CAT5e cables and the devices will automatically discover each other and work (plug and play)



2BLT Volumetric Recessed Lighting 2'x2'

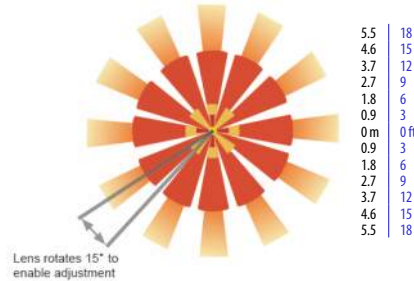
TYPE T2B

Sensor Options					
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking	nLight AIR Networking
		PIR	PDT		
MSD7ADCX	X	X			
MSDPDT7ADCX	X		X		
NES7		X		X	
NES7ADCX	X	X		X	
NESPDT7			X	X	
NESPDT7ADCX	X		X	X	
RES7	X	X			X
RESPDT7	X	X	X		X

Sensor Coverage Pattern  
Mini 360° Lens

- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and
- 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor

9 FT Mounting



Integrated Sensor with Individual Control

The MSD7ADCX PIR occupancy sensor/automatic dimming photocell is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.

The MSDPDT7ADCX PIR/Microphonics Dual Tech occupancy sensor/automatic dimming photocell is ideal for areas with obstructions and where daylight harvesting is desired. Suggested applications include, but not limited to, open offices, private offices, classrooms, public restrooms, and conference rooms.

nLight AIR Wireless

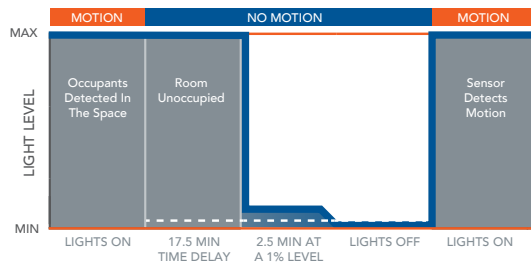
nLight AIR is the ideal solution for retrofit or new construction spaces where adding additional wiring can be labor intensive and nLight AIR is available with or without an integral sensor. The integrated rES7 or rES7PDT smart sensors are part of each luminaire in the nLight AIR network, which can be grouped to control multiple luminaires. The granularity of control with the digital PIR occupancy detection and daylight sensing makes a great solution for any application.

nLight Wired Networking

The nES 7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the nES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

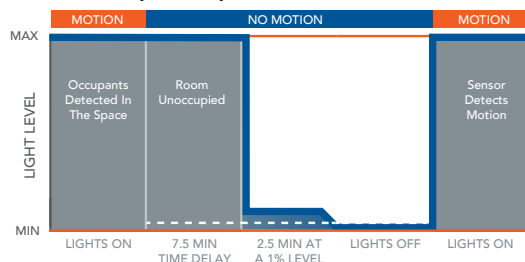
For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy. Additionally, the nESPDT7ADCX includes an integrated photocell, which enables daylight harvesting controls which is ideal for areas where windows are present.

Sequence of Operation (MSD7 Sensor)



\*The presetting on the automatic dimming photocell is 5fc.

Sequence of Operation (nES7 and rES7 and Sensor)



\*The presetting on the automatic dimming photocell is 5fc (NES7) and 10fc (RES7).

TYPE T2B

## 2BLT Volumetric Recessed Lighting 2'x2'

### Controls Accessories

#### nLight® Wired Control Accessories:

Order as separate catalog number. Visit [www.acuitybrands.com/products/controls/nlight](http://www.acuitybrands.com/products/controls/nlight).

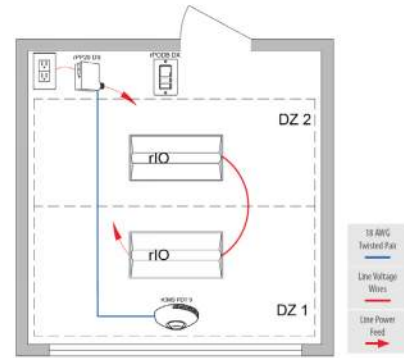
WallPod stations	Model number	Occupancy sensors	Model number
On/Off	nPODMA [Color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODMA DX [Color]	Large motion 360°, ceiling (PIR / dual tech)	nCM10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD TOUCH [Color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
Photocell controls	Model number	Cat-5 cable (plenum rated)	Model number
Full range dimming	nCM ADCX RJB	10' cable	CATS 10FT J1
		30' cable	CATS 30FT J1

#### nLight® AIR Control Accessories:

Order as separate catalog number. Visit [www.acuitybrands.com/products/controls/nlightair](http://www.acuitybrands.com/products/controls/nlightair).

Wall switches	Model number
On/Off single pole	rPODBA [color] G2
On/Off two pole	rPODB A2P [color] G2
On/Off & raise/lower single pole	rPODBA DX [color] G2
On/Off & raise/lower two pole	rPODBA 2P DX [color] G2

BLT fixtures with integrated rIO devices complement any small office space. Pair them with an rCMS occupancy sensor and the space now has wireless occupancy sensing and dimming capability. For additional configuration options please consult with Tech Support.



rCMS <sup>1</sup>		Example: RCMS PDT 10 AR G2					
Series / Detection	Power Supply <sup>1</sup>	Occupancy Detection	Lens (Required)		Operating Mode	Generation	
RCMS nLight AIR occupancy and daylight sensor	[blank] Power Supply ordered separately	[blank] PIR Detection PDT Dual Tech PIR/ Microphonics	10	Large Motion/ Extended Range 360°	[BLANK] None AR Auxiliary Relay	G2 Generation 2 compatibility	
	PS 150 Standard 150 mA Power Supply		9	Small Motion/ Extended Range 360°			
			6	High Bay 360° Lens			

**Notes**

<sup>1</sup> RCMS requires low voltage power from either RPP20 DS 24V G2 or PS150.

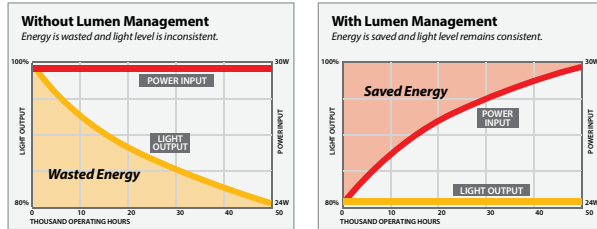


TYPE T2B

## 2BLT Volumetric Recessed Lighting 2'x2'

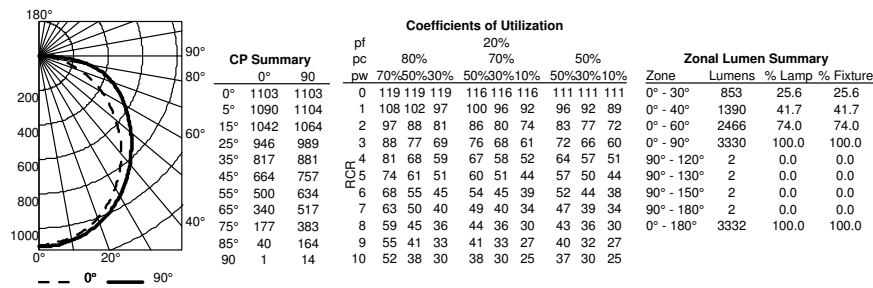
### Constant Lumen Management

Enabled by the embedded nLight control, the BLT actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.

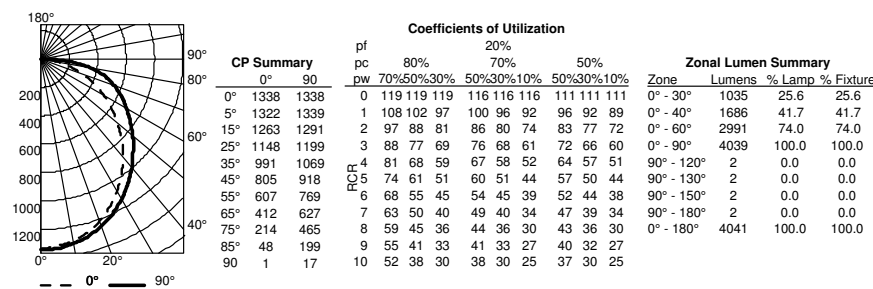


### PHOTOMETRICS

**2BLT2 33L ADP LP835**, 3332 delivered lumens, test no. ISF36900P19, tested in accordance to IESNA LM-79



**2BLT2 40L ADP LP835**, 4041 delivered lumens, test no. ISF36900P35, tested in accordance to IESNA LM-79



BLT-2X2

TYPE T2B

## 2BLT Volumetric Recessed Lighting 2'x2'

Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT2 20L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	2065.45	124.06	16.64	Premium	PM92196A
2BLT2 20L ADP EZ1 (GZ10) LP835 [All Options]	2033	126.58	16.06	Premium	P6445JVD
2BLT2 20L ADP GZ1 LP835 [All Options]	2033	122.11	16.64	standard	PLNK6MX8
2BLT2 20L ADPT EZ1 (GZ10) LP840 [All Options]	2037.91	126.89	16.06	Premium	PYX15QEQ
2BLT2 20L ADPT GZ1 LP835 [All Options]	2005.89	120.49	16.64	standard	P40HQGLB
2BLT2 20L ADPT GZ1 LP840 [All Options]	2037.91	122.41	16.64	standard	PB3HB9AK
2BLT2 33L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	3332	124.92	26.67	Premium	PHSXHE8F
2BLT2 33L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3385.19	126.91	26.67	Premium	PD18CKQ8
2BLT2 33L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	3340.05	125.22	26.67	Premium	PF98CZ2H
2BLT2 33L ADPT EZ1 (GZ10) LP835 [All Options]	3287.57	125.14	26.27	Premium	PTKZR9WQ
2BLT2 33L ADPT GZ1 LP835 [All Options]	3287.57	123.25	26.67	standard	PTN5O23N
2BLT2 40L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4041	127.35	31.73	Premium	P1XWW9GV
2BLT2 40L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4105.51	129.38	31.73	Premium	PHCQ2CQF
2BLT2 40L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3987.12	125.65	31.73	Premium	PW6RMMJ4
2BLT2 40L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4050.77	127.65	31.73	Premium	PSYYDA8
2BLT2 48L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4800	109.9	43.67	standard	PJRHR1G
2BLT2 48L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4876.63	111.66	43.67	standard	P8G93YOK
2BLT2 48L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4736	108.44	43.67	standard	PITU3V6X
2BLT2 48L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4811.61	110.17	43.67	standard	PSX2XU76

DLC information is subject to change, for the most up-to-date information please refer to [www.dlc.org](http://www.dlc.org). Above listings do not cover 347v or SLD.

HE Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT2 20LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	1948	130.59	14.91	Premium	PUQCZNI
2BLT2 20LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	1979.1	132.67	14.91	Premium	PJCZRW21
2BLT2 20LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	1952.71	130.9	14.91	Premium	PLCARF4L
2BLT2 33LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	3392	137.3	24.7	Premium	PXXZN9PH
2BLT2 33LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3446.15	139.5	24.7	Premium	PKPIYRF
2BLT2 33LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3346.77	135.47	24.7	Premium	PZC8BZSS
2BLT2 33LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	3400.2	137.64	24.7	Premium	PMS68AFU
2BLT2 40LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4118	133.71	30.79	Premium	PJ55XFFP
2BLT2 40LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4183.74	135.85	30.79	Premium	PEGFHPZD
2BLT2 40LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4063.09	131.93	30.79	Premium	P8E16E9B
2BLT2 40LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4127.96	134.04	30.79	Premium	PFSSSSVG
2BLT2 48LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4845	128	37.85	Premium	P558XUZP
2BLT2 48LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4922.35	130.04	37.85	Premium	P1863H56
2BLT2 48LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4780.4	126.29	37.85	Premium	PHPTG5M8
2BLT2 48LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4856.71	128.31	37.85	Premium	PBKN954Z

DLC information is subject to change, for the most up-to-date information please refer to [www.dlc.org](http://www.dlc.org). Above listings do not cover 347v or SLD.

### How to Estimate Delivered Lumens in Emergency Mode

Use the formula below to estimate the delivered lumens in emergency mode

$$\text{Delivered Lumens} = 1.25 \times P \times \text{LPW}$$

P = Output power of emergency driver. P = 10W for E10WLCP option.

LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet. LPW = Lumen per watt rating of the luminaire. LPW information available in Performance Data section.



BLT-2X2



**DIGITAL NAVIGATION**

[Ordering Tree](#) [nLight Platform](#) [Sensor Switch JOT](#) [Photometrics](#) [Performance Data](#)

**FEATURES & SPECIFICATIONS**

**INTENDED USE** — The BLT Best-in-Value Low Profile LED luminaire features a popular center basket design that offers a clean, versatile style and volumetric distribution. High efficacy LED light engines deliver energy savings and low maintenance compared to traditional sources. An extensive selection of configurations and options make the BLT the perfect choice for many lighting applications including schools, offices and other commercial spaces, retail, hospitals and healthcare facilities. The low profile BLT design (2-3/8") also makes it an excellent choice for renovation projects.

**CONSTRUCTION** — Prior to fabrication, BLT components are coated with a proprietary paint blend and die-formed for dimensional consistency.

The BLT reflector is available in both smooth and ribbed finishes. Choose RB from the fixture style section below for a ribbed finish.

End plates contain easy-to-position integral T-bar clips for securely attaching the luminaire to the T-grid. For additional T-grid security, optional screw on T-bar clips are available.

Diffusers are extruded from impact modified acrylic for increased durability.

LED boards and drivers are accessible from the plenum.

**OPTICS** — Volumetric illumination is achieved by creating an optimal mix of light to walls, partitions and vertical and horizontal work surfaces – rendering the interior space, objects and occupants in a more balanced, complimentary luminous environment. High performance extruded acrylic diffusers conceal LEDs and efficiently deliver light in a volumetric distribution. Four diffuser choices available – curved and square designs with ribbed or a smooth frosted finish.

**ELECTRICAL** — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and quality of illumination for extended service life. 80% LED lumen maintenance at 60,000 hours (L80/60,000). Color Variation within 3-step MacAdam ellipse (3SDCM).

**Non-Configurable BLT:** Generic 0-10 volt dimming driver. Dims to 10%

**Configurable BLT:** available in High Efficiency (HE) versions for applications where a lower wattage (over the standard product) is required. The High Efficiency versions deliver >130 LPW and can be specified via the Lumen Package designations in the Ordering Information below.

eldoLED driver options deliver choice of dimming range, and choices for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Optional integrated nLight® controls make each luminaire addressable - allowing them to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Connection to nLight is simple. It can be accomplished with integrated nLight AIR wireless r10 and rE57 sensors, or through standard Cat-5 cabling. nLight offers unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission. nLight AIR is commissioned easily through an intuitive model app.

Lumen Management: Unique lumen management system (option N80) provides on board intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing the energy waste created by the traditional practice of over-lighting.

Step-level dimming option allows system to be switched to 50% power for compliance with common energy codes while maintaining fixture appearance.

**SENSOR** — **Integrated sensor (individual control):** Sensor Switch MSD7ADCX ((Passive infrared (PIR) or MSDPDT7ADCX ((PIR/Microphonics Dual Tech (PDT)) integrated occupancy sensor/automatic dimming photocell allows the luminaire to power off when the space is unoccupied or enough ambient light is entering the space. See page 4 for more details on the integrated sensor.

**Integrated Sensor (nLight Wired Networking):** This sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired, using CAT-5 cabling, with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 4 for the nLight sensor options.

**Integrated Smart Sensor (nLight Air Wireless Platform):** The RES7 sensor is nLight AIR enabled, meaning it has the ability to communicate over the wireless nLight control platform. It is available with an automatic dimming photocell, and either a digital PIR or a microphonics (PDT) dual technology occupancy sensor. It pairs to other luminaires and wall switches through our mobile app, *CLARITY*, which allows for simple sensor adjustment. See page 4 for more details on the Integrated Smart Sensor.

**Integrated Wireless Sensor (single room control):** Sensor Switch VERTEX.JOT or JOTVIX15 luminaire-embedded occupancy and ambient light sensor allows the luminaire to power off when the space is unoccupied or when enough ambient light is entering the space. See page X for more details on the integrated wireless sensor.

**INSTALLATION** — The BLT's low profile design of only 2-3/8" provides increased installation flexibility especially in restrictive plenum applications. The BLT fits into standard 15/16" and narrow 9/16" T-grid ceiling systems.

Suitable for damp location.

For recessed mounting in hard ceiling applications, Drywall Grid Adapters (DGA) are available as an accessory. See Accessories section.

**LISTINGS** — CSA Certified to meet U.S. and Canadian standards. IC rated. Tested in accordance with ISO 14644-1; suitable for ISO Class 5-9 positive and negative pressure clean rooms.

Designlights Consortium® (DLC) Premium qualified product and DLC qualified product. Not all versions of this product may be DLC Premium qualified or DLC qualified. Please check the DLC Qualified Products List at [www.designlights.org/QPL](http://www.designlights.org/QPL) to confirm which versions are qualified.

**BUY AMERICAN** — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to [www.acuitybrands.com/buy-american](http://www.acuitybrands.com/buy-american) for additional information.

**WARRANTY** — 5-year limited warranty. Complete warranty terms located at [www.acuitybrands.com/support/warranty/terms-and-conditions](http://www.acuitybrands.com/support/warranty/terms-and-conditions)

**NOTE:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

Catalog Number	TYPE T2C
Notes	
Type	

BLT Series LED



ADP Diffuser Option

**2BLT2**

2' x 2'  
LED



Ribbed Reflector Option



*Specifications*

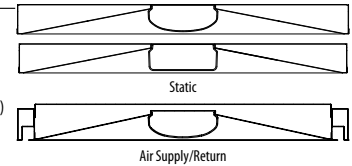
Length: 23-3/4 (60.3)

Width: 23-3/4 (60.3)

Depth: 2-3/8 (6.0)

Depth with Air supply/return: 2-3/4 (6.9)

All dimensions are inches (centimeters) unless otherwise specified.



**Embed nLight controls today. Prepare for tomorrow.**

**Now**

- User-friendly install
- Enhanced energy savings
- Code compliance

**Tomorrow**

- Scalability
- Space configuration
- Future-ready

**Capable Luminaire**

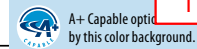
This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® control networks when ordered with drivers marked by a shaded background\*
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a shaded background\*

To learn more about A+, visit [www.acuitybrands.com/aplus](http://www.acuitybrands.com/aplus).

\*See ordering tree for details

2BLT Volumetric Recessed Lighting 2'x2'



TYPE T2C

ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: 2BLT2 33L ADP EZ1 LP835

Series	Fixture Style	Air function	Lumens ‡	Diffuser	Voltage	Driver	Color temperature
2BLT2 2X2 BLT	(blank) Smooth Reflector RB Ribbed Reflector	(blank) Static A Air supply/return ‡	<b>Standard efficiency ‡ (&gt;125 LPW)</b> 20L 2000 33L 3300 40L 4000 48L 4800 <b>High efficiency ‡ (&gt;130 LPW)</b> 20LHE 2000 33LHE 3300 40LHE 4000 48LHE 4800	ADP Curved, ribbed ADSM Curved, smooth SDP Square, ribbed SDSM Square, smooth ADPT Curved, ribbed ADSMT Curved, smooth SDPT Square, ribbed SDSMT Square, smooth	(blank) MVOLT 120 120V 277 277V 347 347V ‡	EZ1 eldoLED dims to 1% (0-10 volt dimming) GZ1 Dims to 1% (0-10V dimming) ‡ GZ10 Dims to 10% (0-10V dimming) ‡ SLD Step-level dimming ‡	LP830 82CRI, 3000 K LP835 82CRI, 3500 K LP840 82CRI, 4000 K LP850 82CRI, 5000 K LP930 90CRI, 3000K LP935 90CRI, 3500K LP940 90CRI, 4000K LP950 90CRI, 5000K

nLight Interface	Control ‡	Individual Control
<b>nLight Wired</b> (blank) no nLight ® interface N80 nLight with 80% lumen management N80EMG nLight with 80% lumen management For use with generator supply EM power ‡ N100 nLight without lumen management N100EMG nLight without lumen management For use with generator supply EM power ‡ <b>nLight Wireless</b> (blank) no nLight ® interface NLTAIR2 nLight AIR Generation 2 enabled ‡	<b>nLight Wired</b> (blank) No sensor control NES7 nLight™ nES 7 PIR integral occupancy sensor ‡ NESPD7 nLight™ nES PDT 7 dual technology integral occupancy control ‡ NES7ADCX nLight™ nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell ‡ NESPD7ADCX nLight™ nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell ‡ <b>nLight Wireless</b> RES7 nLight AIR PIR integral occupancy sensor with automatic dimming photocell for Networking Capabilities RES7PDT nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell RIO nLight AIR radio module without sensor RES7EM nLight AIR PIR integral occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RES7PDTEM nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡ RIOEM nLight AIR radio module less sensor, with UL924 Emergency Operation, via power interrupt detection ‡	<b>MSD7ADCX</b> PIR integral occupancy sensor with automatic dimming control photocell ‡ <b>MSDPDT7ADCX</b> PDT integral occupancy sensor with automatic dimming control photocell ‡ <b>JOT</b> Wireless room control with "Just One Touch" pairing ‡ <b>JOTVTX15</b> Wireless occupancy sensor with "Just One Touch" pairing ‡

Standby Mode	Options
NOC NOC Occupancy sensor disabled ‡	<b>BDP Disconnect Plug</b> EL7L 700 lumen battery pack (Noncompliant with CA T20) ‡ EL14L 1400 lumen battery pack (Noncompliant with CA T20) ‡ EL14LSD 1400 lumen battery pack with self-diagnostic testing feature (Noncompliant with CA T20) ‡ E10WLCP EM Self-Diagnostic battery pack, 10W Constant Power, Certified in CA Title 20 MAEDBS ‡ CP Chicago plenum ‡ BGTD Bodine Generator Transfer Device ‡ PWS1836 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit PWS1846 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuit PWS1846 PWSLV Two cables: one 6' pre-wire, 3/8" diameter, 18 gauge, 2 circuits; one 6' pre-wire, 3/8" diameter, 18 gauge ‡ PWS1856LV 6' pre-wire, 3/8" diameter, 18 gauge, 1 circuit w/low voltage wires ‡ GLR Fast-blowing fuse ‡ GMF Slow-blowing fuse ‡ NPLT Narrow pallet RRL_ RELOC®-ready luminaire ‡ LATC Earthquake clip DWAM Anti-Microbial paint JP28 Job packaging ‡ JP36 Job packaging IPSX Gasketed diffuser compartment to meet IPSX rating ‡ BAA Buy America(n) Act Compliant

NOTE: ‡ indicates option value has ordering restrictions. Please reference the Option Value Ordering Restrictions chart on the next page. Options are sorted alphanumerically.

LUMINAIRES WITH "EM" DESIGNATION TO HAVE BATTERY PACK

ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES



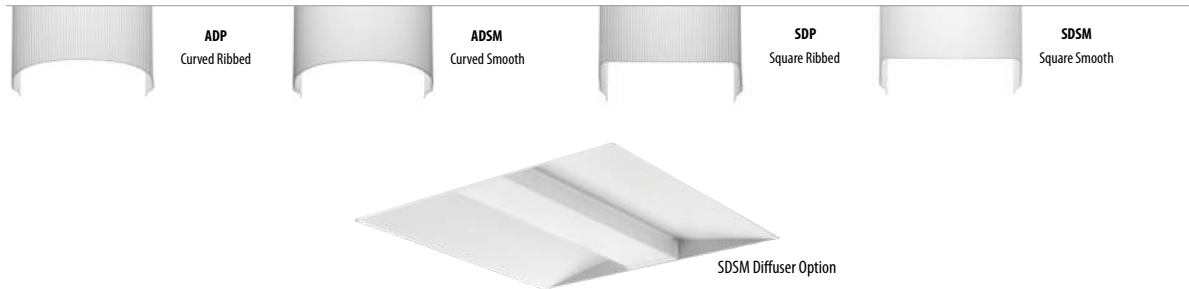
BLT-2X2

TYPE T2C

## 2BLT Volumetric Recessed Lighting 2'x2'

‡ Option Value Ordering Restrictions	
Option value	Restriction
347	Not available with SLD, EL7L, EL14L, or E10WLCP options.
A	Not available with RB fixture style, consult factory for air flow data.
BGTD	Not available with JOT, JOTVTX15 sensor options or emergency battery options. Must specify voltage. Requires BSE labeling, voltage specific. Consult factory for options. Example: BGTD BSE10.
Control	Must specify diffuser with trim rings.
CP	Not available with N80, N80EMG, N100, or N100EMG.
GZ1, GZ10	Not available with any Control or Sensor options except JOT & JOTVTX15
EL7L, EL14L, EL14LSD, E10WLCP	When using pre-wire option, use PWS1846 or PWS1846 PWSLV. For more information on the EL14LSD, please see the <a href="#">PSSD2 specification sheet</a> .
GLR, GMF	Must specify voltage. 120 or 277, with GLR and GMF fusing.
IP5X	Not available with air supply/return or Wired Networking (NES_) and Individual Control (MSD_) sensors.
JOT, JOTVTX15	Not available with SLD, nLight, NLTAIR2, NOC, or BGTD options.
JP28	Only available with options: NES7, NESPDT7, NES7ADCX, NESPDT7ADCX, MSD7ADCX, MSDPDT7ADCX, RES7, RES7PDT, RIO. Not available when sensor options combined with air supply return option.
Lumens	Approximate lumen output. For high Efficiency, all versions may not achieve 130+ LPW. Refer to photometry on <a href="http://www.acuitybrands.com">www.acuitybrands.com</a> . Air supply/return option, 90 CRI, and versions with integral sensor trim rings may not achieve 130 LPW.
MSD7ADCX, MSDPDT7ADCX	Only available with EZ1 driver option. 0-10v dimming wires not accessible via access plate.
NES7, NESPDT7, NES7ADCX, NESPDT7ADCX	Requires N80, N80EMG, N100, or N100EMG. Only available with EZ1 driver.
NLTAIR2	Must order with nLight Wireless option from Control section. Only available with EZ1 driver.
NOC	Can only be ordered in conjunction with EZ1, NLTAIR2, RES7/RES7PDT. Occupancy sensor disabled at factory but can be re-enabled upon commissioning.
N80EMG, N100EMG	nLight EMG option requires a connection to existing nLight network. Power is provided from a separate N80 or N100 enabled fixture.
PWS1846 PWSLV, PWS1856LV	Not available with nLIGHT wired network or individual controls
RES7EM, RES7PDTM, RIOEM	See UL924 Sequence of Operation chart on page 3.
RRL_	For ordering logic consult: <a href="#">RRL_2013</a> .
SLD	Not available with with any nLight Interface or Control options.

### Multiple Diffuser Options

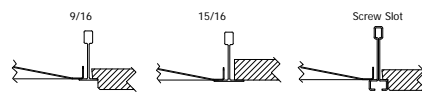


### Non-Configurable BLT

Stock/MTO	Catalog Description *	UPC	Lumens	Wattage	LPW	Color Temperature	Voltage	Pallet Qty
Stock	2BLT2 33L ADP LP835	190887529708	3332	26.67	124.92	3500K/82 CRI	120-277	56
	2BLT2 33L ADP LP840	190887529739	3385	26.67	126.91	4000K/82CRI	120-277	56
	2BLT2 33L ADP EL14L LP835	190887529890	3332	26.67	124.92	3500K/82CRI	120-277	56
	2BLT2 33L ADP EL14L LP840	190887529937	3385	26.67	126.91	4000K/82CRI	120-277	56

\*Generic 0-10V Dimming to 10%.

MOUNTING DATA	
Ceiling Type	Appropriate Trim Type
Exposed grid tee (1" and 9/16")	G
Concealed grid tee	G
Plaster or plasterboard	G*



\*DGA accessory available to provide ceiling trim flange and fixture support for plaster or plasterboard ceiling. Recommended rough-in dimensions for DGA installation is 24-3/4" x 24-3/4" (Tolerance is +1/8", -0").

UL924 Sequence of Operation
For 90 minutes following any complete AC power interruption >200 ms:
<ul style="list-style-type: none"> <li>Digital dimming is commanded to high end trim level.</li> <li>Device ignores wireless lighting control commands.</li> </ul>



BLT-2X2



## 2BLT Volumetric Recessed Lighting 2'x2'

TYPE T2C

### Accessories & Replacement Parts

Accessories: Order as separate catalog number.		Replacement Parts: Order as separate catalog number.		
DGA22	Drywall grid adapter for 2x2 recessed fixture	*247WJV	2DBLT24 ADP LENS ASSEMBLY	2 ft. replacement lens
2X2SMKSH PAF	Surface Mount Troffer Kit Post Paint	*249P2P	2DBLT24 SDP LENS ASSEMBLY	2 ft. replacement lens
RK8BDP 2P U	Disconnect Plug (BDP), 2 Pole, Package of 1	*249P2W	2DBLT24 ADSM LENS ASSEMBLY	2 ft. replacement lens
RK8BDP 3P U	Disconnect Plug (BDP), 3 Pole, Package of 1	*249P32	2DBLT24 SDSM LENS ASSEMBLY	2 ft. replacement lens
RK8BDP 2P J10	Disconnect Plug (BDP), 2 Pole, Package of 10	*237LT1	2DBLT24 ADPT LENS ASSEMBLY	2 ft. replacement lens
RK8BDP 2P J40	Disconnect Plug (BDP), 2 Pole, Package of 40	*237LT3	2DBLT24 SDPT LENS ASSEMBLY	2 ft. replacement lens
		*237LT5	2DBLT24 ADSMT LENS ASSEMBLY	2 ft. replacement lens
		*237LT7	2DBLT24 SDSMT LENS ASSEMBLY	2 ft. replacement lens
		*237LT9	2DBLT24 ADPT SENSOR LENS ASSEMBLY	2 ft. replacement lens
		*237M4Y	2DBLT24 SDPT SENSOR LENS ASSEMBLY	2 ft. replacement lens
		*237M57	2DBLT24 ADSMT SENSOR LENS ASSEMBLY	2 ft. replacement lens
		*237M5H	2DBLT24 SDSMT SENSOR LENS ASSEMBLY	2 ft. replacement lens

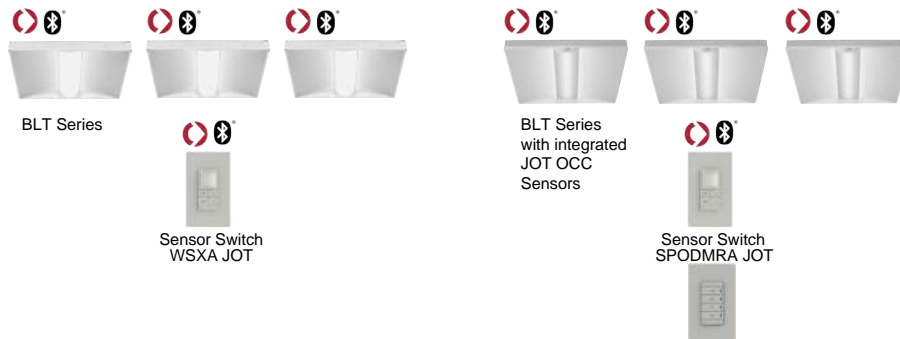
### JOT Wireless



#### Sensor Switch JOT Enabled Wireless Solution

Designed with contractors in mind, the Sensor Switch JOT enabled wireless solution offers a straightforward approach to the installation and pairing of lighting fixtures and controls. Absolutely no 0-10V control wires and no mobile apps are needed with JOT enabled products, allowing for lightning speed installation right out of the box.

- 1. Power:** Install JOT enabled fixtures and controls as instructed.
- 2. Pair:** Insert the pairing tool into the pinhole on the wall switch; press and hold any button for 6 seconds.
- 3. Play:** Once paired, each fixture will individually dim down to 10% brightness. All products will be fully functional.



TYPE T2C

## 2BLT Volumetric Recessed Lighting 2'x2'

### nLight Platform

nLight embedded fixtures offer:	Customers get:
Manual Dimming	Convenience and visual comfort for occupants
Motion Sensing and/or Daylight Harvesting	Energy savings and code compliance
Fixture or Group Level Control	Ability to configure lighting to the space requirements
Flexibility	Ease of fixture moves, adds and changes
Wireless Wall Switch (nLight AIR Only)	Ease and flexibility of placement
Astronomical and Time of Day Scheduling	Energy savings and building security
Scalable Solution	nLight controls to grow with your business
Future-Ready	nLight platform to set foundation for future upgrades and capabilities

### nLight Air Wireless

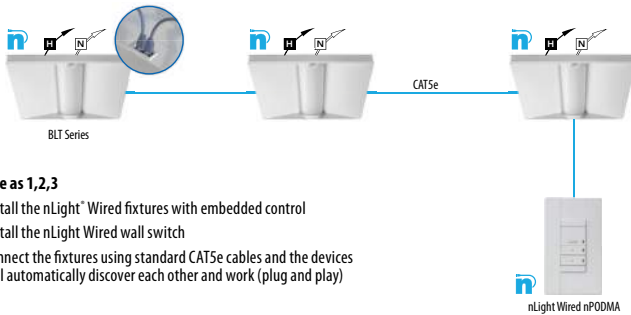


#### Simple as 1,2,3

1. Install the nLight™ AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CLAIRITY app, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome



### nLight Wired Networking



#### Simple as 1,2,3

1. Install the nLight™ Wired fixtures with embedded control
2. Install the nLight Wired wall switch
3. Connect the fixtures using standard CAT5e cables and the devices will automatically discover each other and work (plug and play)

2BLT Volumetric Recessed Lighting 2'x2'

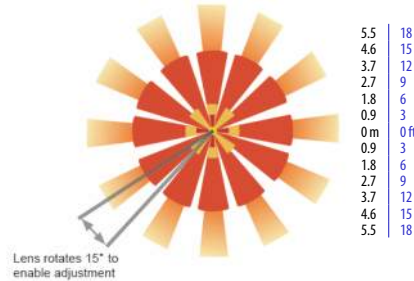
TYPE T2C

Sensor Options					
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking	nLight AIR Networking
		PIR	PDT		
MSD7ADCX	X	X			
MSDPDT7ADCX	X		X		
NES7		X		X	
NES7ADCX	X	X		X	
NESPDT7			X	X	
NESPDT7ADCX	X		X	X	
RES7	X	X			X
RESPDT7	X	X	X		X

Sensor Coverage Pattern  
Mini 360° Lens

- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and
- 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor

9 FT Mounting



Integrated Sensor with Individual Control

The MSD7ADCX PIR occupancy sensor/automatic dimming photocell is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.

The MSPDT7ADCX PIR/Microphonics Dual Tech occupancy sensor/automatic dimming photocell is ideal for areas with obstructions and where daylight harvesting is desired. Suggested applications include, but not limited to, open offices, private offices, classrooms, public restrooms, and conference rooms.

nLight AIR Wireless

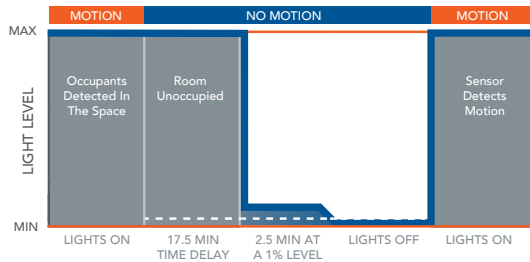
nLight AIR is the ideal solution for retrofit or new construction spaces where adding additional wiring can be labor intensive and nLight AIR is available with or without an integral sensor. The integrated rES7 or rES7PDT smart sensors are part of each luminaire in the nLight AIR network, which can be grouped to control multiple luminaires. The granularity of control with the digital PIR occupancy detection and daylight sensing makes a great solution for any application.

nLight Wired Networking

The nES 7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the nES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

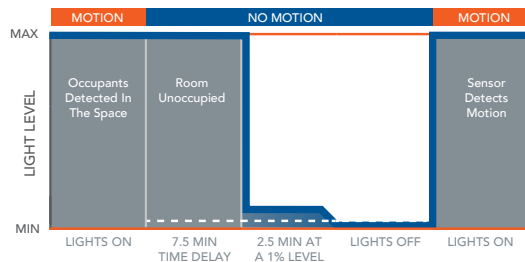
For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy. Additionally, the nESPDT7ADCX includes an integrated photocell, which enables daylight harvesting controls which is ideal for areas where windows are present.

Sequence of Operation (MSD7 Sensor)



\*The presetting on the automatic dimming photocell is 5fc.

Sequence of Operation (nES7 and rES7 and Sensor)



\*The presetting on the automatic dimming photocell is 5fc (NES7) and 10fc (RES7).

TYPE T2C

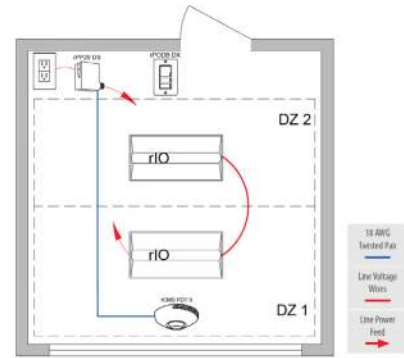
## 2BLT Volumetric Recessed Lighting 2'x2'

### Controls Accessories

nLight® Wired Control Accessories: <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlight">www.acuitybrands.com/products/controls/nlight</a>.</i>			
<b>WallPod stations</b>	<b>Model number</b>	<b>Occupancy sensors</b>	<b>Model number</b>
On/Off	nPODMA [Color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODMA DX [Color]	Large motion 360°, ceiling (PIR / dual tech)	nCM 10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD TOUCH [Color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
<b>Photocell controls</b>	<b>Model number</b>	<b>Cat-5 cable (plenum rated)</b>	<b>Model number</b>
Full range dimming	nCM ADCX RJB	10' cable	CATS 10FT J1
		30' cable	CATS 30FT J1

nLight® AIR Control Accessories: <i>Order as separate catalog number. Visit <a href="http://www.acuitybrands.com/products/controls/nlightair">www.acuitybrands.com/products/controls/nlightair</a>.</i>	
<b>Wall switches</b>	<b>Model number</b>
On/Off single pole	rPODBA [color] G2
On/Off two pole	rPODB A2P [color] G2
On/Off & raise/lower single pole	rPODBA DX [color] G2
On/Off & raise/lower two pole	rPODBA 2P DX [color] G2

BLT fixtures with integrated rIO devices complement any small office space. Pair them with an rCMS occupancy sensor and the space now has wireless occupancy sensing and dimming capability. For additional configuration options please consult with Tech Support.



rCMS <sup>1</sup>		Example: RCMS PDT 10 AR G2						
Series / Detection	Power Supply <sup>1</sup>	Occupancy Detection	Lens (Required)		Operating Mode		Generation	
RCMS nLight AIR occupancy and daylight sensor	[blank]	[blank] PIR Detection PDT Dual Tech PIR/ Microphonics	10	Large Motion/ Extended Range 360°	[BLANK] None AR Auxiliary Relay	G2 Generation 2 compatibility		
	PS 150		9	Small Motion/ Extended Range 360°				
	Standard 150 mA Power Supply		6	High Bay 360° Lens				

**Notes**

<sup>1</sup> RCMS requires low voltage power from either RPP20 DS 24V G2 or PS150.

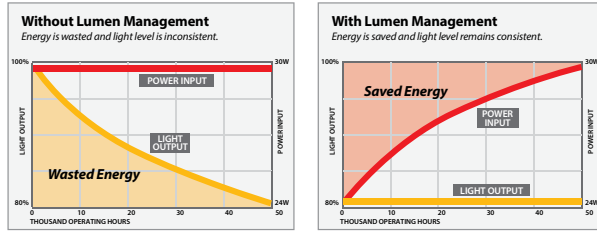


TYPE T2C

## 2BLT Volumetric Recessed Lighting 2'x2'

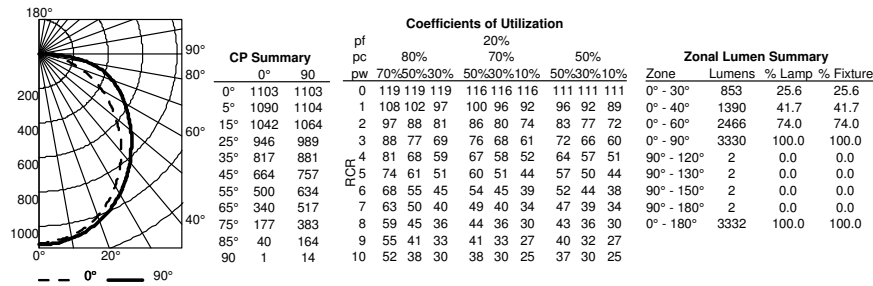
### Constant Lumen Management

Enabled by the embedded nLight control, the BLT actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.

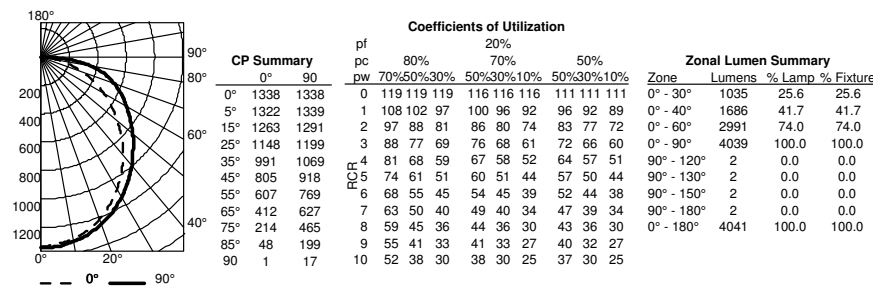


### PHOTOMETRICS

2BLT2 33L ADP LP835, 3332 delivered lumens, test no. ISF36900P19, tested in accordance to IESNA LM-79



2BLT2 40L ADP LP835, 4041 delivered lumens, test no. ISF36900P35, tested in accordance to IESNA LM-79



BLT-2X2

2BLT Volumetric Recessed Lighting 2'x2'

TYPE T2C

Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT2 20L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	2065.45	124.06	16.64	Premium	PM92196A
2BLT2 20L ADP EZ1 (GZ10) LP835 [All Options]	2033	126.58	16.06	Premium	P6445JVD
2BLT2 20L ADP GZ1 LP835 [All Options]	2033	122.11	16.64	standard	PLNK6MX8
2BLT2 20L ADPT EZ1 (GZ10) LP840 [All Options]	2037.91	126.89	16.06	Premium	PYX15QEQ
2BLT2 20L ADPT GZ1 LP835 [All Options]	2005.89	120.49	16.64	standard	P40HQGLB
2BLT2 20L ADPT GZ1 LP840 [All Options]	2037.91	122.41	16.64	standard	PB3HB9AK
2BLT2 33L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	3332	124.92	26.67	Premium	PHSXHE8F
2BLT2 33L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3385.19	126.91	26.67	Premium	PD18CKQ8
2BLT2 33L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	3340.05	125.22	26.67	Premium	PF98CZ2H
2BLT2 33L ADPT EZ1 (GZ10) LP835 [All Options]	3287.57	125.14	26.27	Premium	PTKZR9WQ
2BLT2 33L ADPT GZ1 LP835 [All Options]	3287.57	123.25	26.67	standard	PTN5O23N
2BLT2 40L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4041	127.35	31.73	Premium	P1XWW9GV
2BLT2 40L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4105.51	129.38	31.73	Premium	PHCQ2CQF
2BLT2 40L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3987.12	125.65	31.73	Premium	PW6RMMJ4
2BLT2 40L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4050.77	127.65	31.73	Premium	PSYYDA8
2BLT2 48L ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4800	109.9	43.67	standard	PJRHR1G
2BLT2 48L ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4876.63	111.66	43.67	standard	P8G93YOK
2BLT2 48L ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4736	108.44	43.67	standard	PITU3V6X
2BLT2 48L ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4811.61	110.17	43.67	standard	PSX2XU76

DLC information is subject to change, for the most up-to-date information please refer to www.dlc.org. Above listings do not cover 347v or SLD.

HE Performance Data					
Model Number	Lumens	LPW	Watts	DLC Listing	DLC ID
2BLT2 20LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	1948	130.59	14.91	Premium	PUQCZNI
2BLT2 20LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	1979.1	132.67	14.91	Premium	PJCZRW21
2BLT2 20LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	1952.71	130.9	14.91	Premium	PLCARF4L
2BLT2 33LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	3392	137.3	24.7	Premium	PXXZN9PH
2BLT2 33LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	3446.15	139.5	24.7	Premium	PKPIYRF
2BLT2 33LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	3346.77	135.47	24.7	Premium	PZC8BZSS
2BLT2 33LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	3400.2	137.64	24.7	Premium	PMS68AFU
2BLT2 40LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4118	133.71	30.79	Premium	PJ55XFFP
2BLT2 40LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4183.74	135.85	30.79	Premium	PEGFHPZD
2BLT2 40LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4063.09	131.93	30.79	Premium	P8E16E9B
2BLT2 40LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4127.96	134.04	30.79	Premium	PFSSSSVG
2BLT2 48LHE ADP EZ1 (GZ1, GZ10) LP835 [All Options]	4845	128	37.85	Premium	P558XUZP
2BLT2 48LHE ADP EZ1 (GZ1, GZ10) LP840 [All Options]	4922.35	130.04	37.85	Premium	P1863H56
2BLT2 48LHE ADPT EZ1 (GZ1, GZ10) LP835 [All Options]	4780.4	126.29	37.85	Premium	PHPTG5M8
2BLT2 48LHE ADPT EZ1 (GZ1, GZ10) LP840 [All Options]	4856.71	128.31	37.85	Premium	PBKN954Z

DLC information is subject to change, for the most up-to-date information please refer to www.dlc.org. Above listings do not cover 347v or SLD.

**How to Estimate Delivered Lumens in Emergency Mode**  
Use the formula below to estimate the delivered lumens in emergency mode  
**Delivered Lumens = 1.25 x P x LPW**  
P = Output power of emergency driver. P = 10W for E10WLCP option.  
LPW = Lumen per watt rating of the luminaire. This information is available on the ABL luminaire spec sheet. LPW = Lumen per watt rating of the luminaire. LPW information available in Performance Data section.



BLT-2X2



## FEATURES & SPECIFICATIONS

### INTENDED USE

Provides task or accent lighting in commercial, retail, hospitality and residential applications. Ideal for use under and over cabinets, display cases, task lighting, office lighting, coves and utility/work areas.

### CONSTRUCTION

Low profile design, with on/off rocker switch. Can be direct wired or powered by 5' cord-and-plug (not included). Connect up to 354 watts of fixtures with 13" connector cord or 1-7/8" end row connector (Included). Rugged low profile aluminum housing, available in either white finish. Swivel head allows light to be directed to desired area.

### ELECTRICAL

Long-life LEDs, coupled with a high-efficiency driver, provide extended service life. Fixture is rated to deliver L70 performance at 50,000 hours and operates at 120 volts, 60Hz. Minimum starting temp -20F. Can direct-wire through rear access plate/knockout by utilizing the included Romex connector or by utilizing the optional UCD JB Junction/Splice box (sold separately).

Works with most standard incandescent dimmers (see list of approved dimmers).

### INSTALLATION

All mounting hardware included.

### LISTINGS

UL listed to US and Canadian safety standards. ENERGY STAR® certified product (for 3000K and 4000K only) and Title 24 qualified. Listed for damp locations.

### WARRANTY

5-year limited warranty. Complete warranty terms located at:  
[www.acuitybrands.com/support/customer-support/terms-and-conditions](http://www.acuitybrands.com/support/customer-support/terms-and-conditions)

**NOTE:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

SPECIFICATIONS	12"	18"	24"
<b>Lumens (3000K):</b>	413	585	740
<b>Watts (3000K):</b>	7.3	9.7	12.5
<b>Lumens per watt:</b>	57	60	59
<b>Length:</b>	12.12 (30.8)	18.06 (45.9)	24.12 (61.3)
<b>Width:</b>	3.63 (9.2)	3.63 (9.2)	3.63 (9.2)
<b>Height:</b>	1 (2.54)	1 (2.54)	1 (2.54)
<b>Weight:</b>	.95 (.43)	1.2 (.54)	1.45 (.66)

All dimensions are inches (millimeters) unless otherwise indicated. Weights are pounds (kilograms).

Catalog Number	TYPE UC
Notes	
Type	

Indoor General Purpose

# UCLD LED Linkable Cabinet Light

Linkable



ELECTRICAL CONTRACTOR TO DETERMINE  
APPROPRIATE MOUNTING HARDWARE & ACCESSORIES

### ORDERING INFORMATION

For shortest lead times, configure products using **bolded options**.

Example: UCLD 12IN 30K 90CRI SWR WH

Series	Length	Color temperature	CRI	Options	Finish
<b>UCLD</b> Premium LED Undercabinet	<b>12IN</b> 1' Nominal 18IN <sup>2</sup> 1.5' Nominal 24IN <sup>3</sup> 2' Nominal	<b>30K</b> 3000K	<b>90CRI</b> >90	<b>SWR</b> On/off Rocker Switch	<b>WH</b> White BN Brushed Nickel BZ Bronze

Accessories: Order as separate catalog number.	
UC 5FT POWERCORD WH M6 <sup>1</sup>	White 5' cord and plug
UC 5FT POWERCORD BL M6 <sup>1</sup>	Black 5' cord and plug
UCD JB	White Junction/Splice box - allows for quick and easy direct wiring
UCD JB BL	Black Junction/Splice box - allows for quick and easy direct wiring
UC ERC	White 1-7/8" row connector for end-to-end connections (1 included with each WH fixture)
UC ERC24	White 24" connector cord for longer length connections between fixtures or splice box (required for splice box to first fixture)
UC ERC24 BL	Black 24" connector cord for longer length connections between fixtures or splice box (required for splice box to first fixture)
UC PIR M12	On/Off Motion Sensor

ELECTRICAL CONTRACTOR TO  
DETERMINE APPROPRIATE LENGTH(S)  
TO BE USED AT EACH LOCATION

### Notes

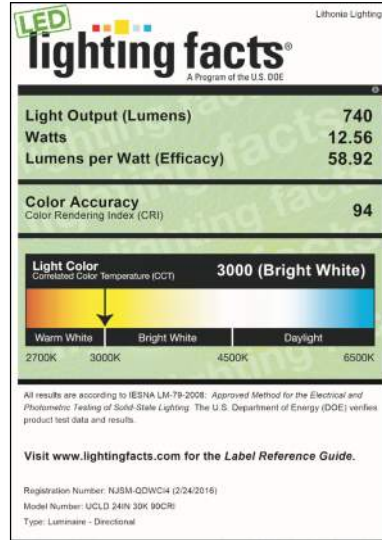
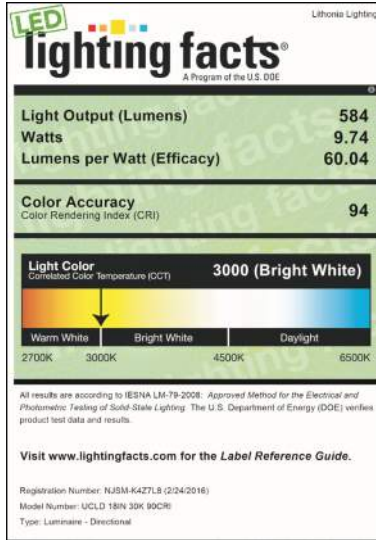
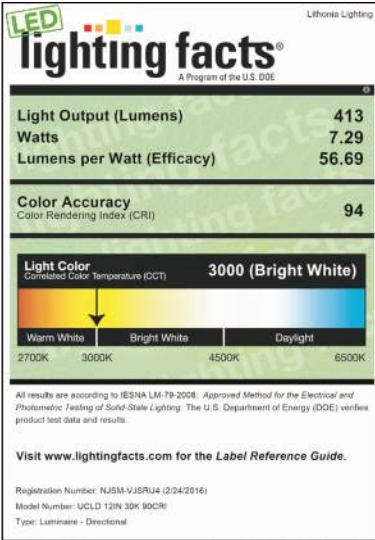
- 1 Can be ordered in any qty.
- 2 18in available in BN or BZ only.
- 3 24in available in BZ only.

DECORATIVE INDOOR

UCLD

TYPE UC

UCLD LED Cabinet Light





UCLD LED Cabinet Light

**Installation**

Can be direct-wired through access plate knockout using included Romex Connector or with UCLD JB Junction/Splice Box

Plug In or Direct-Wire  
Plug In or Direct-Wire

**Included**

- 13" Connector Cord (2)
- Romex® Connector (accepts MC Cable up to 5/8") (3)
- Mounting Screws (4)
- Row Connector (fixture to fixture - 7/8" spacing) (6)  
Model # UCERC-BL

**Accessories**  
*sold separately*

- UC 5FT POWERCORD WH UC 5FT POWERCORD BL (1)
- 5' Cord/Plug (1)  
Model # UCLD JB UCLD JB BL
- Junction/Splice Box (for direct-wiring to first fixture with included 13" Connector cord or optional 24" Connector cord) \*all ci codes\* (4)  
Model # UCERC-4 UCERC-4 BL
- 24" Connector Cord (splice box to fixture or fixture to fixture) (splice box to first fixture or for extended lengths between fixtures) \*all ci codes\* (5)

COMPATIBLE DIMMERS	
The UCLD is designed to operate with most standard Triac Based dimmers and is not compatible with 0-10v dimming systems. The following is a list of dimmers tested and does not imply any guarantee or warranty of compatibility with a particular application. Unlisted dimmers do not imply non-compatibility.	
Manufacturer	Part number(s)
Lutron	DVELV-300P 300P SELV NTELV-300P
Pass & Seymour	HCL453PTCCCV6
SensorSwitch	nSP5 PCD 2W nSP5 PCDELV 120

Rev: 2018/11/08

TYPE W1

CB5518 – POSH™



Type:  Project:

[VisaLighting.com/products/Posh](http://VisaLighting.com/products/Posh)

Order Code: **CB5518**  - **MVOLT**

MODEL **A** SOURCE VOLTAGE **B** FINISH **C** OPTION(S)

Fill in shaded boxes using information listed below



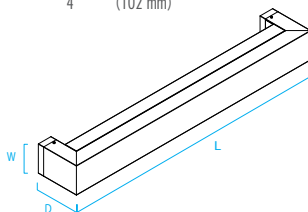
This minimalist design creates a sophisticated look providing soft, indirect light with performance and energy efficiency. Available in 3 lengths, this unique fixture provides beautiful light without harsh glare.

**DIMENSIONS**

Depth is measured from wall to front of fixture

L = Length D = Depth W = Width

W	3"	(72 mm)
L	27-3/4"	(705 mm)
D	4"	(102 mm)



**A SOURCE (Select one) and VOLTAGE**

MVOLT fixture accepts 120 through 277 input voltage  
LED Sources are 83CRI, within 3-step MacAdam and are dimmable 0-10V to 1%

LED Sources	CCT	Delivered Lumens	Power (Watts)	Voltage
• L30K-L	3000K	1100	10	MVOLT
• L35K-L	3500K			
• L40K-L	4000K	1700	15	
• L30K-H	3000K			
• L35K-H	3500K	1800		
• L40K-H	4000K			

**B FINISHES (Select one)**

See page 3 for color chart

Powder Coat Painted Finishes (Standard)

<b>AG7038</b> Agate Grey	<b>CVBL</b> Cove Blue	<b>GW9002</b> Grey White	<b>PB1035</b> Pearl Beige
<b>BMAT</b> Bronze Matte	<b>CW9001</b> Cream	<b>HTHR</b> Heather	<b>RUST</b> Rust
<b>BRNZ</b> Bronze	<b>GLIM</b> Glimmer	<b>JB9005</b> Jet Black	<b>SUNG</b> Sungold
<b>BSIL</b> Blade Silver	<b>GSIL</b> Graphite Silver	<b>OBRZ</b> Old Bronze	<b>TW9016</b> Traffic White

Metal Finishes (Premium)

<b>BA</b> Brushed Aluminum	<b>OBA</b> Oil-rubbed Bronze Alternative
<b>BBA</b> Brushed Brass Alternative	<b>PRA</b> Pewter Alternative
<b>BCA</b> Brushed Chrome Alternative	<b>RBA</b> Rustic Brass Alternative
<b>BUA</b> Brushed Copper Alternative	<b>SNA</b> Satin Nickel Alternative
<b>BZA</b> Brushed Bronze Alternative	

**C OPTIONS (Multiple Selections Allowed)**

⚠ Option availability may be interdependent with Voltage, Source or Other Options

<b>JBC</b>	Junction box cover (4-1/2" square) for use with an existion 4" octagonal junction box. Painted to match finish
<b>XPS</b>	Express 10 day shipping. Items marked with a bullet (•) are not available with XPS

ELECTRICAL CONTRACTOR TO DETERMINE  
APPROPRIATE MOUNTING HARDWARE & ACCESSORIES



LED



ADA Compliant



XPS



ETL Listed

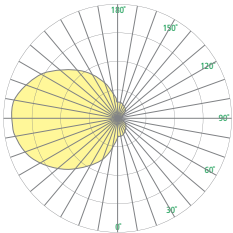


5 Year Warranty

CB5518 – POSH



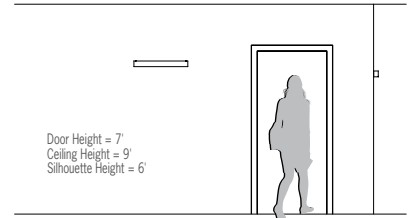
Photometrics



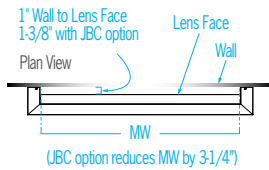
Technical Information

- Integral power supply
- Modular design for replacement of LED source and power supply
- Horizontal or vertical mount
- Mounts without electrical junction box with provided hardware, or to 4" x 4" standard electrical junction box (by others) if JBC option is selected
- Extruded white acrylic diffuser with matte finish
  - UV stable
  - UL-94 HB Flame Class rated
- No VOC powder coat paint; Low VOC clear coat on metal finishes
- ETL listed for damp locations. Not suited for exterior applications

Relative Scale Drawing



JBC Option Detail



Rev: 2018/11/08

















TYPE W1

CB5518 – POSH












Specify color code when ordering. For accurate color matching, individual paint and finish samples are available upon request  
For additional information see [VisaLighting.com/materials-finishes](http://VisaLighting.com/materials-finishes)

Painted Finishes (Standard)

						
<b>TW9016</b> Traffic White (RAL9016)	<b>CW9001</b> Cream (RAL9001)	<b>GW9002</b> Grey White (RAL9002)	<b>JB9005</b> Jet Black (RAL9005)	<b>AG7038</b> Agate Grey (RAL7038)	<b>HTHR</b> Heather	<b>CVBL</b> Cove Blue
						
<b>BSIL</b> Blade Silver	<b>GSIL</b> Graphite Silver	<b>GLIM</b> Glimmer	<b>SUNG</b> Sungold	<b>BRNZ</b> Bronze		
						
<b>OBRZ</b> Old Bronze	<b>BMAT</b> Bronze Matte	<b>PB1035</b> Pearl Beige (RAL1035)	<b>RUST</b> Rust			

Metal Finishes (Premium)

				
<b>BA</b> Brushed Aluminum	<b>BBA</b> Brushed Brass Alternative	<b>BCA</b> Brushed Chrome Alternative	<b>BUA</b> Brushed Copper Alternative	<b>BZA</b> Brushed Bronze Alternative
				
<b>OBA</b> Oil-Rubbed Bronze Alternative	<b>PRA</b> Pewter Alternative	<b>RBA</b> Rustic Brass Alternative	<b>SNA</b> Satin Nickel Alternative	

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# HNLS12

Pathfinder Step Light 12

Type: **TYPE W2**  
Project:



HNLS12 RND

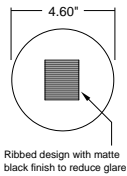


HNLS12 SQU

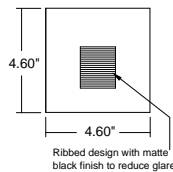


## DIMENSIONS

HNLS12 RND



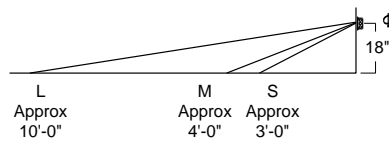
HNLS12 SQU



## HIGHLIGHTS

- Round or Square metal faceplate with three distributions
- Die cast reflector assembly with visible grooved surface painted matte black to reduce glare
- Six static white and six static color LED possibilities
- Fixture has hidden faceplate fasteners
- 0-10v dimming driver
- Three antimicrobial polyester powder paint color finishes standard
- Total System Integration features a 5-year limited warranty by Acuity Brands covering all components and construction

## DISTRIBUTION



Typical Distribution Based on 30K

## LUMEN OUTPUT

\*\* Performance data based upon 30K LED

Fixture	Distribution	Delivered Lumens	Input Watts	Lumens/Watt
HNLS12	Short	36	3	12
	Medium	42	3	14
	Long	54	3	18



# HNLS12

Pathfinder Step Light 12

Type: **TYPE W2**  
Project:

**CATALOG NUMBER**

Example: HNLS12 RND MVOLT LT AMB ZT MIN5 BZAM

Series	Shape	Voltage	Distribution	LED Color Temperature	Control Input	Minimum Dimming Level	Finish
HNLS12 Pathfinder Step Light 12	RND Round SQU Square	MVOLT 120-277 Volt	LT Long Throw MT Medium Throw ST Short Throw	27K 2700K 30K 3000K 35K 3500K 40K 4000K 50K 5000K AMB Amber GRN Green RED Red BLU Blue CYN Cyan RDO Red-Orange	ZT 0-10V	MIN5 Constant Current, Dimming to 5%	GWAM Gloss White Antimicrobial SGB Semi-Gloss Black MWAM Matte White Antimicrobial BA Brushed Aluminum BZAM Bronze Antimicrobial ABP Antique Brass Paint BB Brushed Brass BBP Brushed Brass Paint BSS Brushed Stainless Steel LBPS Light Bronze Paint Smooth LSP Light Silver Paint PB Polished Brass PGP Pale Gold Paint PRM Primer Only PSS Polished Stainless Steel SGW Semi-Gloss White Paint

↑  
ARCHITECT TO CHOOSE SHAPE

ELECTRICAL CONTRACTOR TO DETERMINE APPROPRIATE MOUNTING HARDWARE & ACCESSORIES

↑  
ARCHITECT TO CHOOSE FINISH



# HNLS12

Pathfinder Step Light 12

Type: **TYPE W2**  
Project:

## SPECIFICATIONS

### Housing

Metal faceplate assembly with inner die-cast reflector housing. No exposed fasteners.

### Lens

Extruded clear acrylic optic lens concealed in reflector housing.

### Finish

Color for faceplate only. Available in five metal finishes with protective clear coat, seven polyester powder paint colors, or three antimicrobial polyester powder paint colors. A primer only finish is also available for field painting. Matte black finish always on reflector assembly.

### Mounting

Fixture designed to mount to a Steel City 54171 octagon 2-1/8" deep junction box (by others) or equivalent.

### Source

LED available with six static white color temperatures or six static color options all within a 3 MacAdam ellipse.

### Circuiting

Single circuit

### Dimming Driver

Integral electronic driver for 120 through 277v/50-60Hz input. Standard 0-10V dimming to 5%. THD: <20%. PFC: > 0.90. Complies to FCC CFR Title 47 Part 15, Class B at 120v and Class A at 277v EMI noise rating.

### LED Life

Static White: LED light engine is rated for 60,000 hours (L70).  
Static Color: LED light engine is rated for 60,000 hours (L70).

### Environment

Suitable for dry location use

### Certification

ETL Certified to meet U.S. and Canadian standards conforming to UL1598 and CAN/CSA C22.2 No. 250.0

### Buy American

This product is assembled in the USA and meets the Buy America(n) government procurement requirements under FARS, DFARS and DOT. Please refer to [www.acuitybrands.com/resources/buy-american](http://www.acuitybrands.com/resources/buy-american) for additional information

### Warranty

5-year limited warranty. Complete warranty terms located at: [www.acuitybrands.com/support/customer-support/terms-and-conditions](http://www.acuitybrands.com/support/customer-support/terms-and-conditions)

**Note:** Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25°C. Specifications subject to change without notice.

## Lumen Multiplier Table for CCT

CCT	Multiplier
27K	0.888
30K	1.000
35K	1.031
40K	1.047
50K	1.056
64K	1.052



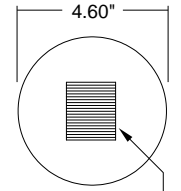
# HNLS12

Pathfinder Step Light 12

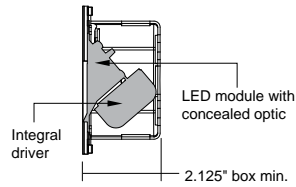
Type: **TYPE W2**  
Project:

## DIMENSIONS

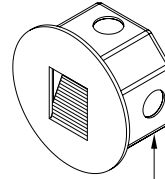
### HNLS12 RND



Ribbed design with matte black finish to reduce glare

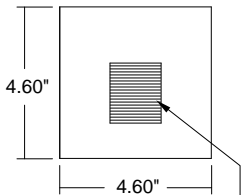


CROSS SECTION

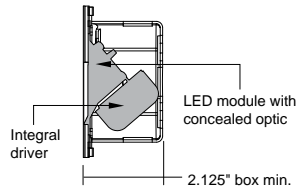


2.125" deep Steel City 4" octagonal box 54171 or equivalent (by others)

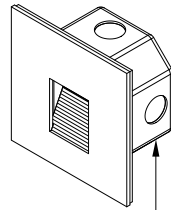
### HNLS12 SQU



Ribbed design with matte black finish to reduce glare



CROSS SECTION



2.125" deep Steel City 4" octagon box 54171 or equivalent (by others)





# HNLS12

Pathfinder Step Light 12

Type: **TYPE W2**  
Project:

## WIRING

### DIMMING INSTALLATIONS

**Read all instructions before installation. Do not make live connections.**

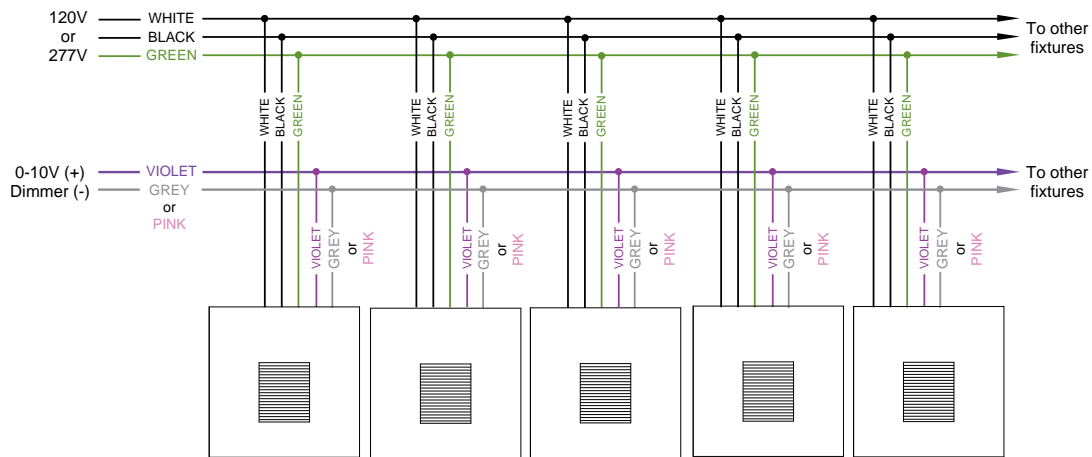
The integral dimming driver is designed to the 0-10V IEC dimming specification 60929 and is compatible with common 0-10V dimmers and dimming systems. Do NOT connect line voltage to dimming input wires.

Connect WHITE wire to power NEUTRAL.

Connect BLACK wire to power HOT.

Connect VIOLET wire to POSITIVE INPUT of Dimming Control.

Connect GREY or PINK wire to NEGATIVE INPUT of Dimming Control.



*Note: For NON-DIMMING installations, cap violet and grey or pink wires separately. Do not cap together.*

## SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Terminations of all communications cabling will be done by others. Contractor shall install all low voltage cabling for telecom outlets, Camera locations, WAPs, etc. Provide slack at ends for termination by others. Lengths of slack are listed in this section.
- B. Section Includes:
  - 1. Pathways.
  - 2. UTP cabling.
  - 3. Cabling system identification products.
  - 4. Cable management system.
- C. Related Sections:
  - 1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
  - 2. Division 28 Section "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

#### 1.3 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.
- D. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- F. EMI: Electromagnetic interference.
- G. IDC: Insulation displacement connector.

- H. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- I. LAN: Local area network.
- J. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
- K. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- L. RCDD: Registered Communications Distribution Designer.
- M. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom without ventilation openings.
- N. Trough or Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom having openings for the passage of air.
- O. UTP: Unshielded twisted pair.

#### **1.4 HORIZONTAL CABLING DESCRIPTION**

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
  - 1. TIA/EIA-568-C.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
  - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
  - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
  - 4. Splitters shall not be installed as part of the optical fiber cabling.
- B. A work area is approximately 100 sq. ft, and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

#### **1.5 PERFORMANCE REQUIREMENTS**

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-C.1, when tested according to test procedures of this standard.

#### **1.6 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
  2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
  3. Cabling administration drawings and printouts.
  4. Wiring diagrams to show typical wiring schematics, including the following:
    - a. Cross-connects.
    - b. Patch panels.
    - c. Patch cords.
  5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
- C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- D. Source quality-control reports.
- E. Maintenance Data: For splices and connectors to include in maintenance manuals.

## **1.7 WARRANTY**

- A. General
1. The cabling system shall be warranted by the manufacturer(s) of the components for a period of not less than 15 years from the time the installation is deemed complete.
  2. It shall be the sole responsibility of the Contractor to register the project with the manufacturer(s) and meet all manufacturers' warranty requirements.
  3. Contractor shall provide Owner with all manufacturers' warranty certificates with Record Documents.
- B. Warranty Coverage
1. Product - all passive components of the cabling system shall be warranted to be free from defects in material and workmanship.
  2. Performance - all passive components, as installed, shall be warranted to exceed TIA and ISO performance specifications for Permanent Link and Channel, as required, at all frequencies specified and shall meet or exceed all manufacturer's published performance data.
  3. Applications - the installed Permanent Link and Channel shall be warranted to support all current applications, as well as those introduced in the future, that require the specified cabling system per TIA and ISO specifications.
- C. Warranty Requirements
1. Warranty shall cover repair or replacement of all defective components free of charge, including all labor performed by a manufacturer-certified installer. All replacements components shall be furnished new. No used, reconditioned, or refurbished components shall be allowed.
  2. The installing contractor shall be certified by the cabling and connector manufacturers as an approved and trained installer of their equipment. Submit letter of certification from the manufacturer to the engineer at time of submittal. No exception to this will be allowed

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
  - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- B. Testing Agency Qualifications: An NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- C. 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.
- 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. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- F. Grounding: Comply with ANSI-J-STD-607-A.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  - 1. Test each pair of UTP cable for open and short circuits.

## 1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install 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.

## 1.11 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

## PART 2 - PRODUCTS

### 2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.

- B. Cable Support: 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.
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceways and Boxes." Flexible metal conduit shall not be used.
  - 1. Outlet boxes shall be no smaller than 4 inches wide, 4 inches high, and 2-1/2 inches deep.

## **2.2 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. Belden CDT Inc.; Electronics Division.
  - 2. Berk-Tek; a Nexans company.
  - 3. CommScope, Inc.
  - 4. General Cable
  - 5. Mohawk; a division of Belden CDT.Superior Essex Inc.
  - 6. SYSTIMAX Solutions; a CommScope, Inc. brand.
  - 7. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. Description: 100-ohm, 4-pair UTP, with a blue thermoplastic jacket.
  - 1. Comply with ICEA S-90-661 for mechanical properties.
  - 2. Comply with TIA/EIA-568-C.1 for performance specifications.
  - 3. Comply with TIA/EIA-568-C.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, Plenum Rated: Type CMP, complying with NFPA 262.

## **2.3 GROUNDING**

- A. Comply with requirements in Division 26 Section "Grounding and Bonding" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

## **2.4 IDENTIFICATION PRODUCTS**

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Electrical Identification."

## **2.5 SOURCE QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-C.1.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

## **PART 3 - EXECUTION**

### **3.1 WIRING METHODS**

- A. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

### **3.2 INSTALLATION OF PATHWAYS**

- A. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- 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 "Raceways and Boxes" for installation of conduits and wireways.
- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where 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 when entering room from overhead.
  - 4. Extend conduits 3 inches 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 dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### **3.3 INSTALLATION OF CABLES**

- A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-C.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. MUTOA shall not be used as a cross-connect point.
5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
  - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
  - b. Locate consolidation points for UTP at least 49 feet from communications equipment room.
6. Cables shall be left unterminated at both ends. See items 12 and 13 in this section for slack requirements.
7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
9. 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.
10. 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.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
12. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
13. At the work area outlet, provide a 12-inch slack loop in each cable.
14. 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.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A 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.



- b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
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.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
  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.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
  5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
  6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.4 FIRESTOPPING

- A. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."
  1. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Division 9 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

- C. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
  
- D. Cable and Wire Identification:
  - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
  - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
  - 6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
  
- E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
  - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

### **3.7 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
  
- B. Tests and Inspections:
  - 1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for 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.
  
- C. Prepare test and inspection reports.

END OF SECTION 271500

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## SECTION 283100 - FIRE ALARM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 26 Section "Electrical General Requirements."

#### 1.2 SUMMARY

- A. This Section includes design and installation of a new fire alarm system
- B. Related Sections include the following:
  - 1. Division 8 Section "Door Hardware" for door closers and holders with associated smoke detectors, electric door locks, and release devices that interface with the fire alarm system.

#### 1.3 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. NICET: National Institute for Certification in Engineering Technologies.
- D. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

#### 1.4 SYSTEM DESCRIPTION

- A. Noncoded, analog-addressable system; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.
  - 1. Interface with existing fire alarm system.
- B. Fire alarm system shall consist of the following:
  - 1. All new fire alarm control panel, devices, and wiring.
  - 2. System smoke detection above all control panels and notification appliance power supply panels.
  - 3. System smoke detection as required at air handling units, smoke rated transfer openings, and smoke damper locations.
  - 4. System smoke detection in areas identified on plan as R2 occupancy (sleeping rooms and associated corridors).
  - 5. System carbon monoxide detection in lower level parking garage.

6. All flow and tamper switches to monitor fire sprinkler and standpipe systems and report appropriate alarm and supervisory signals.
7. Manual fire alarm boxes at each building exit (prior to entering exit stairwells at each floor).
8. Audible and visual notification appliances in all public and common areas of the building.
9. Audible notification appliances for sleeping rooms compliant with required sound rating at the pillow

### **1.5 PERFORMANCE REQUIREMENTS**

- A. Comply with NFPA 72.
- B. Comply with NFPA 70.
- C. Comply with NFPA 720.
- D. A complete functional system meeting the requirements of this specification, including alarm initiating devices and notification appliances at locations and ratings to meet the requirements of the Authorities Having Jurisdiction and all applicable codes shall be provided.
- E. Coordinate and avoid conflicts with casework, markerboards, feature walls, and other areas where fire alarm devices would interfere with furnishings, finishes, etc.
- F. Fire alarm system vendor shall provide sound pressure level calculations demonstrating compliance with NFPA 72 and establish quantities and tap settings of audible devices.
- G. No additional charges for work or equipment required for a code compliant system approved by the Authority Having Jurisdiction will be allowed.
- H. Obtain and refer to mechanical drawings for smoke damper locations, smoke rated transfer openings, and air handling equipment CFM's. Provide smoke detection as required by applicable codes.
- I. Premises protection includes B Type building use group and R2 Type special occupancy type for bunk rooms.
  1. Refer to drawings for complete code analysis including construction type, use groups, special occupancy types, rated walls, smoke barriers and partitions, etc.
- J. System functional performance shall be as indicated on the fire alarm matrix on the drawings.

### **1.6 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  1. Shop Drawings shall be prepared by persons with the following qualifications:
    - a. Trained and certified by manufacturer in fire alarm system design.
    - b. Fire alarm certified by NICET, minimum Level III.
  2. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically

initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.

3. Device Address List: Include address descriptions that will appear on the FACP display.
  4. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
  5. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
  6. Batteries: Provide battery sizing calculations. Battery size shall be a minimum of 125% of the calculated requirement.
  7. Duct Smoke Detectors: Performance parameters and installation details for each detector, verifying that each detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  8. Floor Plans: Indicate final outlet locations showing address of each addressable device. Show device layout, size and route of cable and conduits.
- C. Qualification Data: For Installer.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For fire alarm system to include in emergency, operation, and maintenance manuals. Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.
- F. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.
- G. Documentation:
1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and Authorities Having Jurisdiction.
  2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
    - a. Hard copies on paper to Owner, Architect, and Authorities Having Jurisdiction.
    - b. Electronic media may be provided to Architect.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Work of this Section be performed by a UL-listed company.
- C. Installer Qualifications: Personnel certified by NICET as Fire Alarm Level III.
- D. 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.

## 1.8 PROJECT CONDITIONS

- A. Interruption of Existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
1. Notify Architect, Construction Manager and Owner no fewer than seven days in advance of proposed interruption of fire alarm service.
  2. Do not proceed with interruption of fire alarm service without Architect, Construction Manager and Owner written permission.

## 1.9 SEQUENCING AND SCHEDULING

- A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. FACP and Equipment:
    - a. Edwards Systems Technology Inc.
    - b. NOTIFIER; a Honeywell Company.
    - c. Siemens Building Technologies, Inc.; a Cerberus Division.
    - d. SimplexGrinnell LP; a Tyco International Company.
    - e. Gamewell-FCI; a Honeywell Company.
    - f. National Time & Signal.
    - g. Xtralis.

### 2.2 FACP

- A. General Description:
1. Modular, power-limited design with electronic modules, UL 864, 9<sup>th</sup> edition, listed.
  2. Addressable initiation devices that communicate device identity and status.
    - a. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
  3. Addressable control circuits for operation of mechanical equipment.
  4. Mounting: Surface.

- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP 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, 80 characters, minimum.
- C. Circuits:
  - 1. Signaling Line Circuits between control panels: NFPA 72, Class A, Style 7
  - 2. Signaling Line Circuits from control panel to devices: NFPA 72, Class B, Style 4.
    - a. System Layout: Install no more than 50 addressable devices on each signaling line circuit.
  - 3. Notification-Appliance Circuits: NFPA 72, Class B, Style Y.
  - 4. Actuation of alarm notification appliances, annunciation, shall occur within 10 seconds after the activation of an initiating device.
  - 5. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.
- D. Smoke-Alarm Verification:
  - 1. Initiate audible and visible indication of an "alarm verification" signal at the FACP.
  - 2. Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
  - 3. Record events by the system printer.
  - 4. Sound general alarm if the alarm is verified.
  - 5. Cancel FACP indication and system reset if the alarm is not verified.
- E. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41.
- F. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.
- G. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP after initiating devices are restored to normal.
  - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
  - 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
  - 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- H. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.
- J. Service Modem: The dial-in port shall allow remote access to the FACP for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.



- K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory and digital alarm communicator transmitter shall be powered by the 24-V dc source.
  - 1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
  - 2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."
- L. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
  - 1. Battery and Charger Capacity: Comply with NFPA 72.
- M. Surge Protection:
  - 1. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.
- N. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

### **2.3 MANUAL FIRE ALARM BOXES**

- A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. 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 the FACP.
  - 2. Station Reset: Key- or wrench-operated switch.

### **2.4 SYSTEM SMOKE DETECTORS**

- A. General Description:
  - 1. UL 268 listed, operating at 24-V dc, nominal.
  - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
  - 3. Multipurpose type, containing the following:
    - a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
    - b. Piezoelectric sounder rated at 88 dBA at 10 feet according to UL 464.
    - c. Heat sensor, combination rate-of-rise and fixed temperature.
  - 4. 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 of 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.
- B. Photoelectric Smoke Detectors:
1. Sensor: LED or infrared light source with matching silicon-cell receiver.
  2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
- C. Duct Smoke Detectors:
1. Photoelectric Smoke Detectors:
    - a. Sensor: LED or infrared light source with matching silicon-cell receiver.
    - b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
  2. UL 268A listed, operating at 24-V dc, nominal.
  3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
  4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
    - a. Weatherproof Duct Housing Enclosure: UL listed for use with the supplied detector. The enclosure shall comply with NEMA 250 requirements for Type 4X.
  5. Self-Restoring: Detectors shall 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. Provide remote status and alarm indicator and test station where required.
  7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
  8. Each sensor shall have multiple levels of detection sensitivity.
  9. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
  10. Relay Fan Shutdown: Provide two (2) sets of contacts rated to interrupt fan motor-control circuit.

## 2.5 HEAT DETECTORS

- A. General: UL 521 listed.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or rate-of-rise of temperature that exceeds 15 deg F per minute, unless otherwise indicated.
1. Mounting: Plug-in base, interchangeable with smoke-detector bases.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.
1. Mounting: Plug-in base, interchangeable with smoke-detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

## 2.6 SYSTEM CARBON MONOXIDE DETECTORS

### A. General Description:

1. UL 2075 listed, operating at 24-V dc, nominal.
2. Provide means for addressable connection to fire-alarm system.
3. Detector must communicate detector status (normal, alarm, or trouble) to the FACP.
4. Detector must send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Detector must provide alarm contacts and trouble contacts.
6. Mounting: Adapter plate for outlet box mounting.
7. Testable by introducing test carbon monoxide into sensing cell.
8. Locate, mount, and wire in accordance with manufacturer's written instructions.
9. Test button simulates alarm condition.

## 2.7 NOTIFICATION APPLIANCES

### A. Description: 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.
2. Finishes:
  - a. Wall mounted appliances: Provide white finish with red lettering.
  - b. Ceiling Mounted Appliances: Provide white finish.

### B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn.

### C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.

1. Rated Light Output: 15, 30, 60, 75, 110, 135, 185 candela as required to meet NFPA 72 requirements.
2. Strobe Leads: Factory connected to screw terminals.

## 2.8 REMOTE STATUS AND ALARM INDICATORS

### A. Remote status and alarm indicator and test stations, with LED indicating lights. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single-gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

## 2.9 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

## 2.10 ADDRESSABLE CONTROL MODULE

- A. Provide for integration of auxiliary control functions into the analog signaling circuit. Intelligent analog signaling circuit control module shall have the following capabilities:
  - 1. Communication interaction with the analog signaling circuit having the capability of initiating a control function to an auxiliary device based on a specified event.
  - 2. Provide NO/NC contact pairs rated at 2 amps 120 VAC or 24 VDC.

## 2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Listed and labeled according to UL 632.
- B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.
- C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.
- D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

## 2.12 WIRE AND CABLE

- A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
- B. Fire alarm wire and cable shall be as specified by the system manufacturer including conductor gage, conductor quantity, conductor twists and shielding required to meet NFPA class and style performance specified.
- C. Signaling Line Circuits and other power limited fire alarm circuits (PLFA):
  - 1. PLFA circuits installed in conduit or raceway: U.L. Listed type FPL
  - 2. PLFA circuit cable installed exposed in accessible ceiling spaces, risers and elsewhere: U.L. Listed type FPLP.
  - 3. PLFA circuits installed where 2 hr rating is required to meet the survivability requirements of NFPA 72: Circuit integrity cable, NFPA 70 Article 760, Classification CI, UL listed as Type FPL, FPLR or FPLP as required, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating.
- D. Non-Power-Limited Fire Alarm Circuits (NPLFA):

1. NPLFA circuits installed in conduit: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
  - a. Low-Voltage Circuits: No. 16 AWG, minimum.
  - b. Line-Voltage Circuits: No. 12 AWG, minimum.
2. NPLFA circuit cable installed exposed in ceiling spaces, risers and elsewhere: Multi-conductor cable, U.L Listed type NPLFP.
3. NPLFA circuits installed where 2 hr rating is required to meet the survivability requirements of NFPA 72: Multi-conductor cable, U.L Listed type NPLFP-CI

## **PART 3 - EXECUTION**

### **3.1 EQUIPMENT INSTALLATION**

- A. Smoke or Heat Detector Spacing:
  1. Smooth ceiling spacing shall not exceed 30 feet or the listed spacing of the detectors, whichever is less.
  2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.
  3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.
- B. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.
- C. Duct Smoke Detectors: Comply with NFPA 72. Install sampling tubes so they extend the full width of the duct.
- D. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- E. Remote Status and Alarm Indicators: Install near each smoke detector, each duct detector and each sprinkler water-flow switch and valve-tamper switch that is above 10'-0" aff, concealed, or otherwise not readily visible from normal viewing position. Coordinate exact locations with local fire department and submit to architect for approval.
- F. Audible Alarm Notification Appliances: Install wall mounted appliances not less than 6 inches below the ceiling.
- G. Visible Alarm Notification Appliances: Install wall mounted appliances at 96" AFF or 6 inches below the ceiling, whichever is less.
- H. Coordinate ceiling mounted appliances with reflected ceiling plans. Do not install visual appliances where pendant mounted or suspended lighting fixtures will obstruct intended viewing angles.
- I. Install wall mounted and ceiling mounted notification appliances flush on recessed j-box or back box for all new work and on existing gyp-board partition walls.
- J. Install notification appliances on existing CMU walls on surface back-boxes matching the dimensions and finish of the notification appliance.
- K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

- L. FACP: Surface mounted with tops of cabinets not more than 72 inches above the finished floor.
  - 1. Install smoke detector above panel. Install on ceiling for ceilings under 10 ft. For ceilings above 10', wall mount a smoke detector listed for releasing service 10' AFF or 1' below finished ceiling (whichever is lower).
- M. Provide all 120V branch circuits for all control panels, sub panels, and ancillary equipment required for the system.

### 3.2 WIRING INSTALLATION

- A. Install wiring according to the following:
  - 1. NECA 1.
  - 2. TIA/EIA 568-A.
- B. Wiring Method:
  - 1. Fire alarm circuits shall consist of multi-conductor cables installed in accessible ceiling spaces.
  - 2. Where ceilings consist of exposed construction, fire alarm multi-conductor cable shall be installed on top of joists, beams etc. and shall be concealed from view. Where the structural elements do not allow for the cable to be installed in a concealed fashion, then install the cable in conduit.
  - 3. Install fire alarm cable in conduit in mechanical rooms, loading docks and similar service spaces.
  - 4. Drops to surface mounted devices shall be installed in conduit or surface raceway. No exposed cable shall be visible below the ceiling. Where the ceiling is exposed, route the conduit or raceway up to the structural member that will conceal the cable.
  - 5. Drops to devices recessed in partition walls shall be installed in conduit.
  - 6. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
  - 7. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits, if the system manufacturer permits it.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

### **3.3 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Electrical Identification."
- B. Install instructions frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label "FIRE ALARM."

### **3.4 GROUNDING**

- A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

### **3.5 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. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
  - 2. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
  - 3. Testing: Follow procedure and record results complying with requirements in NFPA 72.
  - 4. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

### **3.6 PROGRAMMING**

- A. Coordinate final address descriptions for alarm, supervisory and trouble indication that appear on FACP and Annunciator displays with the Owners representative. This shall include all room names, room numbers, building areas for fire protection zones, exit door descriptions and similar items. This coordination shall take place and be implemented in the programming prior to Demonstration and Owner Training.

### **3.7 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.
- B. Follow-Up Tests and Inspections: After date of Substantial Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.

**3.8 WARRANTY**

- A. All newly installed equipment shall be warranted by the contractor for a period of one year following acceptance. The warranty shall include parts, labor, prompt field service, pickup and delivery.

**3.9 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 283100



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## **SECTION 321313 - CONCRETE PAVING, WALKS, CURBS AND GUTTERS**

### **PART 1 - GENERAL**

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 035350 – Cementitious stamp able Overlay for colored stamped concrete.

#### 1.2 SUMMARY

- A. Extent of portland cement concrete paving is shown on Drawings, including curbs, gutters, walks, paving, and joint sealant work.
- B. Related Sections: The following sections contain requirements that relate to this Section:
  - 1. Comply with applicable requirements of Division 31 Section "Earth Moving" for excavation and backfilling required in connection with preparation for placement of concrete.
  - 2. Comply with applicable requirements of Division 03 Section "Cast-In Place Concrete" for concrete work required in connection with exterior concrete placement.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: Submit the mix design to the Architect/Engineer for review and approval by the Architect/Engineer and Testing Agency, a minimum of two (2) weeks prior to intended installation date.
- C. Samples: None required.

#### 1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with local governing regulations, if more stringent than herein specified.
- B. Michigan Department of Transportation "Standard Specification for Construction", MDOT, 2012 Edition and all supplements to date.
- C. U.S. Department of Justice 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design including Guidance issued on Sept. 15, 2010 and/or local barrier-free code if more stringent. Requirements applicable to all sidewalks, ramps, barrier-free pathways within parking areas, and parking spaces with adjacent aisles designated for the disabled.
- D. Testing and Inspection Service:

1. Comply with requirements of Division 01 Sections “Quality Control – General” and “Testing and Inspection Services – Site Work”.

#### 1.5 JOB CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities. Coordinate with Owner.
- B. Utilize flagmen, barricades, warning signs and warning lights as required.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
  1. Use flexible spring steel forms or laminated boards to form radius bends as required.
- B. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.
- C. Welded Wire Mesh: As indicated per details on Drawings. Welded plain cold-drawn steel wire fabric, ASTM A 185.
  1. Furnish in flat sheets, not rolls, unless otherwise acceptable to Architect/Engineer.
- D. Reinforcing Bars: As indicated per details on Drawings. Deformed steel bars, ASTM A 615, Grade 40.
- E. Joint Dowel Bars: As indicated per details on Drawings. Plain steel bars, ASTM A 615, Grade 40. Cut bars true to length with ends square and free of burrs.
- F. Metal Expansion Caps: As indicated per details on Drawings. Furnish for one end of each dowel bar in expansion joints. Design caps with one end closed and a minimum length of 3" to allow bar movement of not less than 1", unless otherwise indicated.
- G. Hook Bolts: As indicated per details on Drawings. ASTM A 307, Grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- H. Subdrains: Subdrains per details on drawings and specifications.
- I. Dense Aggregate: Sound, angular crushed stone, crushed gravel; crushed slag is not acceptable; complying with the following:
  1. Base Course:
    - a. MDOT 21AA: Crushed limestone to the grading requirements in 2012 MDOT 902.05, Table 902-1 and physical requirements in Table 902-2. Crushed concrete or slag is not acceptable.

- J. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone, gravel, or combinations thereof, complying with ASTM D 1073 or 2012 MDOT 902.09.
- K. Concrete Materials: Design mix: 3500 PSI or as indicated per details on Drawings.
  - 1. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
    - a. Portland Cement: ASTM C 150, Type I, Low Alkali.
    - b. Ground Granulated Blast-Furnace Slag (GGBFS): ASTM C 989, Grade 100 or 120.
      - 1) Reduce the cement quantity 20 to 25 percent and substitute with equal weight of GGBFS.
  - 2. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source.
    - a. Use MDOT 6AA coarse aggregate.
  - 3. Water: ASTM C 94.
  - 4. Air-Entraining Admixture: ASTM C 260.
  - 5. Chemical Admixtures: ASTM C 494, of type suitable for application, certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
- L. Joint Filler: ASTM D 1752 premolded resilient non-extruding non-staining closed cell foam polyethylene, PVC foam or sponge rubber, 25% wider than joint width, thickness indicated.
- M. Curing Compound: (Natural colored concrete) ASTM C 309, non-yellowing, non-staining liquid membrane-forming type containing a fugitive dye. Chlorinated rubber compounds not acceptable for exterior use.
- N. Joint sealants: (Natural colored concrete) One-component nonpriming, self-leveling elastomeric polyurethane complying with FS TT-S-00230C, Type 1, Class A, color gray, designed for foot traffic.
- O. Sealant Backer Rod: Compressible rod stock of polyethylene foam, polyethylene jacketed polyurethane foam or other flexible, permanent, durable non-absorptive material as recommended by sealant manufacturer for compatibility with sealant and joint filler.
- P. Form release agent: Non-staining chemical form release agent free of oils, waxes, and other materials harmful to concrete.
- Q. Epoxy Resin Grout: FS MMM-G-650.
- R. Detectable Warning Devices for Walks:
  - 1. Manufacturers: ADA Solutions, Inc. or approved equal, in accordance with Americans with Disabilities Act (ADA) accessibility guidelines Section 4.29, cast-in-place truncated dome detectable warning plates, straight or radius as required. Install plates into concrete per Manufacturer's guidelines.
  - 2. Color: Black
  - 3. The detectable surface must consist of raised truncated domes in compliance with 2010 ADA Standards for Accessible Design or local code if more stringent. The texture of the detectable

warning feature must contrast with the surrounding surfaces (either light-on-dark or dark-on-light).

## 2.2 CONCRETE MIX, DESIGN AND TESTING

- A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control, and as herein specified.
- B. Design mix proportioned according to ACI 301 to produce standard-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture and water to produce the following properties:
  - 1. Compressive Strength: 3500 psi, minimum at 28 days.
  - 2. Slump Range: 2" for curbs, 3" for other concrete.
  - 3. Air Content: 5% to 8%.
  - 4. Submit design mix two (2) weeks before paving operation commences to Architect/Engineer.

## **PART 3 - EXECUTION**

### 3.1 SURFACE PREPARATION

- A. Remove loose material from compacted subgrade (subbase) surface immediately before placing concrete.
- B. Proof-roll prepared subgrade and granular base course surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

### 3.2 FORM CONSTRUCTION

- A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
- B. Check completed formwork for grade and alignment to following tolerances:
  - 1. Top of forms not more than 1/8" in 10'.
  - 2. Vertical face on longitudinal axis, not more than 1/4" in 10'.
- C. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage

### 3.3 CONCRETE PLACEMENT

- A. General:
  - 1. Comply with requirements of ACI 301 for mixing and placing concrete, and as herein specified.
  - 2. Do not place concrete until subgrade and/or base course and forms have been checked for line and grade. Moisten subgrade and/or base course if required to provide a uniform dampened condition

at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

3. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation.
4. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
5. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.
6. When adjacent pavement areas are placed in separate pours, do not operate equipment on concrete until pavement has attained sufficient strength to carry loads without injury.

B. Curbs and Gutters:

1. Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified

3.4 JOINTS

A. General:

1. Construct weakened-plane (contraction) and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. Joint Sealants:

1. Install joint sealants where indicated in accordance with manufacturer's installation instructions. Clean and prime joints. Remove dirt and loose coatings.
2. Provide backer rod for all sealant joints.
3. Apply sealants in continuous beads, without open joints, voids, or air pockets. Hand tool and finish all joints.
4. Confine materials to joint areas with masking tape or other precautions.
5. Remove excess compound promptly as work progresses and clean adjoining surfaces.
6. In rough surfaces or joints of uneven widths, install joint sealant well back into joints

3.5 CONCRETE FINISHING

- A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible.
- B. Adjust floating to compact surface and produce uniform texture.
- C. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
- D. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

- E. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
  - 1. Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.
- F. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas.
- G. Remove and replace areas or sections with major defects, as directed by Architect.

### 3.6 CURING

- A. Protect and cure finished concrete paving, complying with applicable requirements of ACI 301. Use curing and sealing compound or approved moist-curing methods.
- B. Precautions shall be taken in hot weather to prevent plastic cracking resulting from excessively rapid drying at surface as described in CIP 5 Plastic Shrinkage Cracking published by the National Ready Mixed Concrete Association.
- C. Do not cover concrete with plastic sheeting.

### 3.7 FIELD QUALITY CONTROL

- A. Concrete Paving Testing:
  - 1. The Owner will retain an independent testing laboratory. The laboratory shall be responsible to the Owner for testing work. Contractor shall pay for all services and tests on non-conforming material or work.
  - 2. Refer to Division 01, Section "Testing and Inspection Services – Site Work" for scope of testing to be performed.

### 3.8 REPAIRS AND PROTECTIONS

- A. Repair or replace broken or defective concrete, as directed by Architect.
  - 1. Drill test cores where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy resin grout.
- B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains, tire marks and spillage of materials as they occur.
- C. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION 321313

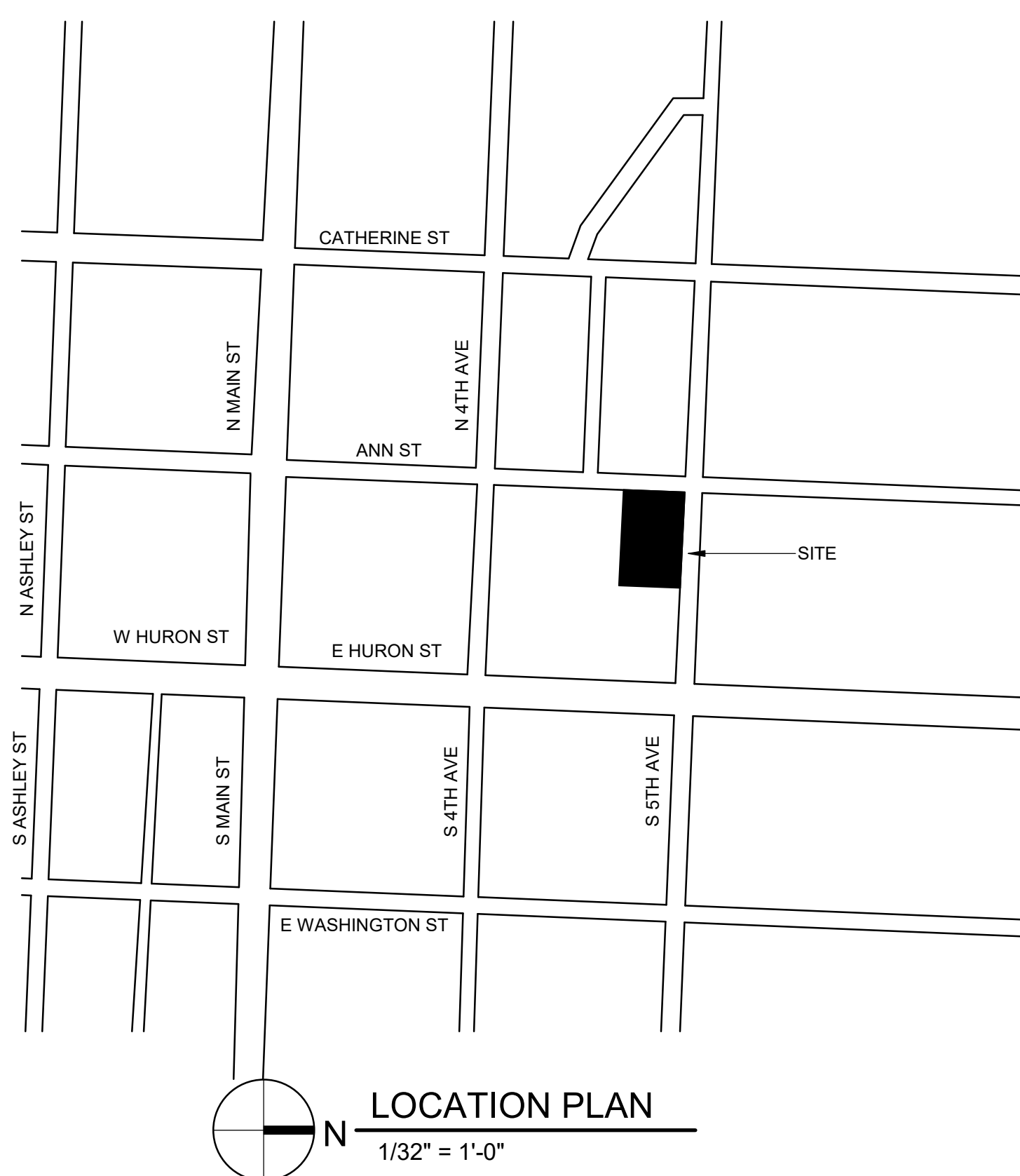
# CITY OF ANN ARBOR

# ANN ARBOR FIRE STATION NO.1 RENOVATION

111 NORTH FIFTH AVE

ANN ARBOR, MI 48104

ISSUED FOR BIDDING



## DRAWING LIST

GENERAL	TITLE SHEET
G-001	G-101
	CODE INFORMATION
ARCHITECTURAL	
A-001	ARCHITECTURAL INFORMATION
A-101	SECOND FLOOR DEMOLITION PLAN AND FLOOR PLAN
A-111	SECOND FLOOR CEILING DEMOLITION PLAN AND CEILING PLAN
A-401	ENLARGED PLANS AND ELEVATIONS
A-402	ENLARGED PLAN - FIRST FLOOR ENTRANCE
A-501	DETAILS
A-502	DETAILS
A-601	ROOM FINISH SCHEDULE
A-611	DOOR SCHEDULE AND DETAILS
MECHANICAL	
M-001	MECHANICAL STANDARDS AND DRAWING INDEX
MD-101	SECOND FLOOR MECHANICAL DEMOLITION PLAN
M-101	SECOND FLOOR MECHANICAL NEW WORK PLAN
M-601	MECHANICAL DETAILS
M-701	MECHANICAL SCHEDULES
M-801	TEMPERATURE CONTROL STANDARDS AND GENERAL NOTES
ELECTRICAL	
E-001	ELECTRICAL STANDARDS AND DRAWING INDEX
E-002	ELECTRICAL STANDARD SCHEDULES
ED-101	SECOND FLOOR ELECTRICAL DEMOLITION PLAN
E-101	BASEMENT AND FIRST FLOOR ELECTRICAL NEW WORK PLAN
E-102	SECOND FLOOR ELECTRICAL NEW WORK PLAN
E-501	PANEL SCHEDULES
E-701	ELECTRICAL DETAILS AND DIAGRAMS

CLIENT:  
**CITY OF ANN ARBOR**  
 111 NORTH FIFTH AVE  
 ANN ARBOR, MI  
 48104

ARCHITECT:  
**NSA ARCHITECTURE**  
 FARMINGTON HILLS, MICHIGAN  
 (248) 477-2444

CONSULTANTS:  
MECHANICAL / ELECTRICAL:  
**PETER BASSO ASSOCIATES, INC**  
 TROY, MI  
 (248) 879-5666

CITY OF ANN ARBOR  
 ANN ARBOR FIRE STATION NO.1 RENOVATION  
 ISSUED FOR: ISSUED FOR BIDDING  
 DATE: 02-15-2022

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**NSA**  
 ARCHITECTURE

PROJECT NO.  
 221015.00  
 SHEET  
**G-001**



**APPLICABLE CODES**

- MICHIGAN BUILDING CODE 2015
- MICHIGAN REHABILITATION CODE FOR EXISTING BUILDINGS 2015 (WORK AREA METHOD - LEVEL 2 ALTERATIONS)
- MICHIGAN PLUMBING CODE 2015
- MICHIGAN MECHANICAL CODE 2015 / ASHRAE STANDARD 90.1 2013
- MICHIGAN ELECTRICAL CODE BASED ON THE 2017 NATIONAL ELECTRICAL CODE WITH PART 8 STATE AMENDMENTS
- NATIONAL FIRE ALARM AND SIGNALING CODE (NFPA 72-13)
- 2015 INTERNATIONAL ENERGY CONSERVATION CODE PART 10 WITH ANSI / ASHRAE / IESNA STANDARD 90.1-2013
- ICC / ANSI A117.1 - 2009 & MICHIGAN BARRIER FREE DESIGN LAW OF PUBLIC ACT 1 OF 1966 AS AMENDED

**MICHIGAN REHABILITATION CODE APPLICABILITY: MBC ARTICLE 101.4.7 MBC**

- ALTERATIONS LEVEL 1: (FIRE ALARM REPLACEMENT) MRC 503.1
- ALTERATIONS LEVEL 2: (2ND FLOOR RENOVATIONS) MRC 504.1
- ALTERATIONS LEVEL 3: NOT APPLICABLE. "WORK AREA" DOES NOT EXCEED 50% MRC 505.1, SECTION 202 - DEFINITIONS FOR "WORK AREA"

**GENERAL PROJECT OVERVIEW**

PARTIAL RENOVATION TO THE SECOND FLOOR (OFFICES, SLEEPING AREA, AND STORAGE) OF AN EXISTING TWO STORY FIRE STATION. THE RENOVATED WORK AREA TO RECEIVE FIRE SUPPRESSION SYSTEM AND RATED WALL UPGRADES. ENTIRE BUILDING WILL RECEIVE UPGRADED FIRE ALARM SYSTEM.

THE RENOVATION WORK AREA IS 8089 SF. THE ENTIRE EXISTING BUILDING IS 44,645 SF. THUS THE WORK DOES NOT EXCEED 50 PERCENT OF BUILDING AREA AND MEETS THE CRITERIA FOR LEVEL 2 ALTERATIONS PER SECTION 504.

**MIXED USE AND OCCUPANCY**

PURSUANT TO ARTICLE 508.3 THE BUILDING IS CLASSIFIED AS MIXED USE NON-SEPARATED. THE MORE STRINGENT OF EACH USE REQUIREMENTS WILL APPLY TO THE ENTIRE BUILDING.

**NON-SEPARATED OCCUPANCIES**

GROUP B: BUSINESS

GROUP R-2: RESIDENTIAL

SECTION 508.4 MBC  
NO SEPARATION REQUIRED

1/2 HR FIRE PARTITION REQUIRED (420.2, 708.3.2)

1 HOUR FIRE SEPARATION PROVIDED

**USE GROUP CLASSIFICATION**

GROUP B: BUSINESS

GROUP R-2: RESIDENTIAL

MBC SECTION 302

**TYPE OF CONSTRUCTION**

TYPE II-B, MBC SECTION 602

**ACTIVE FIRE SAFETY FEATURES**

- AUTOMATIC SPRINKLER SYSTEM
- FIRE ALARM AND DETECTION
- PORTABLE FIRE EXTINGUISHERS
- MAXIMUM DISTANCE OF TRAVEL TO EXTINGUISHERS:

SECTION 903.2.8 MBC

MBC 907.2.9 THROUGHOUT

SECTION 906.1, 906.2 MBC

72'-0" TABLE 508.3 MBC

**OCCUPANCY CLASSIFICATION**

MBC SECTIONS 304.1, 310.4, 311.3

GROUP B: BUSINESS

GROUP R-2: RESIDENTIAL

TOTAL AREA

8,663 SF

1,426 SF

8,089 SF

**BUILDING AREA**

2ND FLOOR RENOVATED WORK AREA

2ND FLOOR TOTAL AREA

TOTAL BUILDING AREA (3-LEVELS & MEZZANINE)

8,089 SF

14,379 SF

44,645 SF

\*NOTE: CONFERENCE SPACES WITH OCCUPANCY BELOW 50 ARE CLASSIFIED BUSINESS USE PURSUANT TO ARTICLE 303.1.2

- OCCUPANT LOAD OF THE CONFERENCE ROOM IS 4

**FIRE-RESISTANCE RATING REQUIREMENTS (TABLE 601 MBC)**

PRIMARY STRUCTURAL FRAME

0 HOURS

EXTERIOR BEARING WALLS

0 HOURS (TABLE 601)

INTERIOR BEARING WALLS

0 HOURS

NONBEARING WALLS / PARTITIONS

0 HOURS

FLOOR CONSTRUCTION AND ASSOCIATED SECONDARY MEMBERS

0 HOURS

ROOF CONSTRUCTION AND ASSOCIATED SECONDARY MEMBERS

0 HOURS

NOTE: WALLS BASED UPON > 30 FT. FIRE SEPARATION DISTANCE (TABLE 601)

NOTE: ALL WOOD BLOCKING & WOOD TO BE FIRE RETARDANT

**PORTABLE FIRE EXTINGUISHERS (906)**

WITHIN 30'-0" OF COMMERCIAL COOKING EQUIPMENT

MAXIMUM ALLOWABLE TRAVEL DISTANCE = 75'-0"

**FIRE RESISTANCE RATINGS OF EGRESS COMPONENTS**

EXIT ACCESS CORRIDORS (TABLE 1020.1)

1 FIRE RATING WITHOUT SPRINKLER SYSTEM

NO SEPARATION WITH SPRINKLER SYSTEM

EXIT PASSAGEWAYS (SECTION 1024.3)

1 HOUR FIRE RESISTANCE CONSTRUCTION (FIRE BARRIER)

HORIZONTAL EXITS (SECTION 1026.2)

2 HOUR FIRE RESISTANCE CONSTRUCTION (FIRE BARRIER)

EXIT STAIRWAY (SECTION 1023.2)

1 HOUR FIRE RESISTANCE CONSTRUCTION LESS THAN 4 STORIES (FIRE BARRIER)

**MEANS OF EGRESS**

EXITS REQUIRED: 2 EXITS (TABLE 1008.3.1) - (3) EXISTING STAIRS

**ELEVATORS REQUIRED (SECTION 1009.2.1)**

IN BUILDINGS WHERE A REQUIRED ACCESSIBLE FLOOR IS FOUR OR MORE STORIES ABOVE OR BELOW A LEVEL OF EXIT DISCHARGE, NOT LESS THAN ONE REQUIRED ACCESSIBLE MEANS OF EGRESS SHALL BE AN ELEVATOR COMPLYING WITH SECTION 1009.4

**INTERIOR EXIT STAIRS (SECTION 1009.2, ITEM 2)**

INTERIOR EXIT STAIRWAYS COMPLYING WITH SECTIONS 1009.3 AND 1023.

**STAIRWAYS (SECTION 1009.3)**

IN ORDER TO BE CONSIDERED PART OF AN ACCESSIBLE MEANS OF EGRESS, A STAIRWAY BETWEEN STORIES SHALL HAVE A CLEAR WIDTH OF 48" MINIMUM BETWEEN HANDRAILS AND SHALL EITHER INCORPORATE AN AREA OF REFUGE WITHIN AN ENLARGED FLOOR-LEVEL LANDING OR SHALL BE ACCESSED FROM AN AREA OF REFUGE COMPLYING WITH SECTION 1008.6. EXIT ACCESS STAIRWAYS THAT CONNECT LEVEL IN THE SAME STORY ARE NOT PERMITTED AS A PART OF AN ACCESSIBLE MEANS OF EGRESS.

**EXCEPTIONS:**

1. EXIT ACCESS STAIRWAYS PROVIDING MEANS OF EGRESS FROM MEZZANINES ARE PERMITTED AS PART OF AN ACCESSIBLE MEANS OF EGRESS EXIT ACCESS TRAVEL DISTANCE (TABLE 1017.2 MBC)

2. THE CLEAR WIDTH OF 48" BETWEEN HANDRAILS IS NOT REQUIRED IN BUILDINGS EQUIPPED THROUGHOUT WITH AN AUTOMATIC SPRINKLER SYSTEM INSTALLED IN ACCORDANCE WITH SECTION 903.3.1.1 OR 903.3.1.2

3. AREAS OF REFUGE ARE NOT REQUIRED AT STAIRWAYS IN BUILDINGS EQUIPPED THROUGHOUT WITH AN AUTOMATIC SPRINKLER SYSTEM INSTALLED IN ACCORDANCE WITH SECTION 903.1.1 OR 903.3.1.2

**MAXIMUM TRAVEL DISTANCE TO AN EXIT (TABLE 1017.2)**

BUSINESS

300 FT (WITH SPRINKLER SYSTEM)

RESIDENTIAL

250 FT (WITH SPRINKLER SYSTEM)

**COMMON PATH OF TRAVEL (TABLE 1006.2.1)**

BUSINESS

100 FT (WITH SPRINKLER SYSTEM)

RESIDENTIAL

125 FT (WITH SPRINKLER SYSTEM)

**MINIMUM CORRIDOR WIDTH (TABLE 1020.2)**

44" (36" < 50 OCCUPANTS)

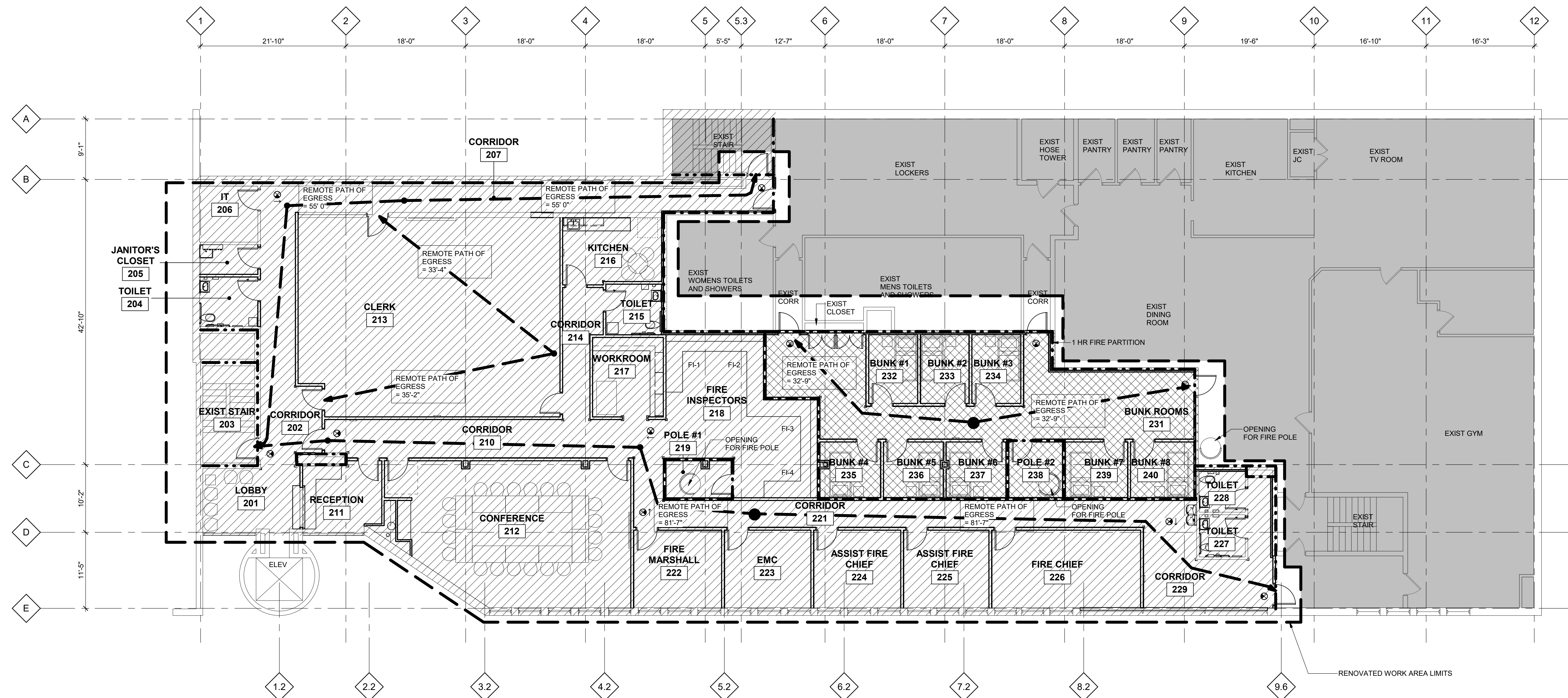
**EGRESS OCCUPANT LOADS (TABLE 1004.1.2) WORK AREA ONLY**

USE GROUP	FLOOR AREA	FLOOR/ OCC	# OF OCC	EGRESS WIDTH (0.2)	EGRESS REQ'D	EGRESS PROV'D	EXITS REQ'D	EXITS PROV'D
BUSINESS	6,663	100	67	14	44"	108"	2	3
RESIDENTIAL	1,426	200	8	2	34"	108"	1	3
TOTAL	8,089		75	16	78"	216"	3	6

**PLUMBING FIXTURE CALCULATIONS (TABLE 403.1 "B" USE, MOST STRINGENT)**

OCCUPANT LOAD	WATER CLOSET	URINALS	LAVATORIES	DRINKING FOUNTAINS	SERVICE SINK
75 TOTAL	1 PER 25 FOR THE FIRST 50 1 PER 50 AFTER		1 PER 40 FOR THE FIRST 80 1 PER 80 AFTER	1 REQ'D	1 REQ'D
75 UNISEX	4 PROVID 3 REQ'D		4 PROVID 2 REQ'D	1 PROVID	1 PROVID

NOTE 1: WATER COOLER OR BOTTLED WATER DISPENSER TO BE PROVIDED AS A SUBSTITUTION FOR A DRINKING FOUNTAIN, MPC 410.4



**CODE PLAN LEGEND**


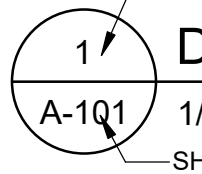
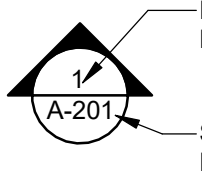
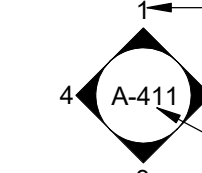
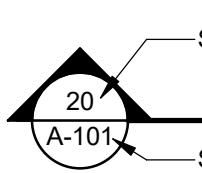
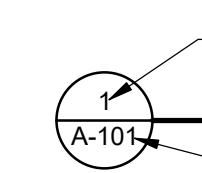
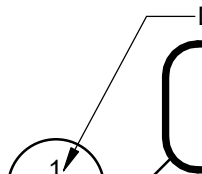
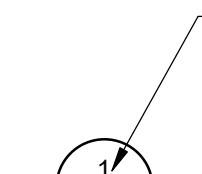


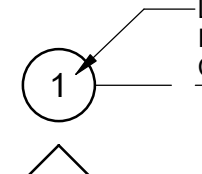
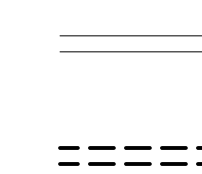
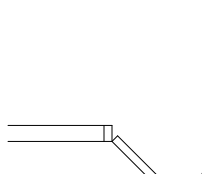
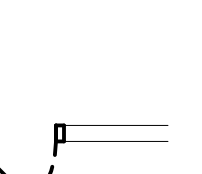
- 1 HR FIRE PARTITION
- 2 HR FIRE PARTITION
- RENOVATED WORK AREA LIMITS
- RESIDENTIAL, R-2 OCCUPANCY
- BUSINESS OCCUPANCY
- NOT IN SCOPE

**SECOND FLOOR CODE PLAN**  
1/8" = 1'-0"

**ARCHITECTURAL ABBREVIATIONS**

<b>A</b> A/C A/V ABR ABS AC NSUL ACC ACB ACCP ACT AD ADDN ADJ AFF AFSS AGGR AHU AL CLD AL OR ALUM ALT AM PNL AMP AMPF AMT ANCH ANCHS ANOD AP APPR APPROX APT ARCH ASB ASB BD ASPH ASPH T ASR ASST ASSY AUTO AUX AV AVG AW B	AND CENTERLINE PLUS OR MINUS ROUND QUARTER ROUND AT  AIR CONDITIONING AUDIO/VIDEO ANCHOR BOLTS ABRASIVE ABSORBING ACOUSTICAL, ACOUSTICAL INSULATION AIR CIRCUIT BREAKER ACCESS ACOUSTICAL CEILING PANEL ACOUSTICAL CEILING TILE ACCESS DOOR AMERICANS WITH DISABILITIES ACT ADDITION ADJUTANT ABOVE FINISH FLOOR AUTOMATIC FIRE SUPPRESSION SYSTEM AGGREGATE AIR HANDLING UNIT ALUMINUM-CLAD ALUMINUM ALTERNATE ACOUSTICAL METAL PANEL ALTERNATE AMPERE AMPLIFIER AMOUNT ANCHOR, ANCHORAGE ANCHORS ANODIZED ACCESS PANEL APPROVED APPROXIMATE APARTMENT ARCHITECT, ARCHITECTURAL ASBESTOS ASBESTOS BOARD ASPHALT ASPHALT TILE AUTOMATIC SPRINKLER RISER ASSISTANT ASSEMBLY AUTOMATIC AUXILIARY ACID VENT AVERAGE ACID WASTE	BL RES BLDG BLK BLOCK BLKG BLOCKING BLKH BULKHEAD BLR BOILER BLF BOILER FEED BLR H BOILER HOUSE BLVD BOULEVARD BM BEAM BT BENCH BR BRICK BRKR BREAKER BRK BRACKET BRN BRONZE BSMT BASEMENT BT BATHUB, BENT BTU BRITISH THERMAL UNIT BULL BULLETIN BUZZ BUZZ ROOFING BUZZ BLUZZ BWW BACK WATER VALVE	BLAST-RESISTANT BUILDING BLOCK BLOCKING BULKHEAD BOILER BOILER FEED BOILER HOUSE BOULEVARD BEAM BRICK BREAKER BRACKET BRONZE BASEMENT BATHUB, BENT BRITISH THERMAL UNIT BULLETIN BUZZ ROOFING BUZZ BACK WATER VALVE	COR CORNER CORR CORRUGATED COV COVER COVPL COVER PLATE CP CONTROL PANEL CPT CARPET CRS COURSE, COURSES CSTG CASTING CTR CENTER CTSJK COUNTERSINK (SUNK) CUFT CUBIC FEET (FOOT) CUH CABINET UNIT HEATER CULV CULVERT CW COLD WATER CWR CONDENSING WATER RETURN CWS CONDENSING WATER SUPPLY CY CUBIC YARD, CYCLES CYLINDER	CORNER CORRIDOR, CORRUGATED COVER COVER PLATE CONTROL PANEL CARPET COURSE, COURSES CASTING CENTER COUNTERSINK (SUNK) CUBIC FEET (FOOT) CABINET UNIT HEATER CULVERT COLD WATER CONDENSING WATER RETURN CONDENSING WATER SUPPLY CUBIC YARD, CYCLES CYLINDER	ENCL ENCLOSURE ENGR ENGINEER ENT ENTRANCE, ENTRY EP ELECTRICAL PANEL, EPOXY EQM EQUIPMENT EQU EQUIVALENT ER EXHAUST REGISTER ELM ELASTOMERIC SHEET EMBR MEMBRANE EWP WATERPROOFING ESP EXTERNAL STATIC PRESSURE EWS EACH WAY EWG ELECTRIC WATER SUPPLY EXC EXCAVATED EXH EXHAUST EXIST EXISTING EXP EXPANSION EXP B EXPANSION BOLT EXPD EXPOSED EXPL P EXPLOSION PROOF EXT EXTERIOR EXTN EXTENSION EXTR EXTRUDED	ENCLOSURE ENGINEER ENTRANCE, ENTRY ELECTRICAL PANEL, EPOXY EQUIPMENT EQUIVALENT EXHAUST REGISTER ELASTOMERIC SHEET MEMBRANE WATERPROOFING EXTERNAL STATIC PRESSURE EACH WAY ELECTRIC WATER SUPPLY EXCAVATED EXHAUST EXISTING EXPANSION EXPANSION BOLT EXPOSED EXPLOSION PROOF EXTERIOR EXTENSION EXTRUDED	GHT GLAZED HOLLOW TILE GLZ GLASS, GRID LINE GPM GALLONS PER HOUR GPM GALLONS PER MINUTE GR GRADE GRANO GRANOLITHIC GRAT GRATING GRD GROUND GS GREASE SEPARATOR GSC GREASE SCRUBBER GUST GREASE TRAP GV B GATE VALVE AND BOX GYP GYPSUM GYP BD GYPSUM BOARD	L LAB LAB LABORATORY LAD LADDER LAM LAMINATE, LAMINATED LAV LAVATORY LBL LABEL LBS OR # POUNDS LD LINEAR DIFFUSER LDG LANDING LDY LDRY LEV LEVEL LF LINEAR FEET LH LEFT HAND LGE LARGE LGTH LENGTH LH LEFT HAND LL LONG LEG LLH LONG LEG HORIZONTAL LLV LONG LEG VERTICAL LOU LOUVER OPENING LP LIGHTING PANEL, LOW POINT LPG LIQUID PETROLEUM GAS LPR LIQUID PROPANE GAS LRT LIVING ROOM LH LIGHT LIG LIGHTING LTW LIGHTWEIGHT LWTWCONC LIGHTWEIGHT CONCRETE	NIC NO OR # NOM NOMINAL NOS NOISE NRC NOISE REDUCTION COEFFICIENT NSR NEAR SIDE NST NOT TO SCALE  O O O/O OUT TO OUTSIDE O/S OUTSIDE AIR OBS OBSOLETE OBS GL OBSOBERE GLASS ON ON CENTER OD OUTSIDE DIAMETER OFF OFFICE OH OVERHEAD OHC OVERHEAD COILING DOOR OHD DR OVERHEAD DOOR OPP OPERABLE PARTITION OPENING OPP OPPOSITE HAND ORN ORNAMENTAL OXY OXYGEN OZ OUNCE	NOT IN CONTRACT NUMBER NOMINAL NOISE NOISE REDUCTION COEFFICIENT NEAR SIDE NOT TO SCALE  O OUT TO OUTSIDE OUTSIDE AIR OBSOLETE OBSOBERE GLASS ON CENTER OUTSIDE DIAMETER OFFICE OVERHEAD OVERHEAD COILING DOOR OVERHEAD DOOR OPERABLE PARTITION OPENING OPPOSITE HAND ORNAMENTAL OXYGEN OUNCE	PTWR PAPER TOWEL DISPENSER AND WASTE RECEPTACLE PVC VINYL CHLORIDE (PIPE) PVG PAVING PVMT PAVEMENT  Q QUARRY TILE QUARTER QUANTITY  R RISER RETURN AIR RADIUS, RETURN AIR DUCT RETURN AIR FAN ROOF CONDUCTOR ROAD, ROOF DRAIN RECESS RECEPTACLE RECT RECTANGLE, RECTANGULAR RECV REDUCER REF REFERENCE REFR REFLECTED, REFLECTIVE REFR REFRIGERATION, REFRIGERATOR REG REGISTER REINFR REINFORCE, REINFORCING, REINFORCEMENT REM REMOVABLE, REMOVE REQD REQUIRED RESL RESILIENT RET RETURN REV REVISED, REVISION RFG ROOFING RH RIGHT HAND RHK ROBE HOOK RHMS ROUND HEAD MACHINE RHS PERFORATED RHWS ROUND HEAD WOOD SCREW RM ROOM RO ROUGH OPENING ROW RIGHT OF WAY RPM REVOLUTIONS PER MINUTE RR RAILROAD RS ROOF SUMP RT RUBBER TILE RV ROOF VENTILATOR RWC RAIN WATER CONDUCTOR	PAPER TOWEL DISPENSER AND WASTE RECEPTACLE VINYL CHLORIDE (PIPE) PAVING PAVEMENT  QUARRY TILE QUARTER QUANTITY  RISER RETURN AIR RADIUS, RETURN AIR DUCT RETURN AIR FAN ROOF CONDUCTOR ROAD, ROOF DRAIN RECESS RECEPTACLE RECTANGLE, RECTANGULAR REDUCER REFERENCE REFLECTED, REFLECTIVE REFRIGERATION, REFRIGERATOR REGISTER REINFORCE, REINFORCING, REINFORCEMENT REMOVABLE, REMOVE REQUIRED RESILIENT RETURN REVISED, REVISION ROOFING RIGHT HAND ROBE HOOK ROUND HEAD MACHINE PERFORATED ROUND HEAD WOOD SCREW ROOM ROUGH OPENING RIGHT OF WAY REVOLUTIONS PER MINUTE RAILROAD ROOF SUMP RUBBER TILE ROOF VENTILATOR RAIN WATER CONDUCTOR	SPECIFICATIONS SPKRLR SPRINKLER SQR SQUARE FEET, SQUARE FOOT SQ FT SR SUPPLY REGISTER SS SERVICE SINK STL STRUCTURAL STEEL ST STREET STL STAINLESS STEEL STATION STAG STAGGERED SOUND TRANSMISSION CLASS STD STANDARD STEEL STLPL STEEL PLATE STM STEAM STR STORAGE STR STRUCTURAL SUB SUBSTATION SUBS SUBSTITUTE SUPP SUPPORT SURF SURFACE SUSP SUSPENDED, SUSPENSION SW SWITCH SWBD SWITCHBOARD SYN SYNCHRONIZING SYM SYMBOL, SYMMETRICAL SYS SYNTHETIC SYSTEM	SPECIFICATIONS SPRINKLER SQUARE FEET, SQUARE FOOT SQ FT SUPPLY REGISTER SERVICE SINK STRUCTURAL STEEL STREET STAINLESS STEEL STATION STAGGERED SOUND TRANSMISSION CLASS STANDARD STEEL STEEL PLATE STEAM STORAGE STRUCTURAL SUBSTATION SUBSTITUTE SUPPORT SURFACE SUSPENDED, SUSPENSION SWITCH SWITCHBOARD SYNCHRONIZING SYMBOL, SYMMETRICAL SYNTHETIC SYSTEM	VAT VINYL ASBESTOS TILE VALVE BOX VERTICAL CURVE VACUUM CLEANER OUTLET VCT VITRIFIED CLAY PIPE VCL VINYL COMPOSITION TILE VOLUME DAMPER VEH VEHICLE VENT VENTILATE, VENTILATED VENT VENTILATION VERT VERTICAL, VERTICALLY VEST VESTIBULE VIN VINYL VIN FAB VINYL FABRIC VIT VITREOUS VITR SURF VITREOUS SURFACING VOL VOLUME VAPORTIGHT VENT THROUGH ROOF VTR VITRIFIED VWC VINYL WALL COVERING VIF VERIFY IN FIELD	VINYL ASBESTOS TILE VALVE BOX VERTICAL CURVE VACUUM CLEANER OUTLET VITRIFIED CLAY PIPE VINYL COMPOSITION TILE VOLUME DAMPER VEHICLE VENTILATE, VENTILATED VENTILATION VERTICAL, VERTICALLY VESTIBULE VINYL VINYL FABRIC VITREOUS VITREOUS SURFACING VOLUME VAPORTIGHT VENT THROUGH ROOF VTR VITRIFIED VINYL WALL COVERING VERIFY IN FIELD
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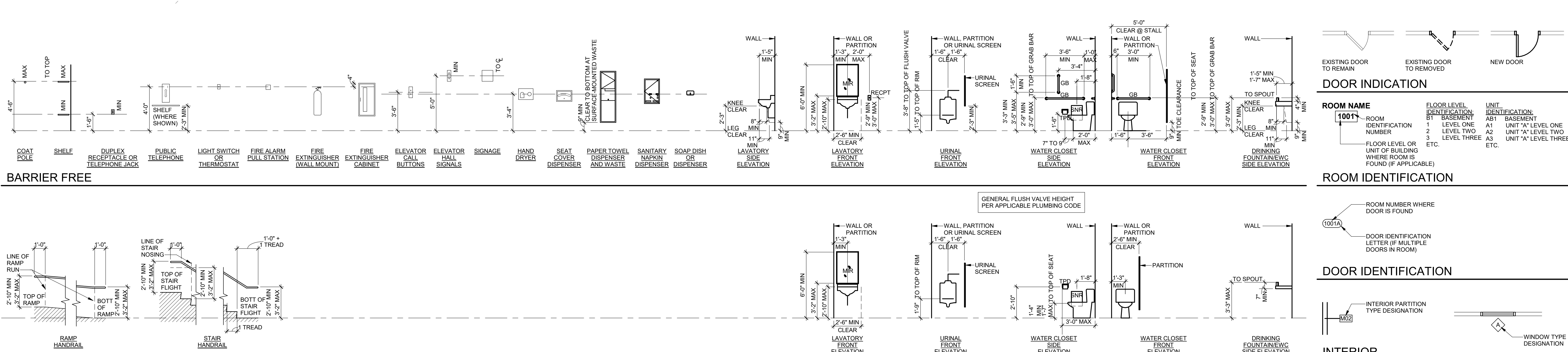
**DRAWING SYMBOLS**

	ASSUMED NORTH IF NOT TRUE NORTH, OR PLAN NORTH WHERE TRUE NORTH IS INDICATED BY SMALL ARROW ON FIRST PLAN IN SET		DRAWING / DETAIL NUMBER <b>DRAWING TITLE</b> 1/8" = 1'-0" SHEET WHERE DRAWING / DETAIL IS REFERENCED AT
	EXTERIOR ELEVATION NUMBER		INTERIOR ELEVATION NUMBER
	SECTION NUMBER		DETAIL NUMBER
	BUILDING SECTION CUT		WALL SECTION DETAIL CUT
	ENLARGED PLAN / DETAIL		ENLARGED PLAN / DETAIL
	MATCHLINE		MATCHLINE
	COLUMN LINE		WALL INDICATION

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Consultant:  
Seal:  
Client:  
**CITY OF ANN ARBOR**  
ANN ARBOR MI  
Project Title:  
**ANN ARBOR FIRE STATION NO.1 RENOVATION**  
Date:  
11-11-2021 ISSUED FOR OWNER REVIEW  
12-08-2021 ISSUED FOR PLAN REVIEW  
02-04-2022 PLAN REVIEW RESUBMITTAL  
02-15-2022 BIDDING

**TYPICAL LAYOUT INFORMATION AND MOUNTING HEIGHTS**



**BARRIER FREE**

**GENERAL**



**NEW**

NOTE: NOT ALL OF THE STANDARD ITEMS LISTED HERE ARE USED WITHIN THIS SET OF DRAWINGS. ANY SPECIFIC DRAWINGS, NOTES, SYMBOLS, ETC. DEFINED AND USED IN THE FOLLOWING SHEETS GOVERN.

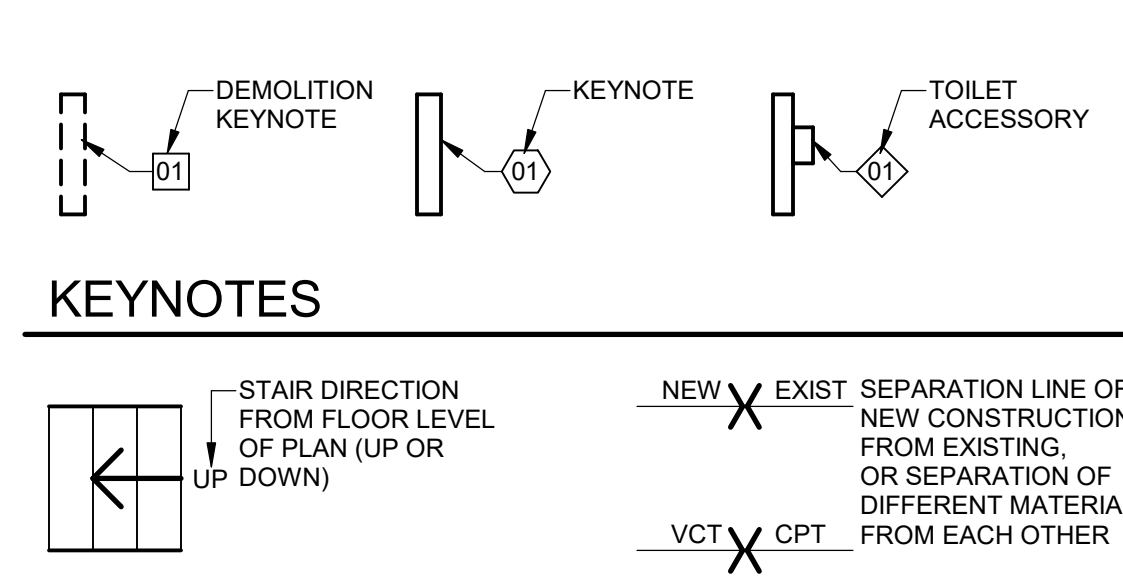
**INTERIOR PARTITION TYPE**

**WINDOW TYPE**



**DIMENSION LINE**

**TEXT LEADER**



**STAIR DIRECTION**

**SEPARATION**



PA/PE: REF PM: GM CH: AP:  
CAD Drawing File: A-001.DWG  
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Project Number: 221015.00  
Sheet Title: ARCHITECTURAL INFORMATION  
Sheet Number: A-001

**DEMOLITION NOTES**

- THESE DRAWINGS CANNOT ACCOUNT FOR HIDDEN CONDITIONS THAT MAY BECOME APPARENT DURING DEMOLITION. CONTRACTOR SHALL VERIFY ALL ON SITE CONDITIONS AND DIMENSIONS AND NOTIFY THE ARCHITECT OF ANY DISCREPANCIES OR OMISSIONS WITH THE EXISTING FIELD CONDITIONS AND THE DOCUMENTS PRIOR TO CONSTRUCTION/DEMOLITION.
- REFER TO MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS FOR COORDINATION AND ADDITIONAL DEMOLITION WORK.
- REPAIR DEMOLITION PERFORMED IN EXCESS OF THAT INDICATED ON THE DRAWINGS. RETURN ELEMENTS OF CONSTRUCTION AND SURFACES SOLED OR DAMAGED BY SELECTIVE DEMOLITION WORK. REPAIR FIREPROOFING DAMAGED OR REMOVED IN ACCORDANCE WITH FIRE MARSHAL'S REQUIREMENTS.
- ALL STRUCTURAL MEMBERS ARE TO REMAIN (TYPICAL UNLESS NOTED OTHERWISE).
- IF HAZARDOUS MATERIALS ARE ENCOUNTERED DURING DEMOLITION OPERATIONS, COMPLY WITH APPLICABLE REGULATIONS, LAWS AND ORDINANCES CONCERNING REMOVAL, HANDLING, AND PROTECTION AGAINST EXPOSURE, OR ENVIRONMENTAL POLLUTION.
- CONDUCT SELECTIVE DEMOLITION OPERATIONS AND DEBRIS REMOVAL IN A MANNER TO ENSURE MINIMUM INTERFERENCE WITH ADJACENT OCCUPIED OR USED FACILITIES. DO NOT CLOSE, BLOCK OR OTHERWISE OBSTRUCT OTHER OCCUPIED OR USED FACILITIES WITHOUT WRITTEN PERMISSION FROM AUTHORITIES HAVING JURISDICTION. PROVIDE ALTERNATE ROUTES AROUND CLOSED OR OBSTRUCTED TRAFFIC WAYS IF REQUIRED BY GOVERNING REGULATIONS.

**DEMO KEYNOTES**

- REMOVE WALL INCLUDING DOOR, DOOR FRAME, AND DOOR
- REMOVE DOOR, DOOR FRAME AND DOOR HARDWARE
- REMOVE MILLWORK AND COUNTERTOPS
- REMOVE PLUMBING FIXTURES, TOILET ACCESSORIES, GRAB BARS, LIGHT FIXTURES, CEILING, WALL TILE AND BACKER BOARD, TILE FLOOR AND BASE
- RELOCATE WATER HEATER AND PIPING - SEE MECH
- REMOVE CARPET, BASE AND ADHESIVE
- REMOVE WALL CONSTRUCTION AS REQUIRED FOR NEW DOOR
- REMOVE WALL CONSTRUCTION
- REMOVE ELECTRIC WATER COOLER AND PIPING - SEE MECH
- REMOVE GYPSUM BOARD ENCLOSURE
- REMOVE DOOR, FRAME TO REMAIN
- REMOVE LAVATORY AND CAP PLUMBING
- REMOVE FLOOR TILE AND BASE
- REMOVE LOCKER AND BASE
- REMOVE COAT HOOKS
- REMOVE THRESHOLD
- REMOVE WINDOW & FRAME
- REMOVE WINDOW SILL
- REMOVE GYPSUM BOARD ON BOTH SIDES, STUD TO REMAIN
- REMOVE EXIST LAYER OF GYPSUM BOARD ON CORRIDOR SIDE OF WALL ONLY
- REMOVE EXISTING LAYERS OF GYPSUM BOARD AND SINGLE STUD ON SIDE OF RENOVATED WORK AREA ONLY - REFER TO DETAIL 9A-502
- LAVATORY AND WATER CLOSET TO BE REMOVED, AND RE-INSTALLED - REFER TO MECH FOR TEMPORARY DISCONNECT AND REPLACEMENT
- REMOVE WALL CONSTRUCTION AS REQUIRED FOR CONTINUOUS SHAFT WALL

**PLAN NOTES**

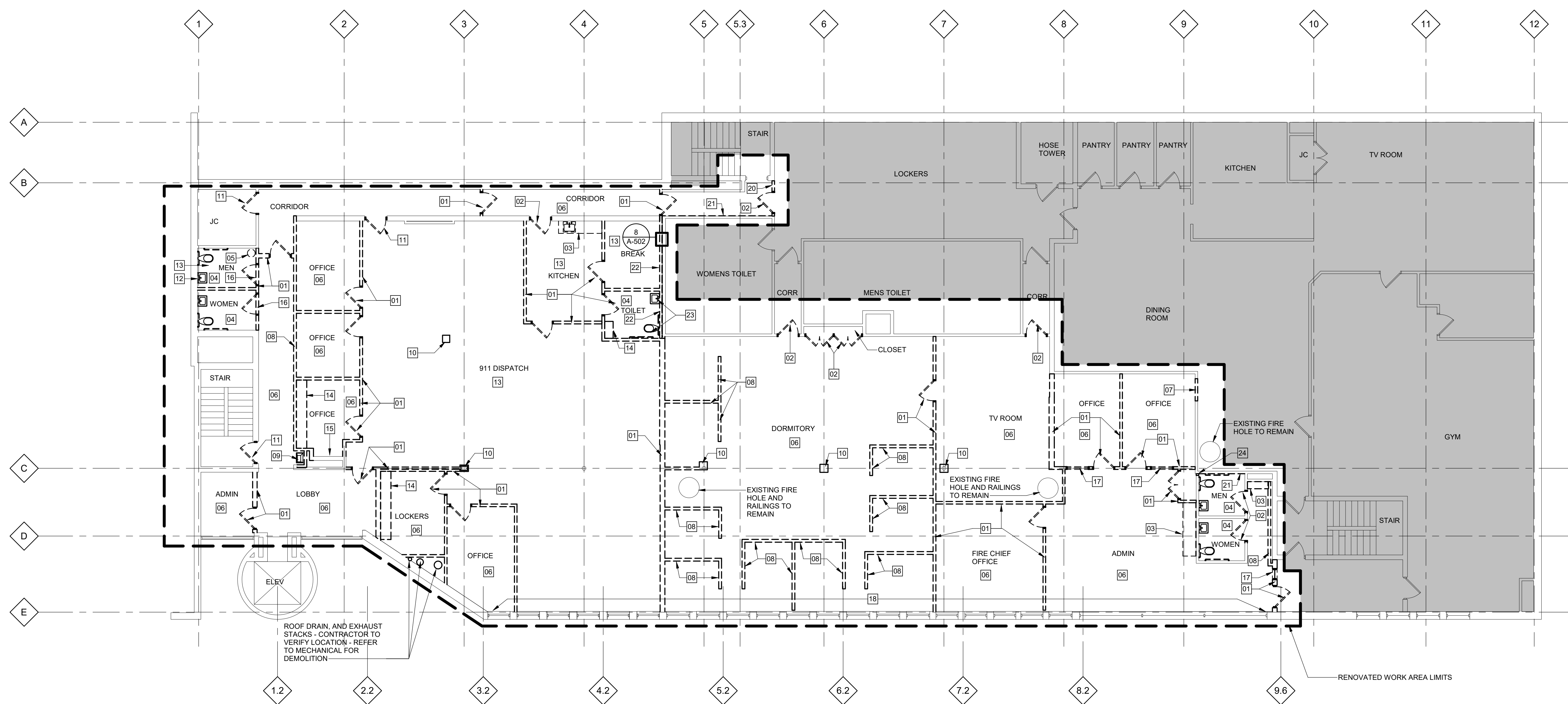
- DIMENSIONS AT NEW STUD WALLS ARE TO FACE OF STUD, ALL OTHER DIMENSIONS ARE TO FACE OF WALL. TYPICAL UNLESS OTHERWISE NOTED
- LOCATE ALL DOORS 4" FROM FACE OF WALL TO BACK OF DOOR FRAME. TYPICAL UNLESS OTHERWISE NOTED
- PATCH AND REPAIR REMAINING SURFACES AT AREAS OF DEMOLITION TO ACCOMMODATE NEW FINISH
- FIELD VERIFY ALL DIMENSIONS
- PATCH FLOOR AT REMOVED CONSTRUCTION, DAMAGED CONDITIONS, HOLES, ETC TO MATCH ADJACENT
- PATCH WALLS AT REMOVED CONSTRUCTION, WALL ANCHORS, CRACKED AND DAMAGED CONDITIONS, HOLES, ETC TO MATCH ADJACENT CONSTRUCTION AND PAINT
- PATCH ALL EXISTING RATED ASSEMBLIES IN FIELD
- REMOVE AND REPAIR GYPSUM BOARD AS REQUIRED FOR NEW RECEPTACLES, SWITCHES, BLOCKING, ETC
- REMOVE AND REPAIR WALLS AS REQUIRED FOR NEW PLUMBING FIXTURES
- REFER TO SHEET A-401 FOR ADDITIONAL DIMENSIONS, NOTES AND TAGS
- CONTRACTOR IS RESPONSIBLE FOR BLOCKING IN GYPSUM BOARD WALLS AS REQUIRED FOR ALL WALL MOUNTED ACCESSORIES

**PLAN LEGEND**

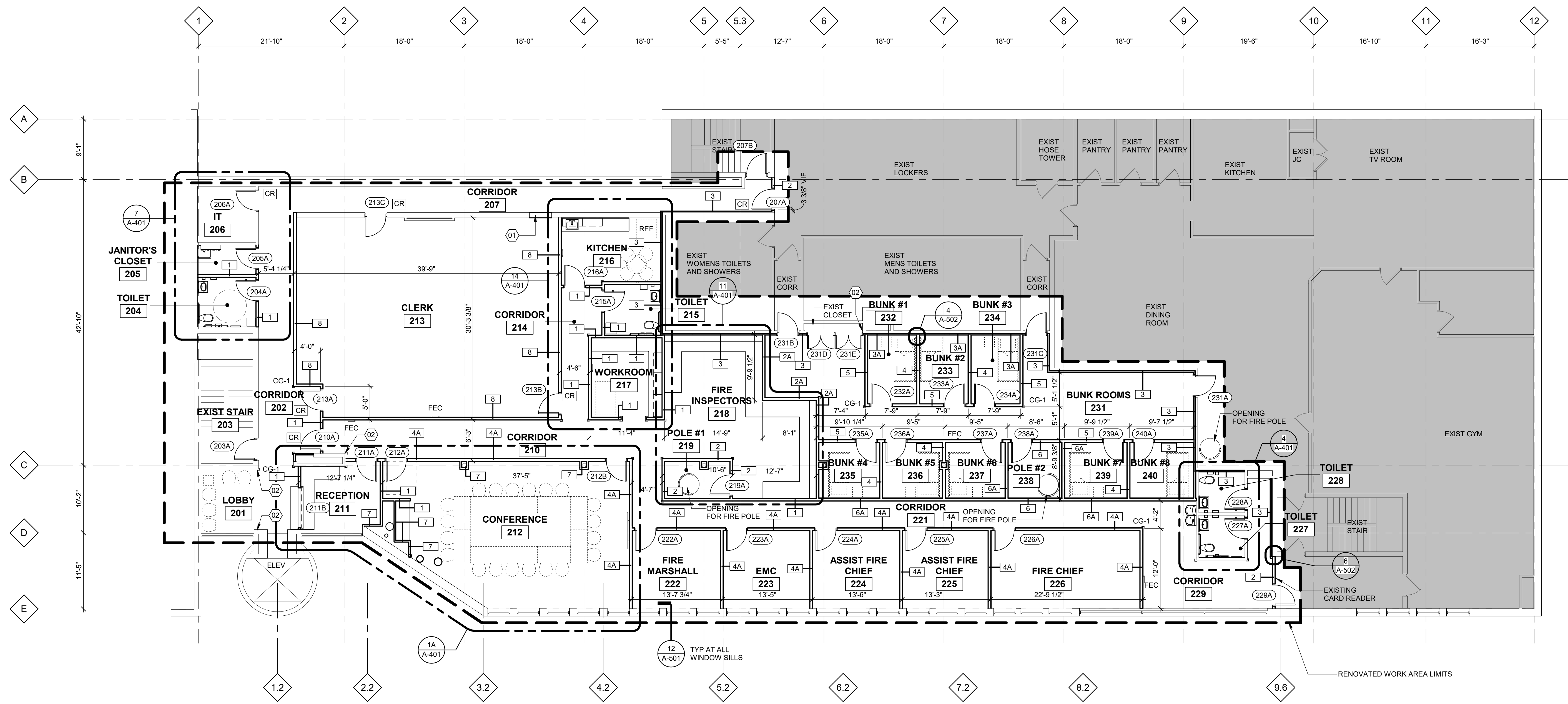
- EXISTING
- NEW
- RENOVATED WORK AREA LIMITS
- CG-1 CORNER GUARD - REFER TO MATERIAL FINISH SCHEDULE
- CG-2 CORNER GUARD - REFER TO MATERIAL FINISH SCHEDULE
- NOT IN SCOPE

**PLAN KEYNOTES**

- INFILL OPENING WITH GYPSUM BOARD AND METAL STUD FRAMING TO MATCH EXISTING
- PATCH & REPAIR GYPSUM BOARD WALL CONSTRUCTION TO MAINTAIN THE EXISTING WALL RATING



**SECOND FLOOR DEMOLITION PLAN**  
1/8" = 1'-0"



**SECOND FLOOR CODE PLAN**  
1/8" = 1'-0"



SECOND FLOOR CEILING DEMOLITION PLAN  
1/8" = 1'-0"



SECOND FLOOR CEILING PLAN  
1/8" = 1'-0"

**DEMOLITION NOTES**

- ALL DRAWINGS ARE SCHEMATIC - EXTENT OF DEMOLITION SHOWN IS APPROXIMATE - FIELD VERIFY
- REFER TO MECHANICAL AND ELECTRICAL DRAWINGS FOR EXTENT OF DEMOLITION
- FOR MECHANICAL AND ELECTRICAL WORK OUTSIDE OF THE AWORK AREA - REMOVE AND REPLACE CEILING ELEMENTS AS REQUIRED

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**CEILING DEMO KEYNOTES**

- C1 REMOVE LAY-IN CEILING TILES AND GRID
- C2 REMOVE GYPSUM BOARD CEILING AND FRAMING
- C3 REMOVE LINEAR WOOD CEILING AND SUPPORT SYSTEM

Client:  
**CITY OF ANN ARBOR**  
ANN ARBOR MI

Project Title:  
**ANN ARBOR FIRE STATION NO.1 RENOVATION**

**CEILING NOTES**

- CEILING TILES TO BE CENTERED BETWEEN WALLS AS SHOWN UNLESS OTHERWISE NOTED
- CONTRACTOR TO COORDINATE RECESSED LIGHT FIXTURE LOCATIONS W/ DUCTWORK, SPRINKLERS AND STRUCTURE
- FOR FIXTURE TYPES - REFER TO ELECTRICAL DRAWINGS
- CENTER LIGHTS, GRILLES, AND DIFFUSERS IN CEILING TILES OR ALIGN IN GYPSUM BOARD ASSEMBLIES
- PAINT ALL EXPOSED STRUCTURE, STEEL AND CONCRETE PLANKS UNLESS OTHERWISE NOTED - REFER TO ROOM FINISH SCHEDULE

Date: 11-11-2021  
12-08-2021  
02-04-2022  
02-15-2022

Issued For: OWNER REVIEW  
ISSUED FOR PLAN REVIEW  
PLAN REVIEW RESUBMITTAL  
BIDDING

**CEILING LEGEND**

- 10'-0" CEILING HEIGHT
- EXP EXPOSED CONSTRUCTION
- 2'-0" x 2'-0" ACOUSTICAL LAY-IN CEILING TILE
- GYPSUM BOARD CEILING
- CJ CEILING CONTROL JOINT
- ACCESS PANEL (24" x 24" UON)
- SUPPLY AIR GRILLE
- RETURN AIR GRILLE
- EXHAUST FAN
- LINEAR DIFFUSER
- LAY-IN LIGHT FIXTURE
- LAY-IN EMERGENCY LIGHT FIXTURE
- RECESSED LIGHT FIXTURE
- WALL MOUNTED LIGHT FIXTURE
- WALL MOUNTED EXIT LIGHT FIXTURE
- EMERGENCY EXIT LIGHTING
- H HEAT DETECTOR
- SD SMOKE DETECTOR
- E FIRE ALARM SPEAKER
- S SPEAKER
- NOT IN SCOPE
- 3 1/2" SOUND BATT INSULATION ABOVE THE CEILING

PA/PE: REF PM: GM CH: AP:

CAD Drawing File: A-111.DWG  
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Project Number:  
**221015.00**

Sheet Title:  
**SECOND FLOOR CEILING DEMOLITION PLAN AND CEILING PLAN**

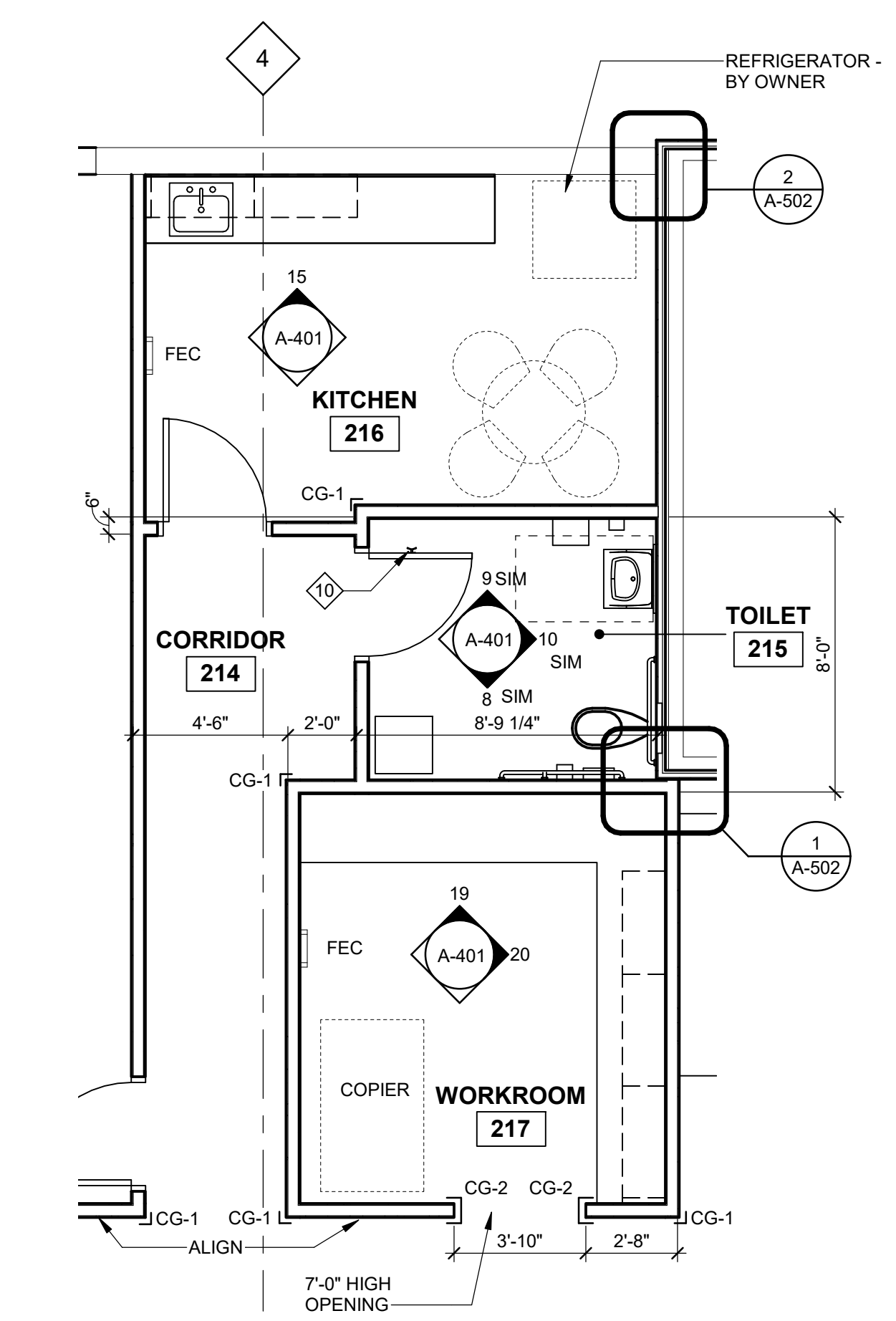
Sheet Number:  
**A-111**

**NOTES**

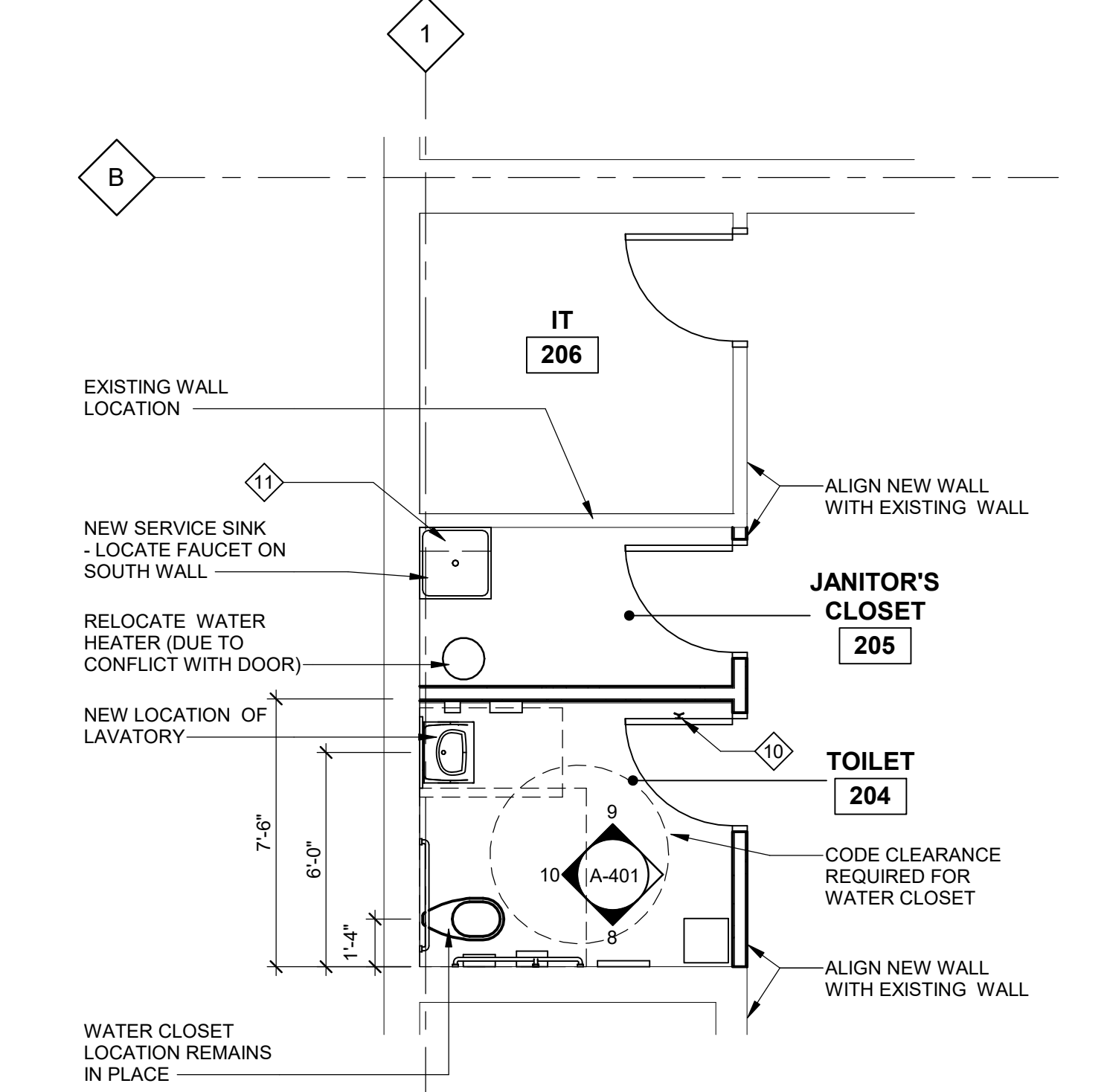
- REFER TO SHEET A-101 FOR PLAN NOTES
- REFER TO SHEET A-101 FOR PLAN LEGEND
- PROVIDE WALL BLOCKING FOR ALL WALL MOUNTED ACCESSORIES AND SHELVING

**TOILET ACCESSORIES**

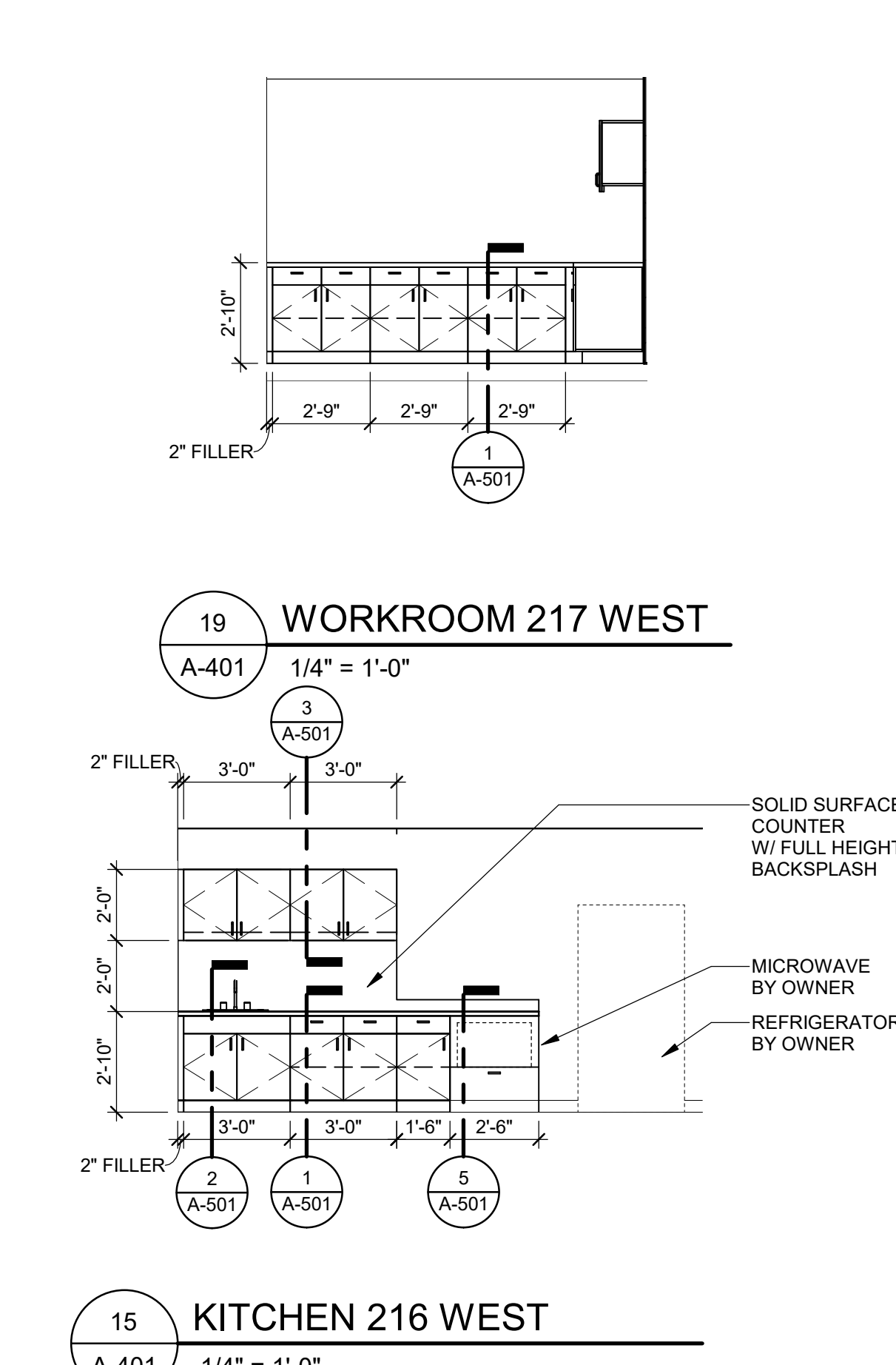
- SOAP DISPENSER
- SEAT COVER DISPENSER
- TOILET TISSUE DISPENSER
- 18" VERTICAL GRAB BAR
- 42" GRAB BAR
- 36" GRAB BAR
- SANITARY NAPKIN DISPOSAL
- TOWEL DISPENSER - DISPENSED PRODUCT LOCATED 3'-0" MAX AFF
- FRAME MIRROR 24"x36"
- COAT HOOK
- MOP AND BROOM HOLDER
- TRASH CAN



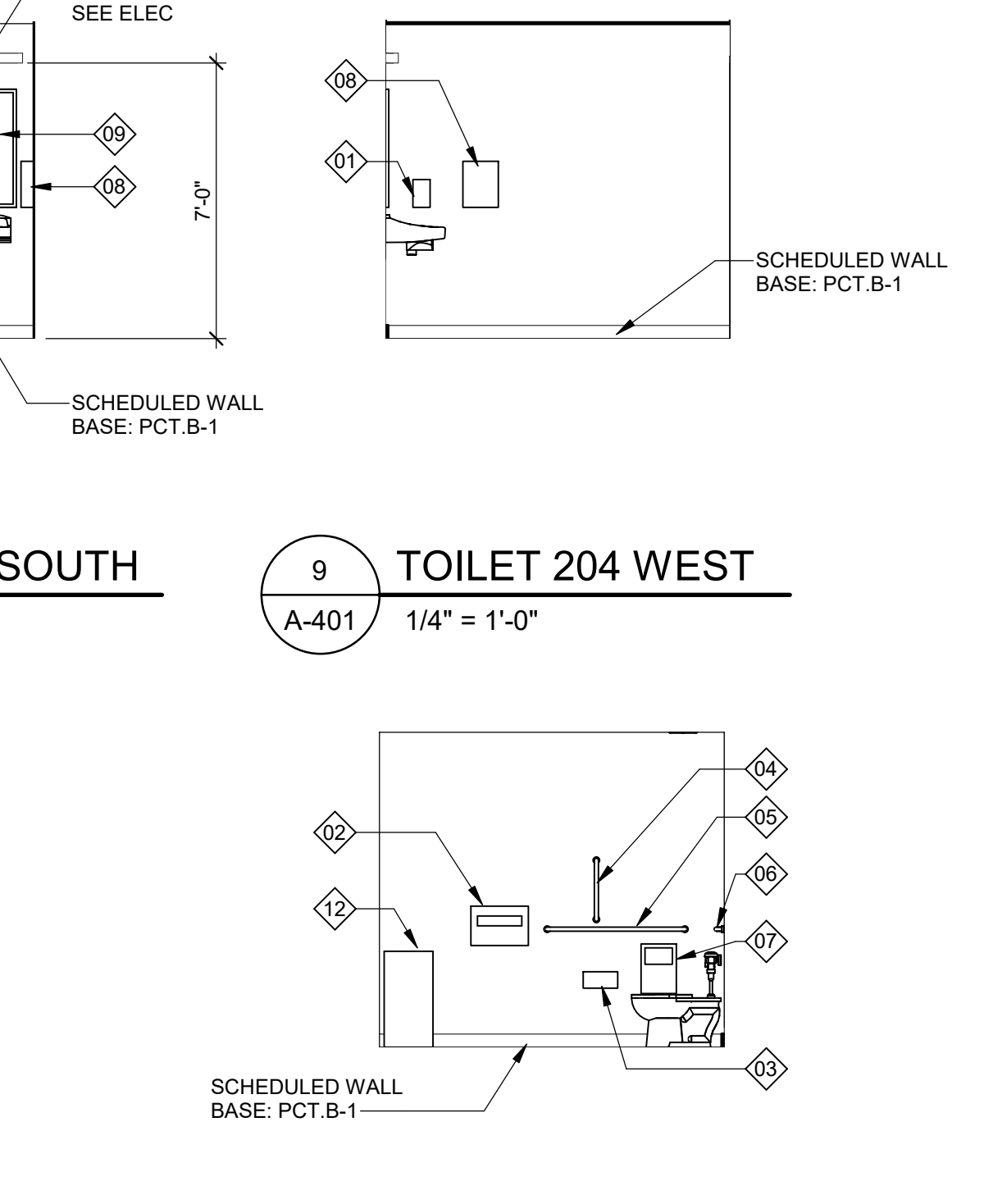
**14 ENLARGED PLAN - KITCHEN, TOILET, WORKROOM**  
A-101 1/4" = 1'-0"



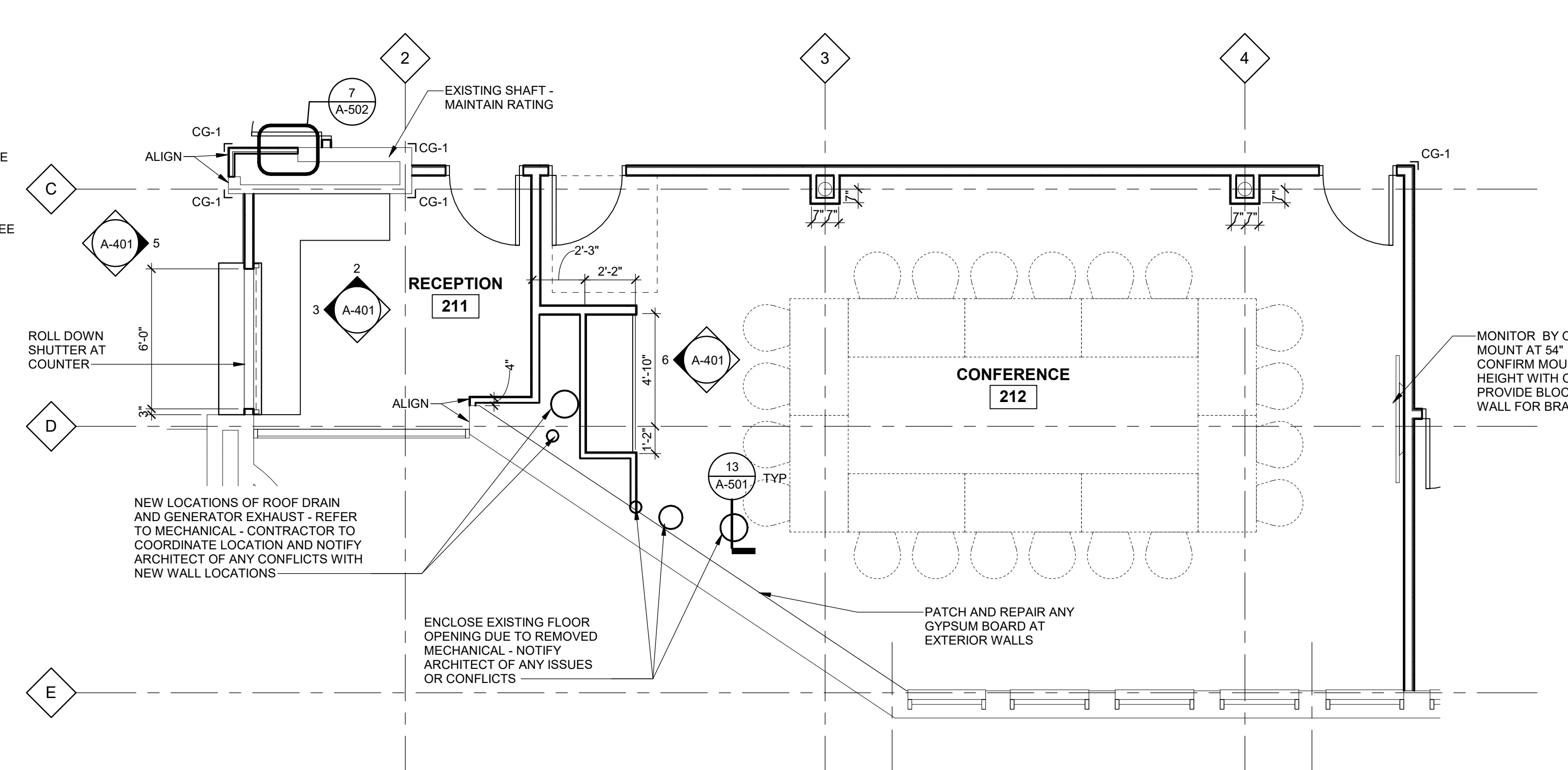
**7 ENLARGED PLAN - TOILETS & JC**  
A-101 1/4" = 1'-0"



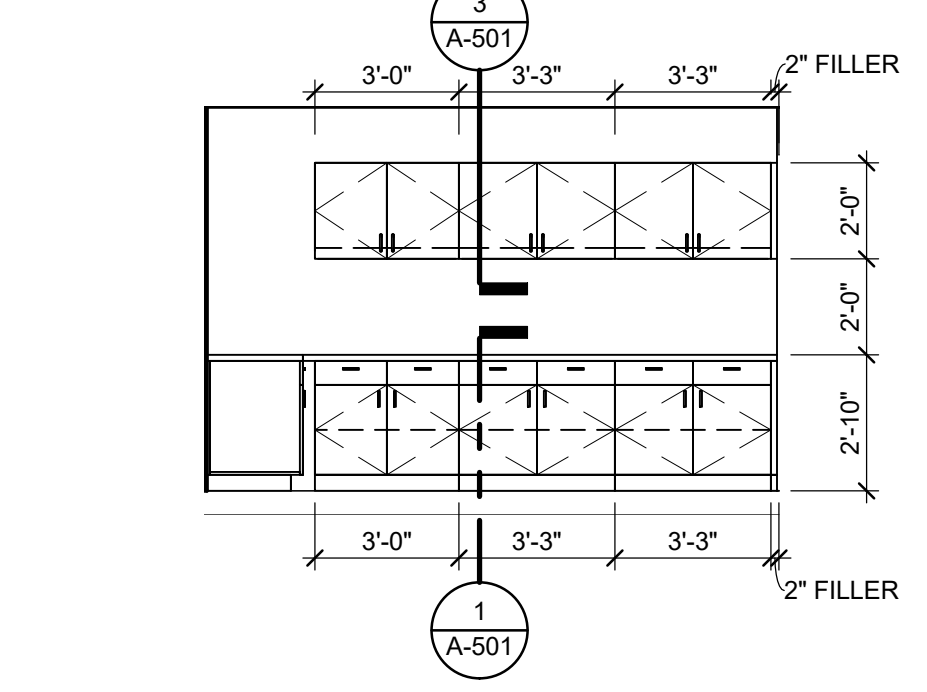
**15 KITCHEN 216 WEST**  
A-401 1/4" = 1'-0"



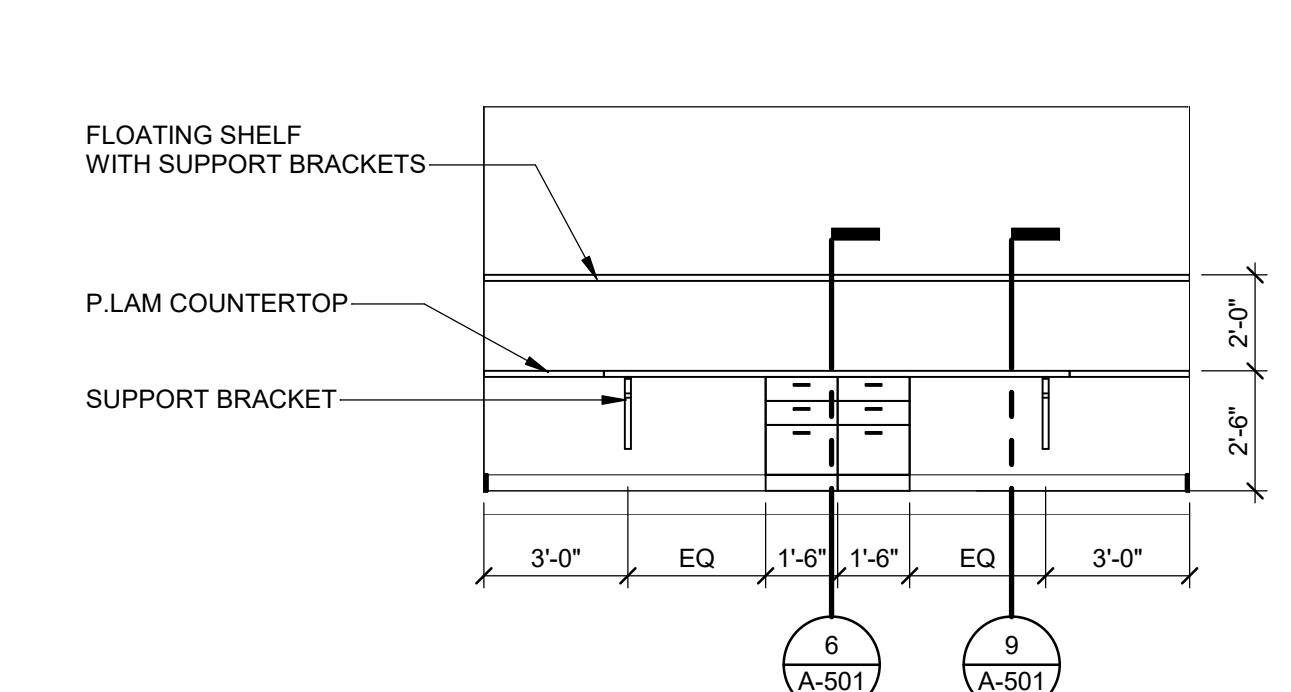
**8 TOILET 204 EAST**  
A-401 1/4" = 1'-0"



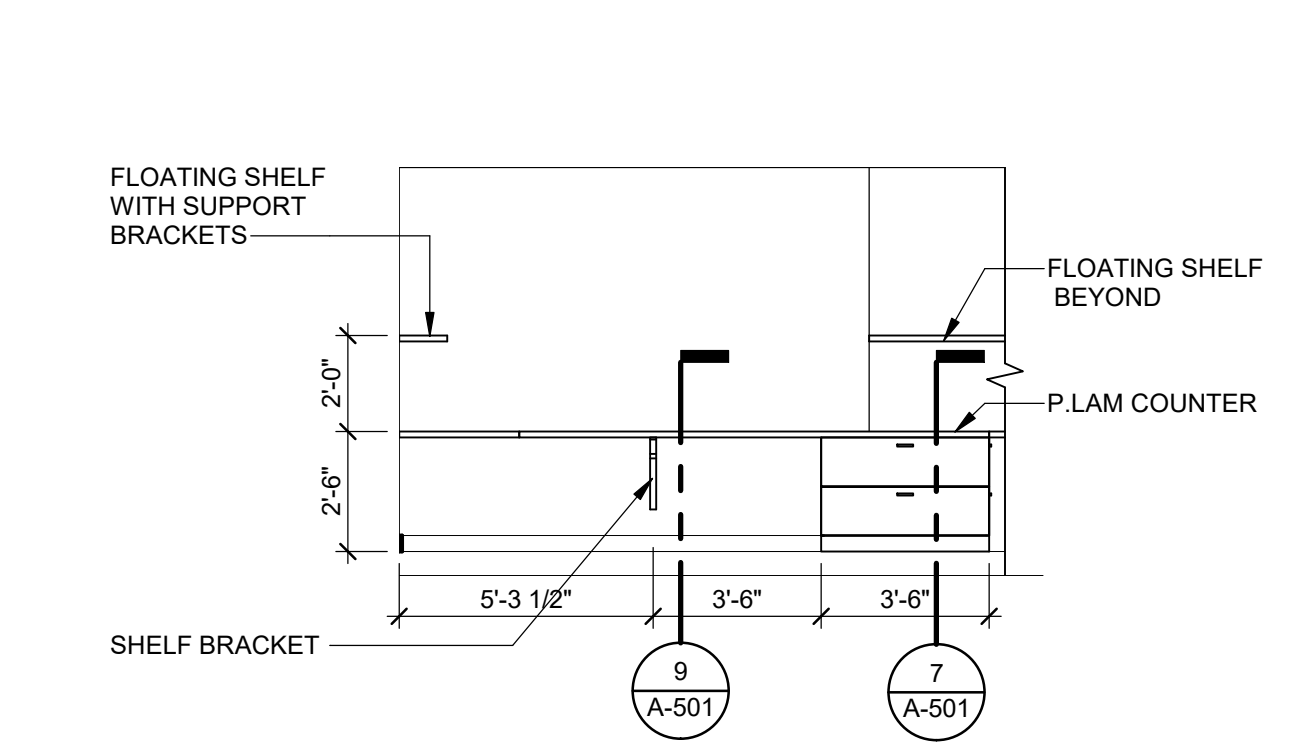
**1A RECEPTION 211 AND PARTIAL CONFERENCE 212**  
A-101 1/4" = 1'-0"



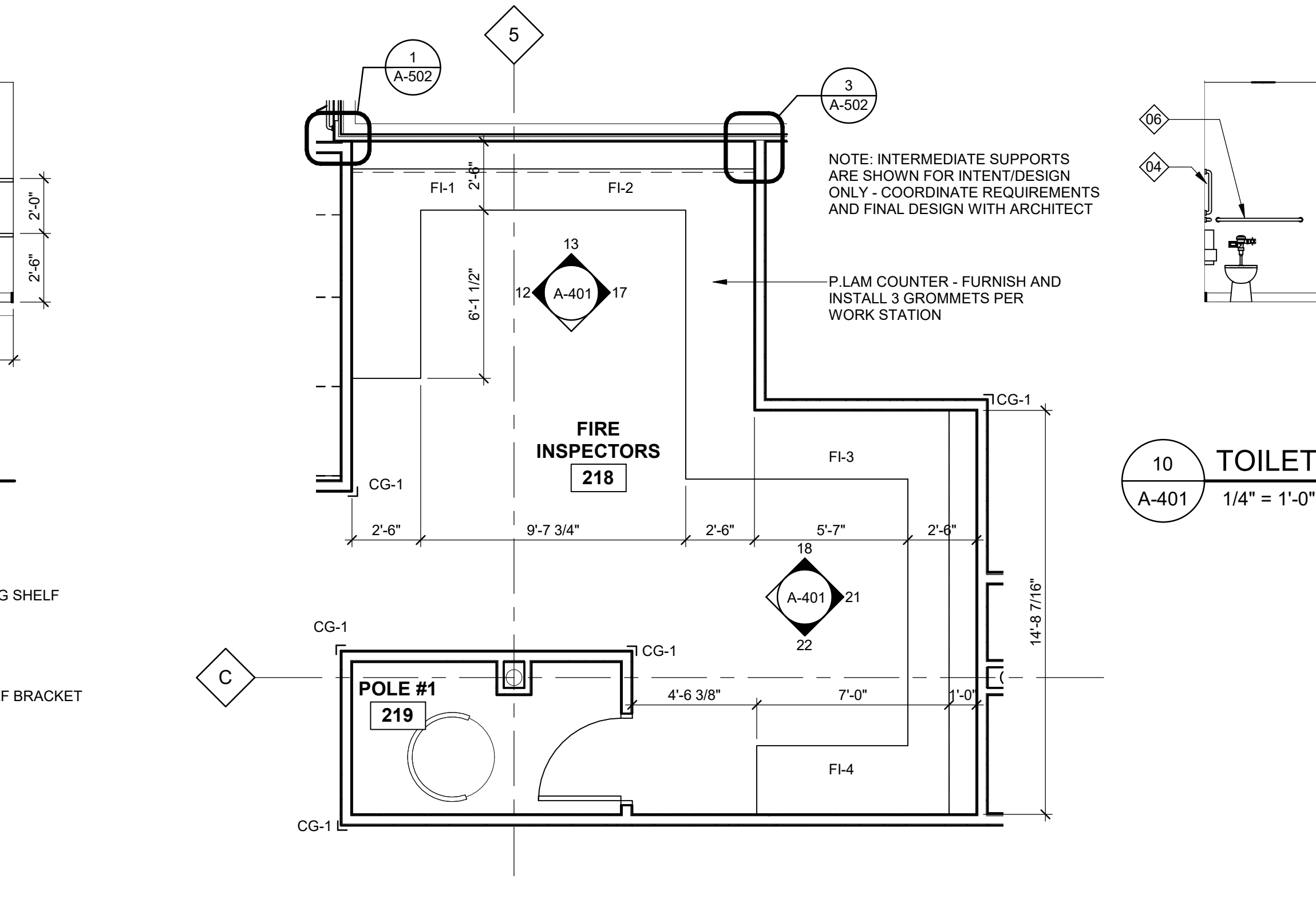
**20 WORKROOM 217 NORTH**  
A-401 1/4" = 1'-0"



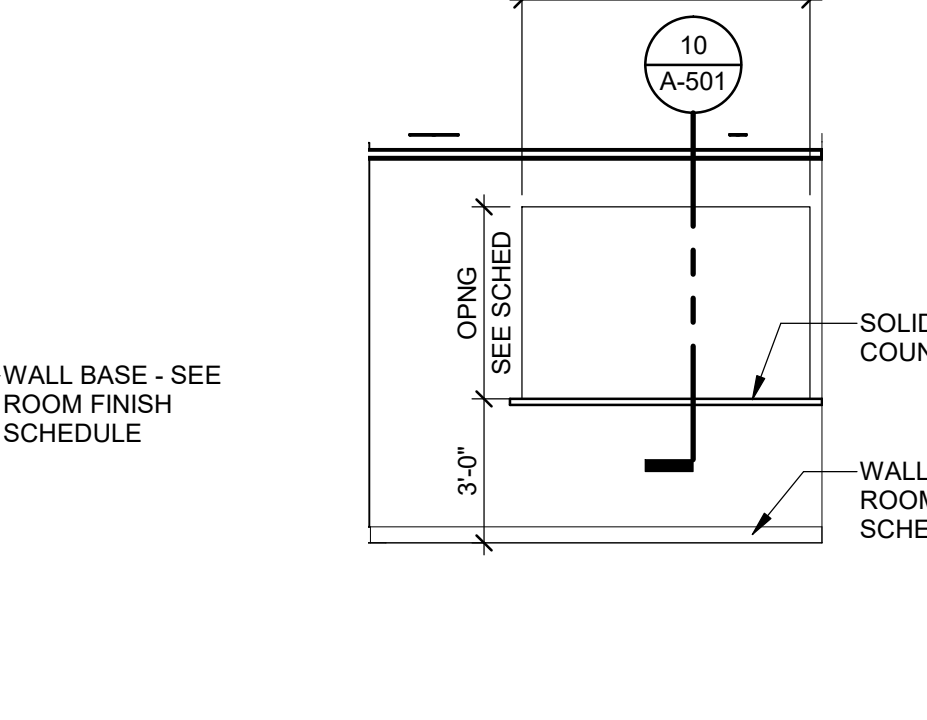
**21 FIRE INSPECTOR 218 NORTH**  
A-401 1/4" = 1'-0"



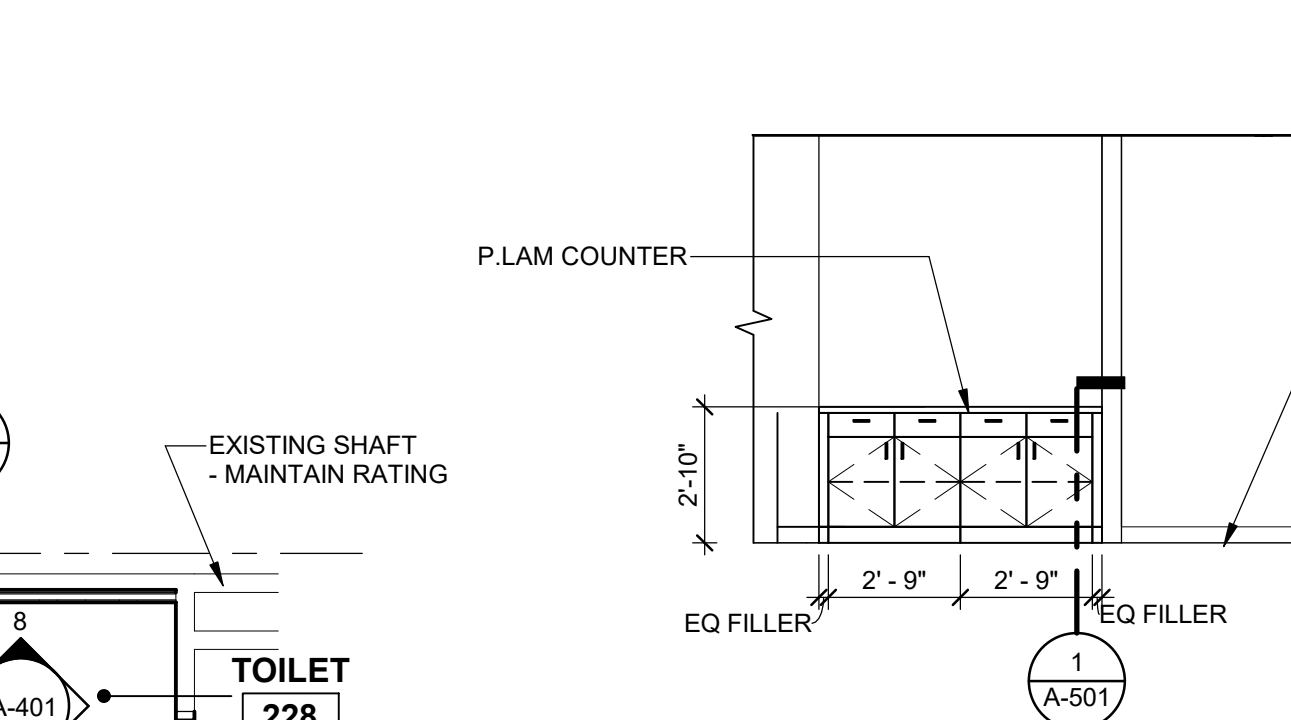
**17 FIRE INSPECTOR 218 NORTH**  
A-401 1/4" = 1'-0"



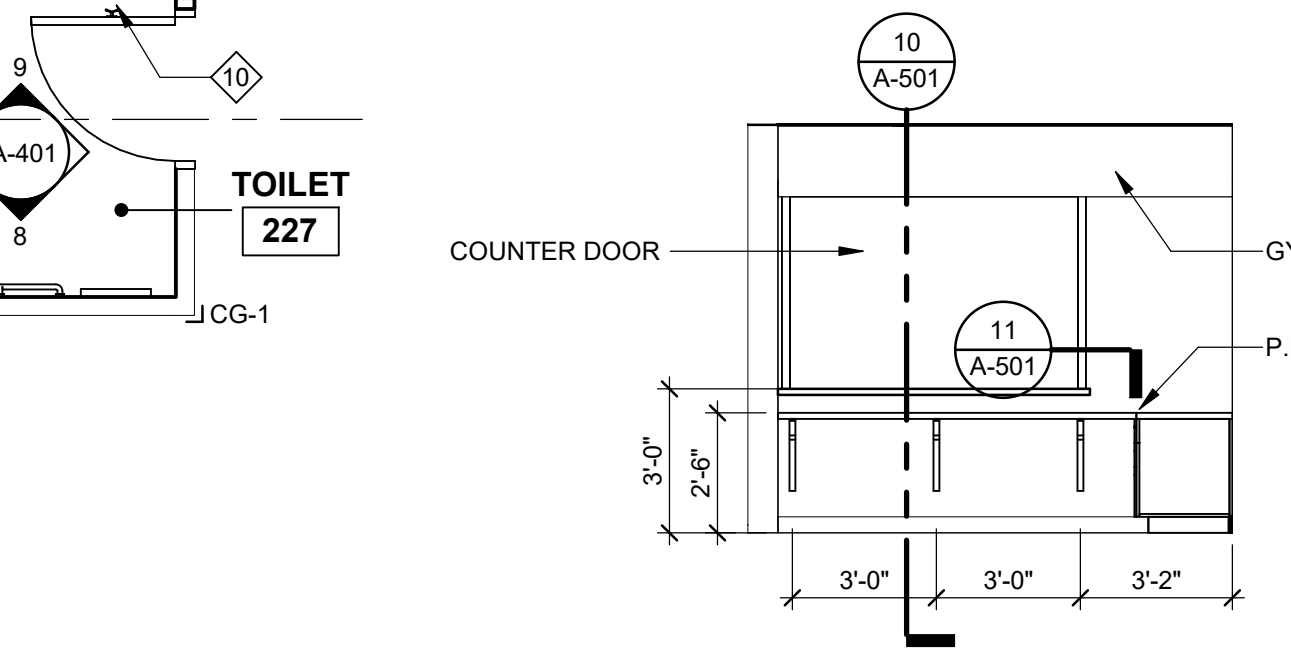
**11 ENLARGED PLAN - FIRE INSPECTORS**  
A-101 1/4" = 1'-0"



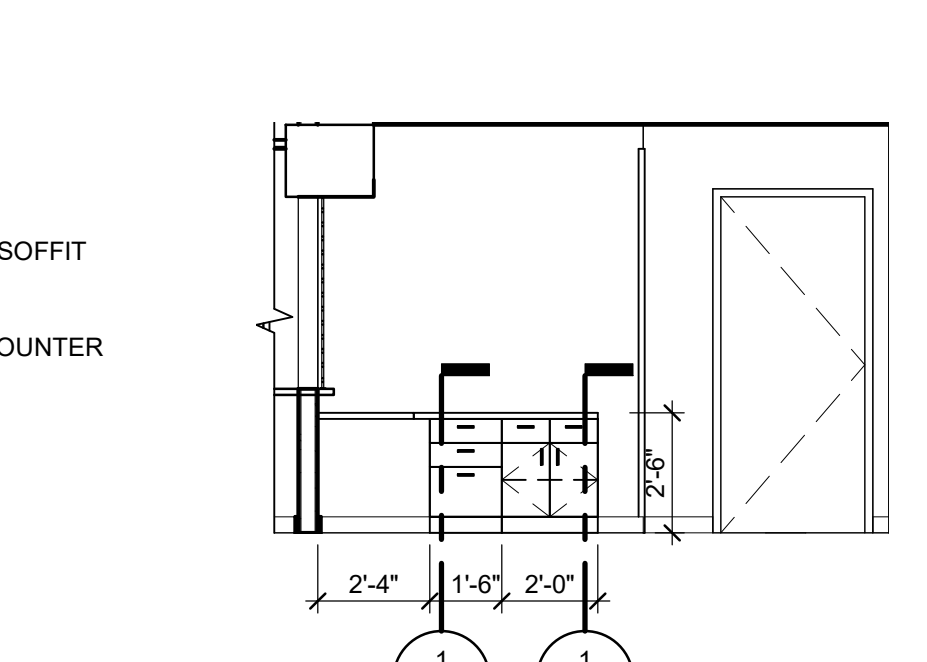
**5 LOBBY 201 NORTH**  
A-401 1/4" = 1'-0"



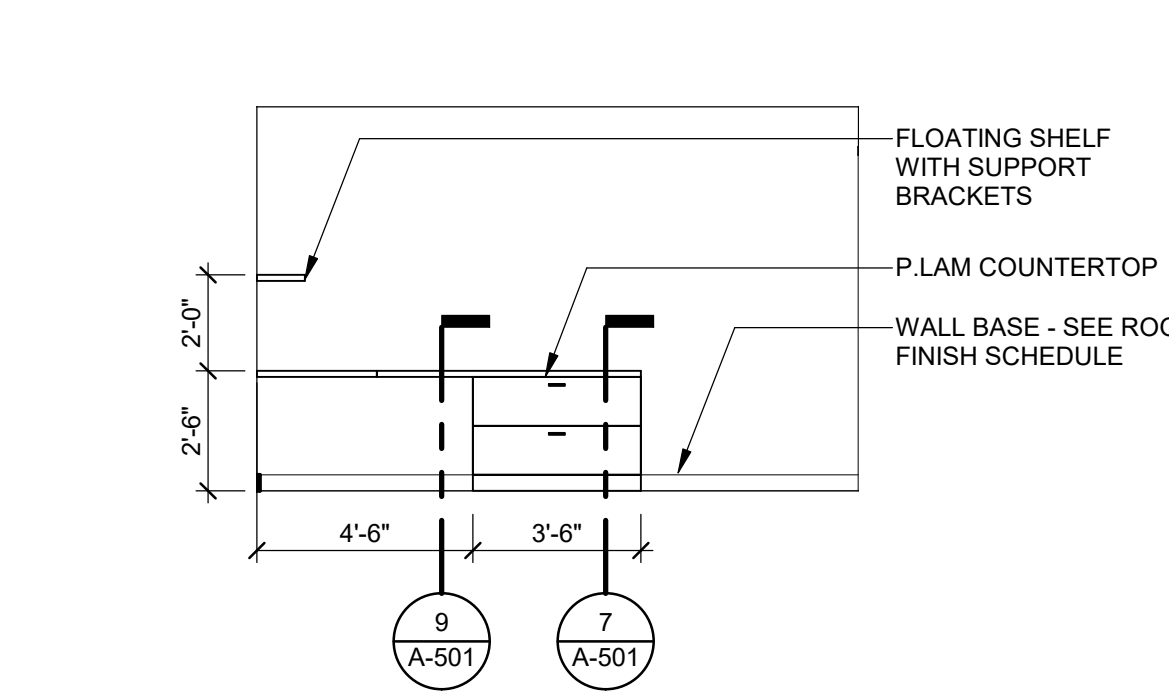
**6 CONFERENCE 212 SOUTH**  
A-401 1/4" = 1'-0"



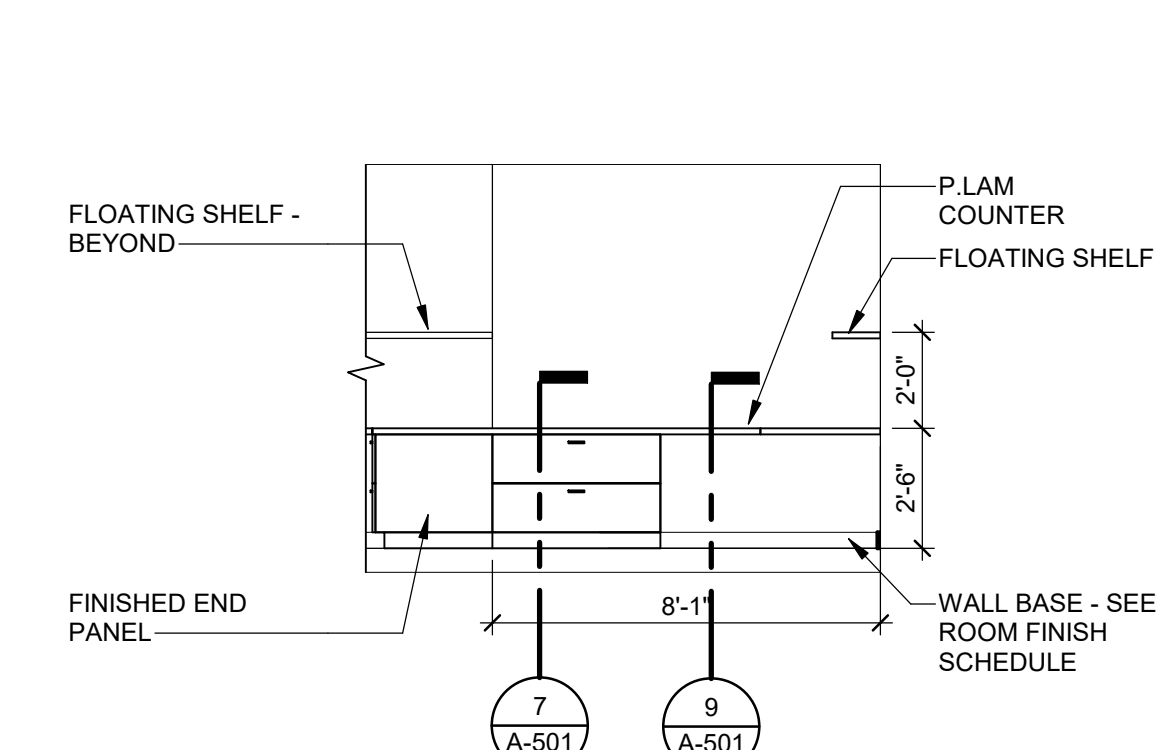
**3 RECEPTION 211 SOUTH**  
A-401 1/4" = 1'-0"



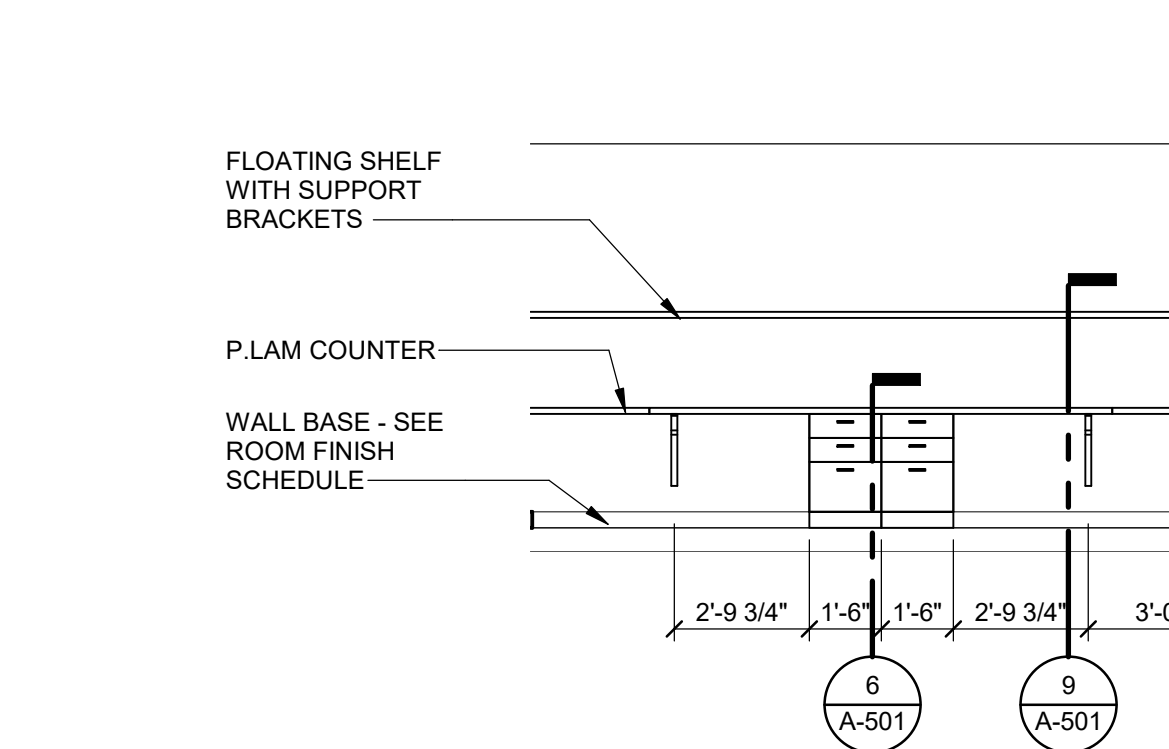
**2 RECEPTION 211 WEST**  
A-401 1/4" = 1'-0"



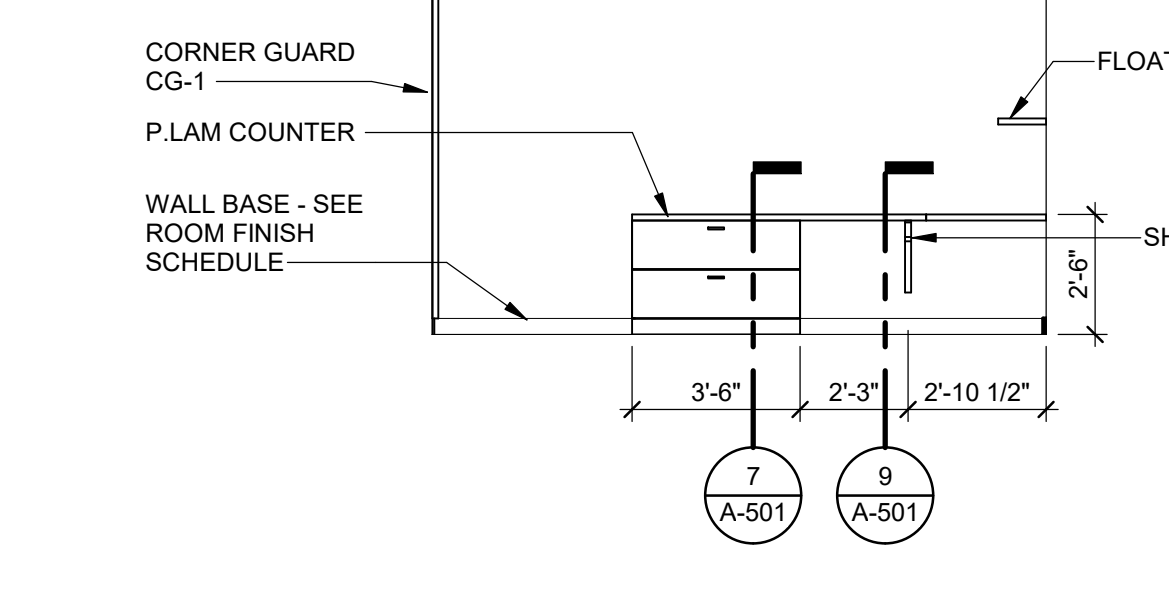
**22 FIRE INSPECTOR 218 EAST**  
A-401 1/4" = 1'-0"



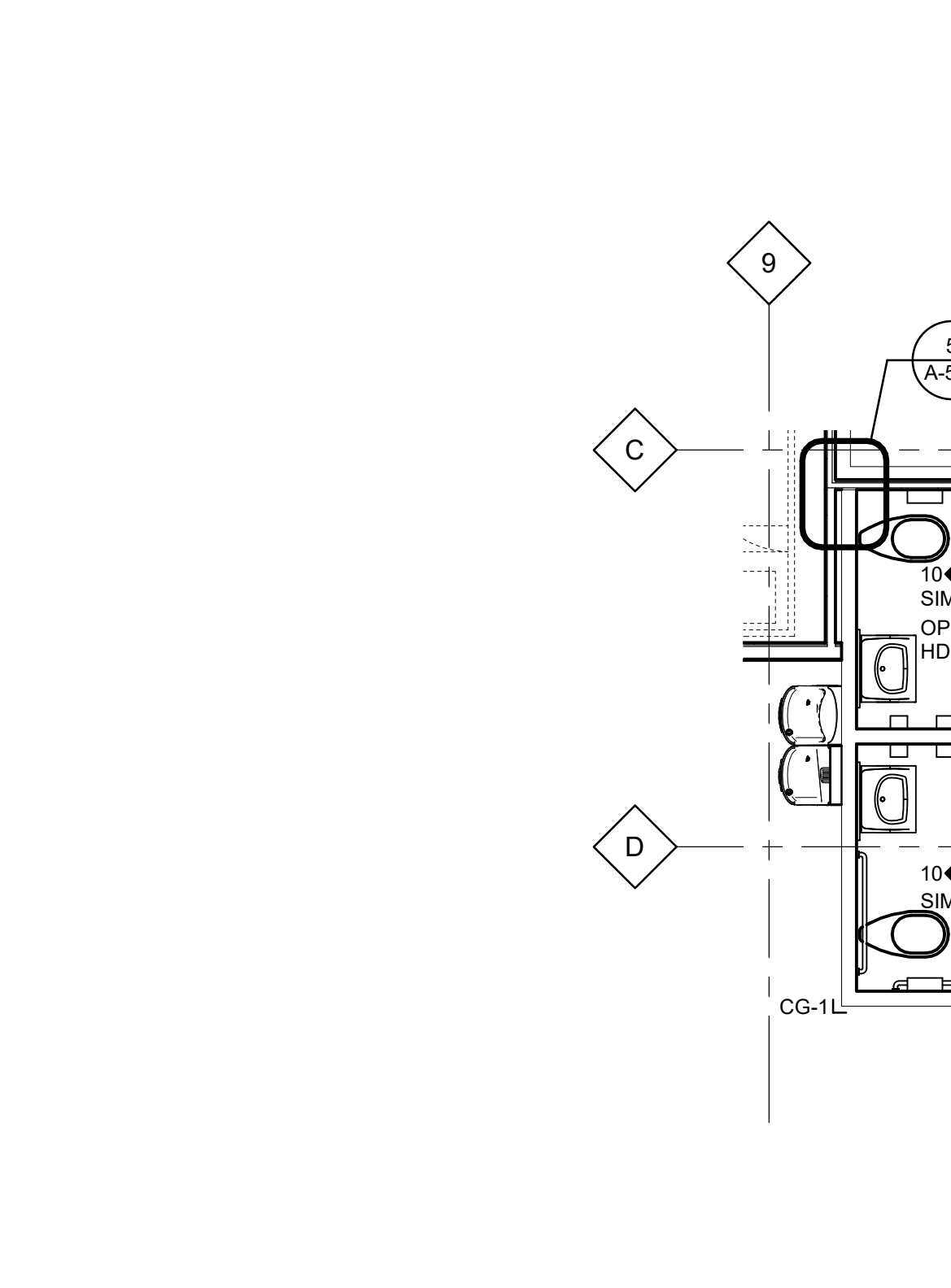
**18 FIRE INSPECTOR 218 WEST**  
A-401 1/4" = 1'-0"



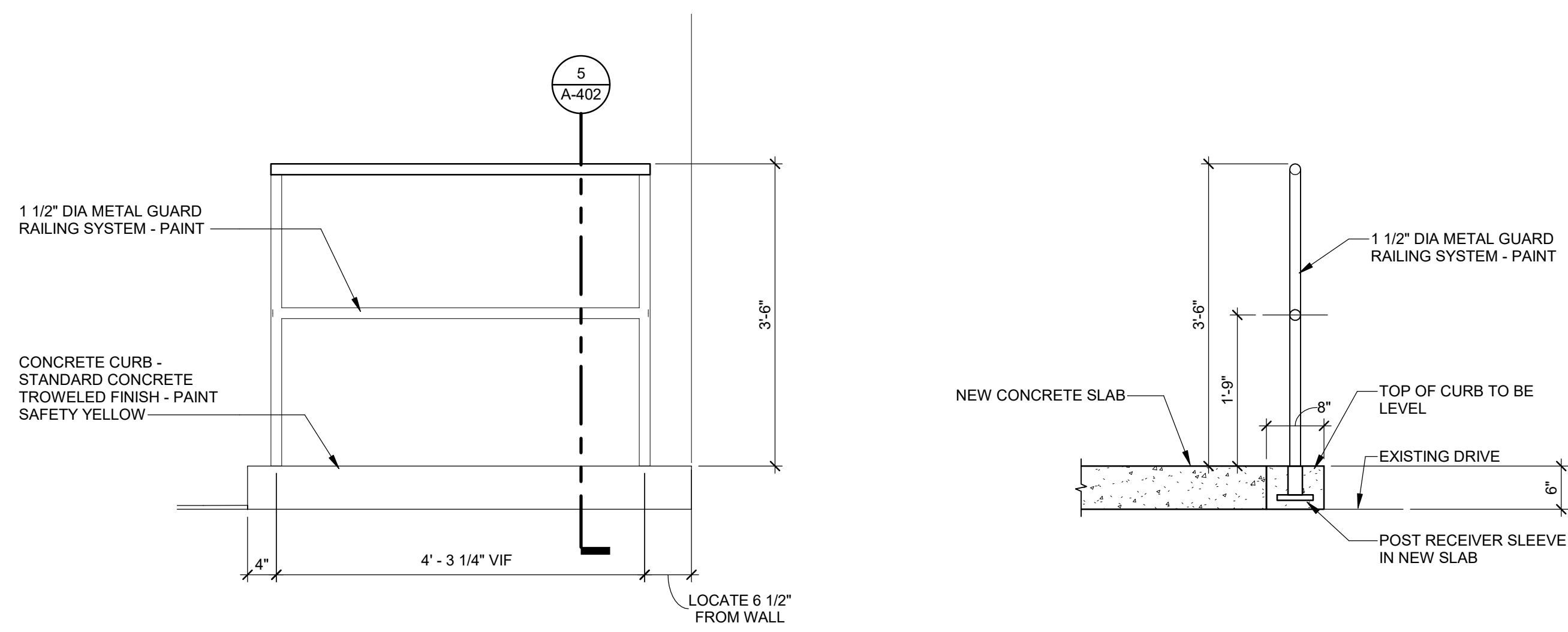
**13 FIRE INSPECTOR 218 WEST**  
A-401 1/4" = 1'-0"



**12 FIRE INSPECTOR 218 SOUTH**  
A-401 1/4" = 1'-0"

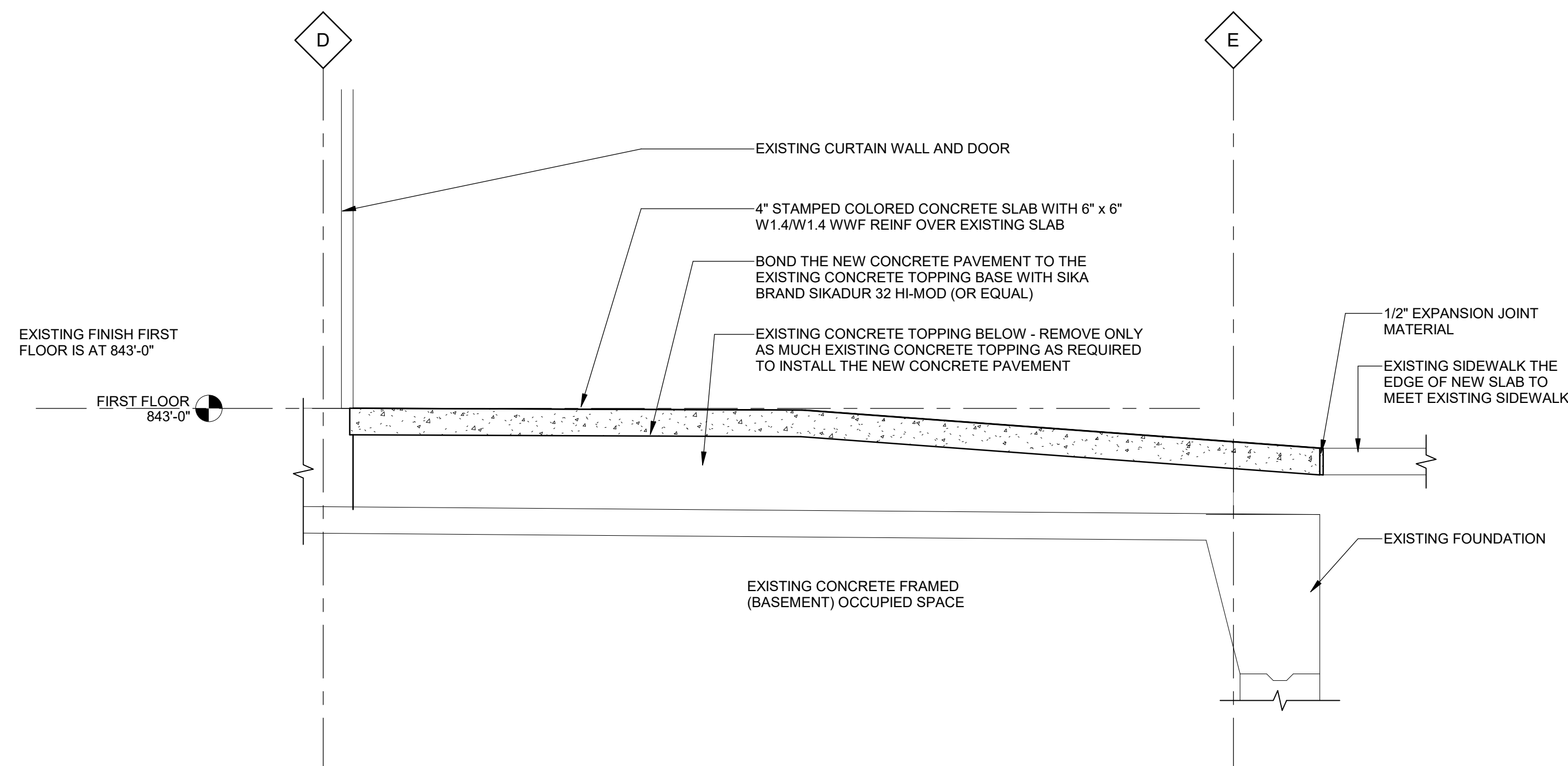


**4 ENLARGED PLANS - TOILET**  
A-101 1/4" = 1'-0"

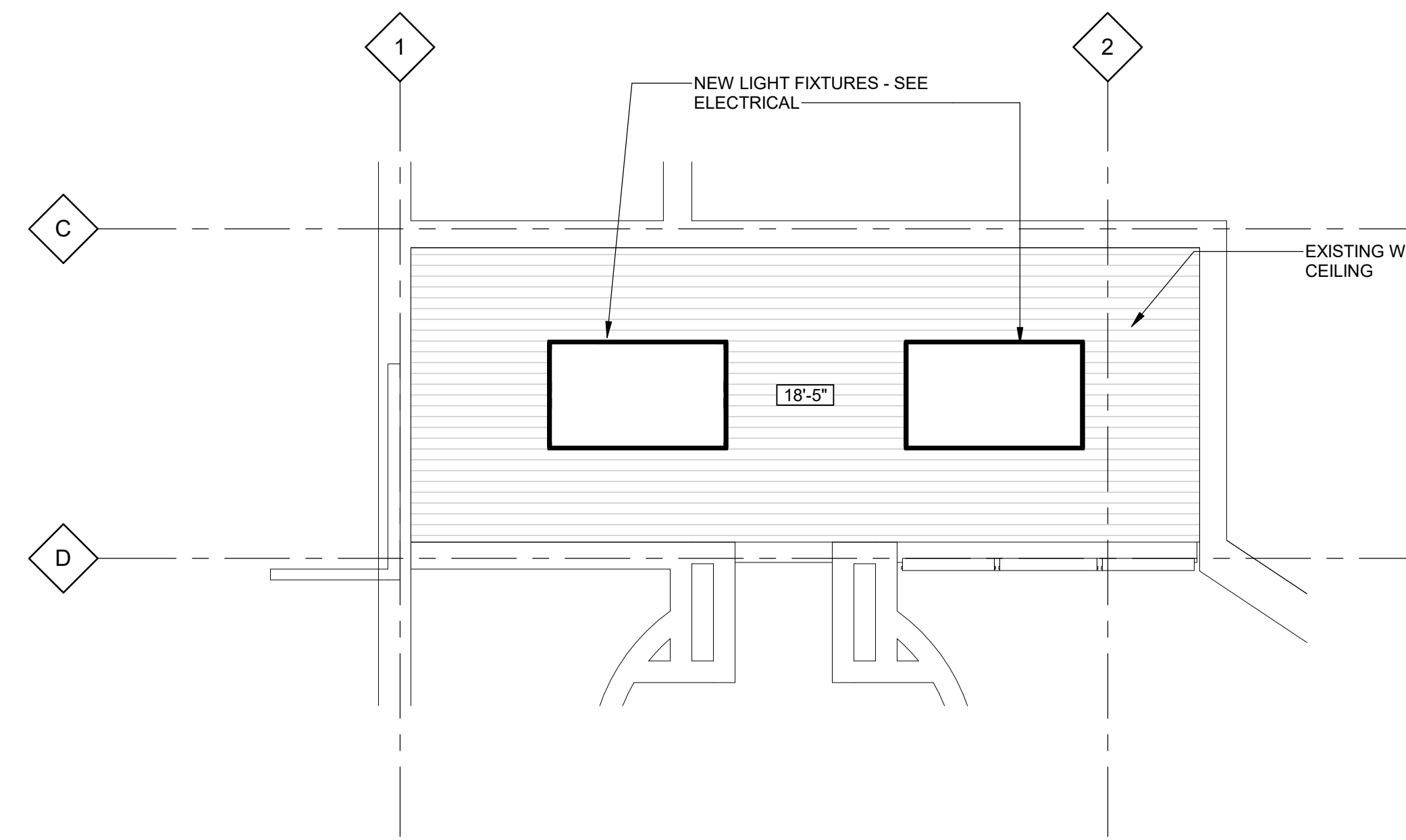


**6 EXTERIOR GUADRAIL**  
A-402 3/4" = 1'-0"

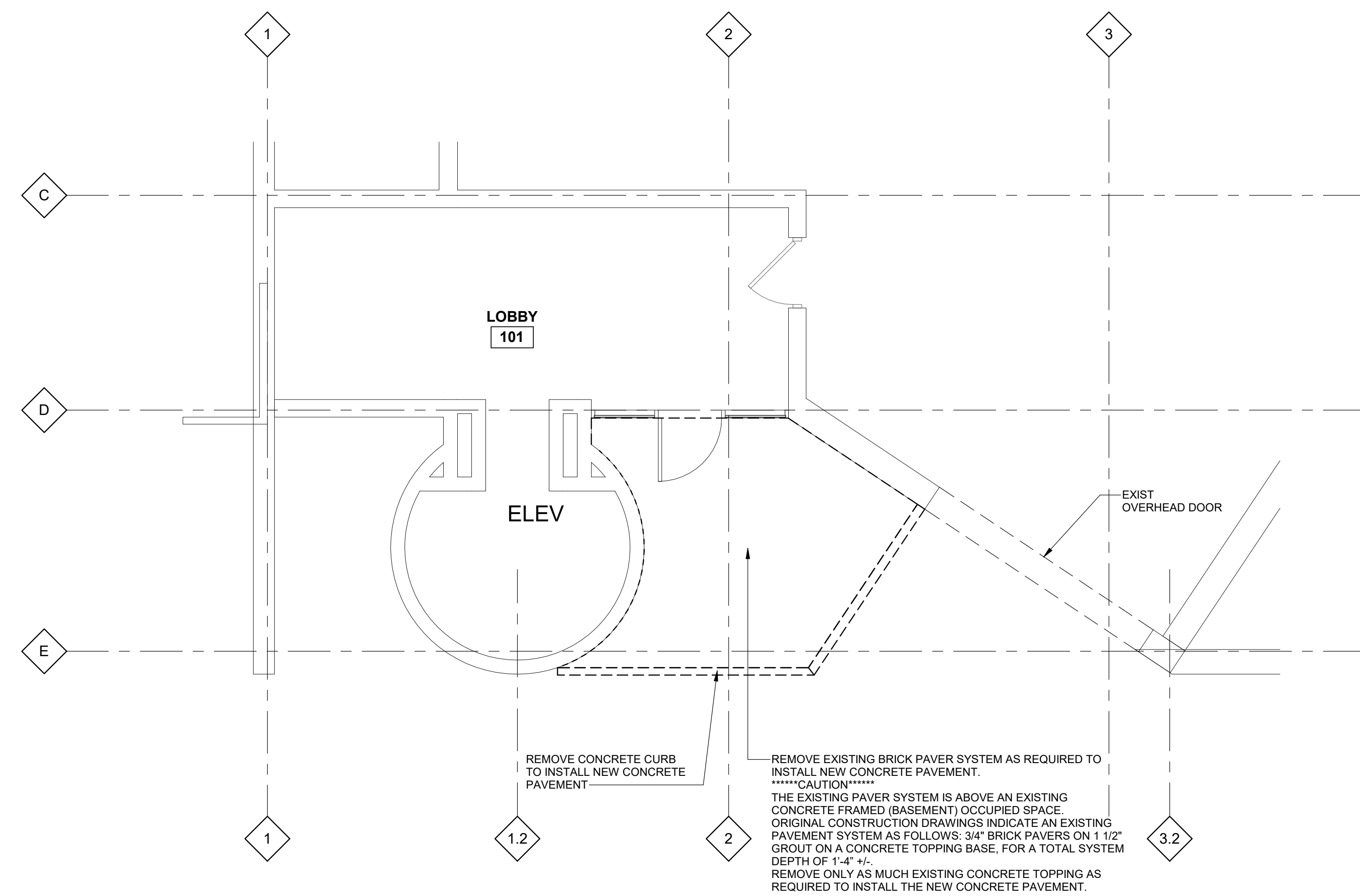
**5 EXTERIOR GUARDRAIL**  
A-402 3/4" = 1'-0"



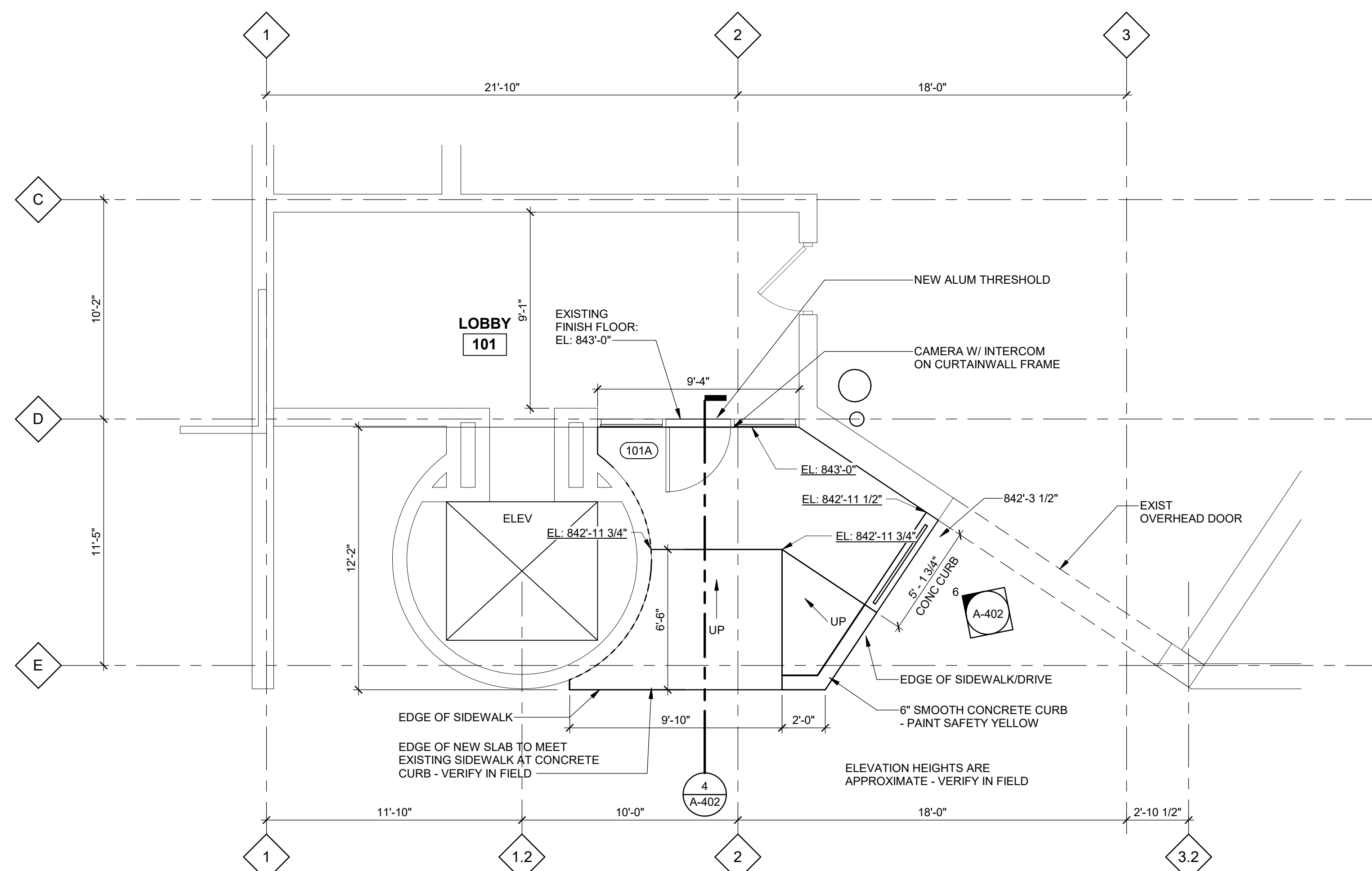
**4 SECTION AT RAMP**  
A-402 3/4" = 1'-0"



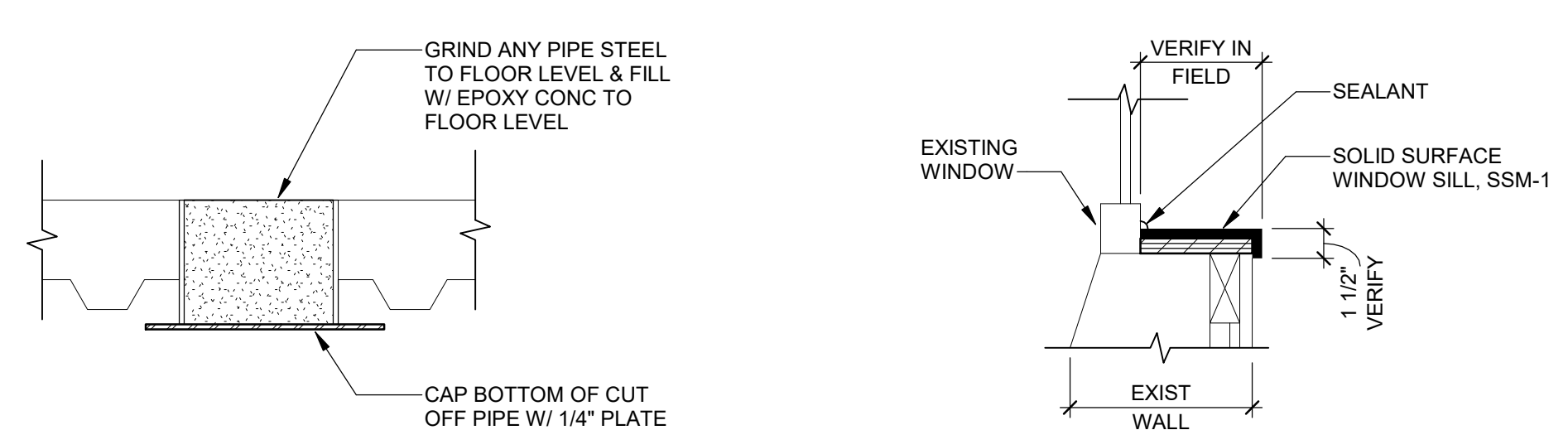
**3 FIRST FLOOR CEILING PLAN**  
A-402 1/4" = 1'-0"



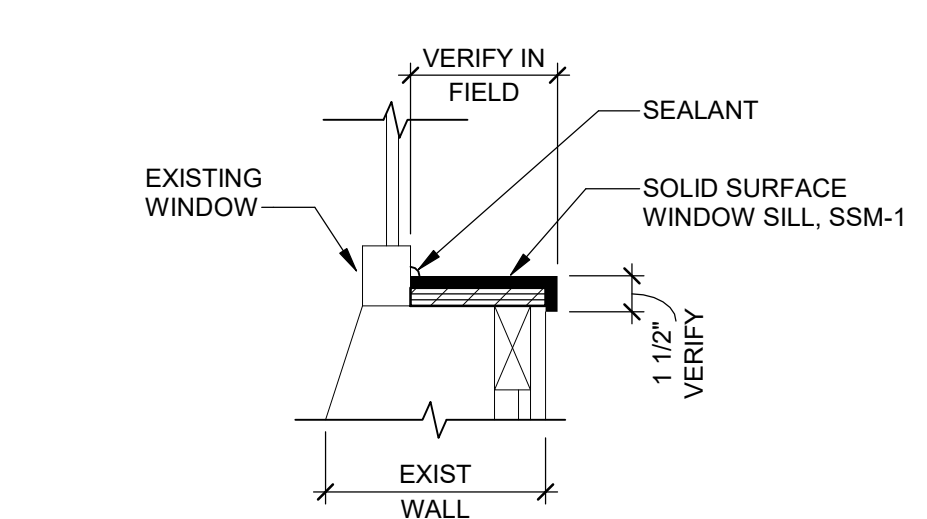
**2 DEMOLITION PLAN - LOBBY ENTRANCE**  
A-402 1/4" = 1'-0"



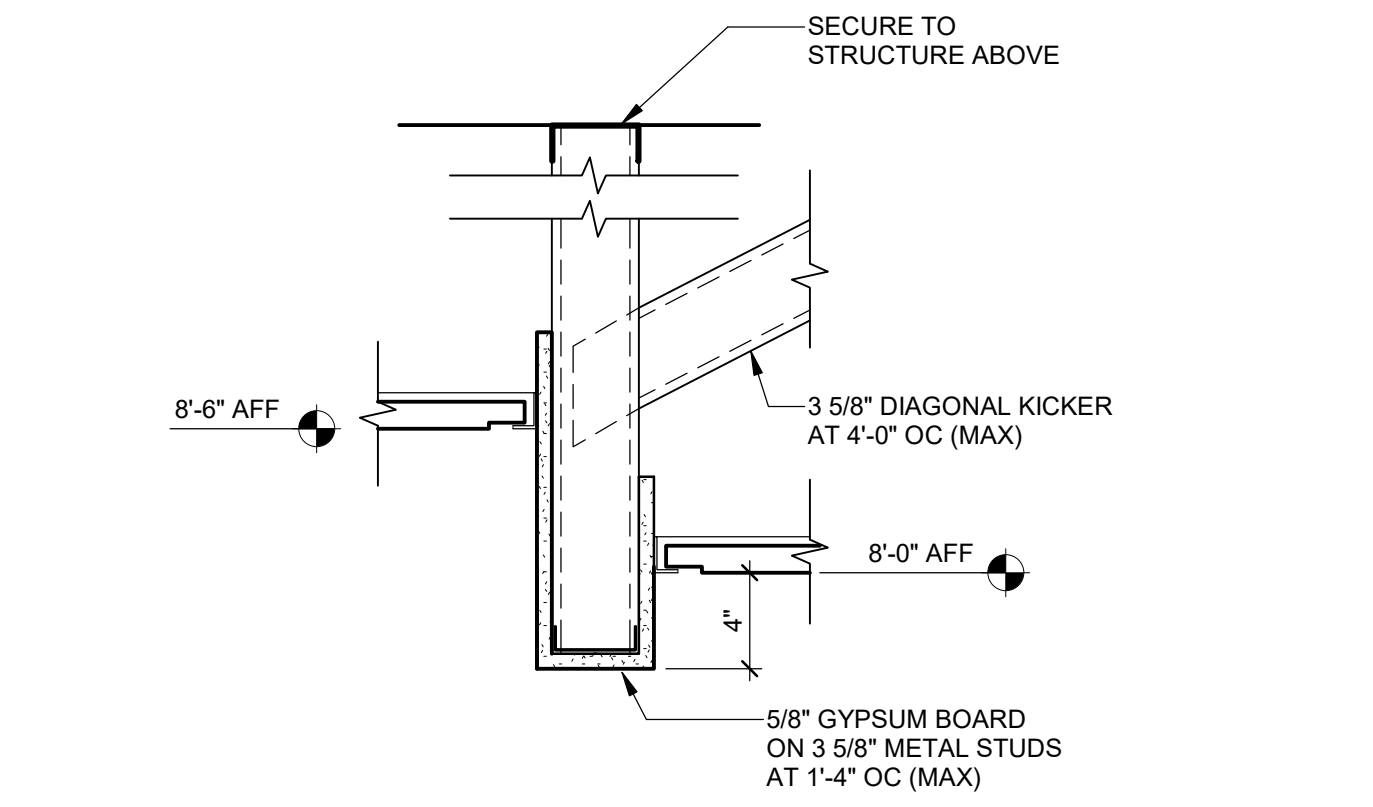
**1 FLOOR PLAN - LOBBY ENTRANCE**  
A-402 1/4" = 1'-0"



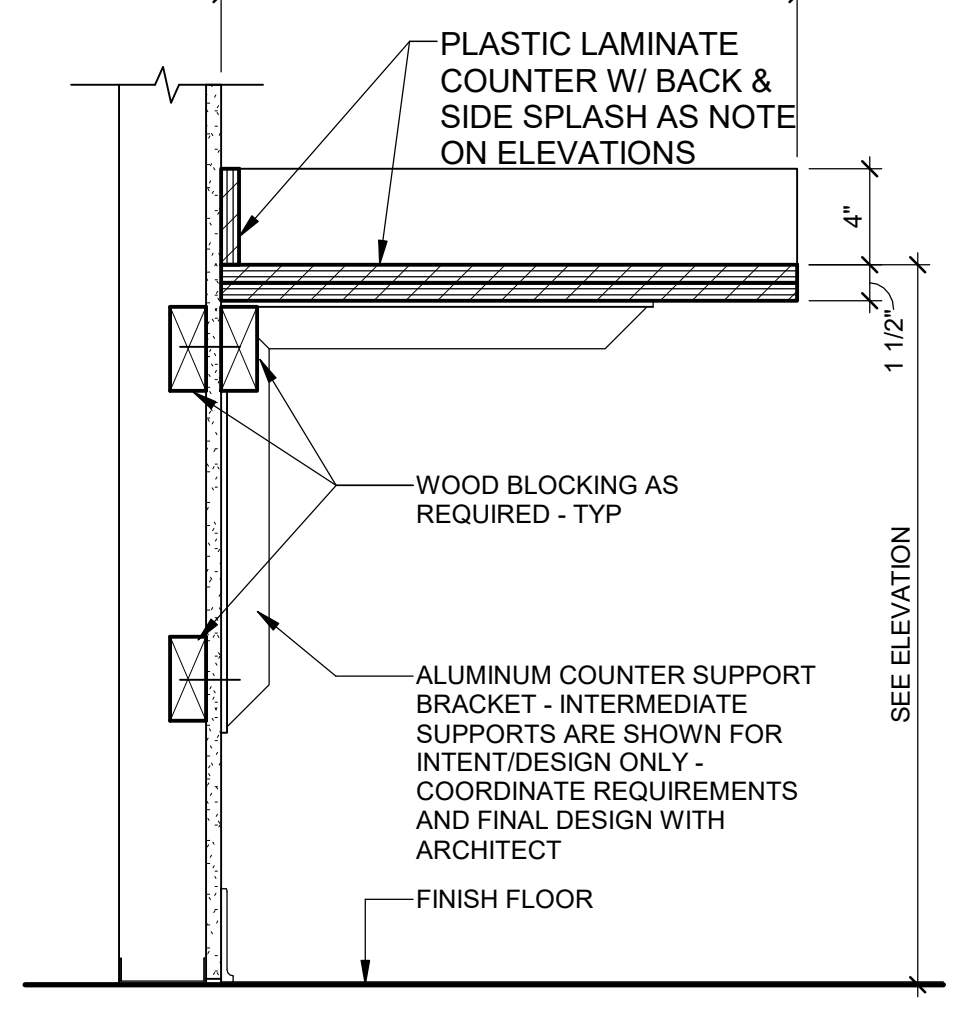
13 FLOOR INFILL  
A-401 1 1/2" = 1'-0"



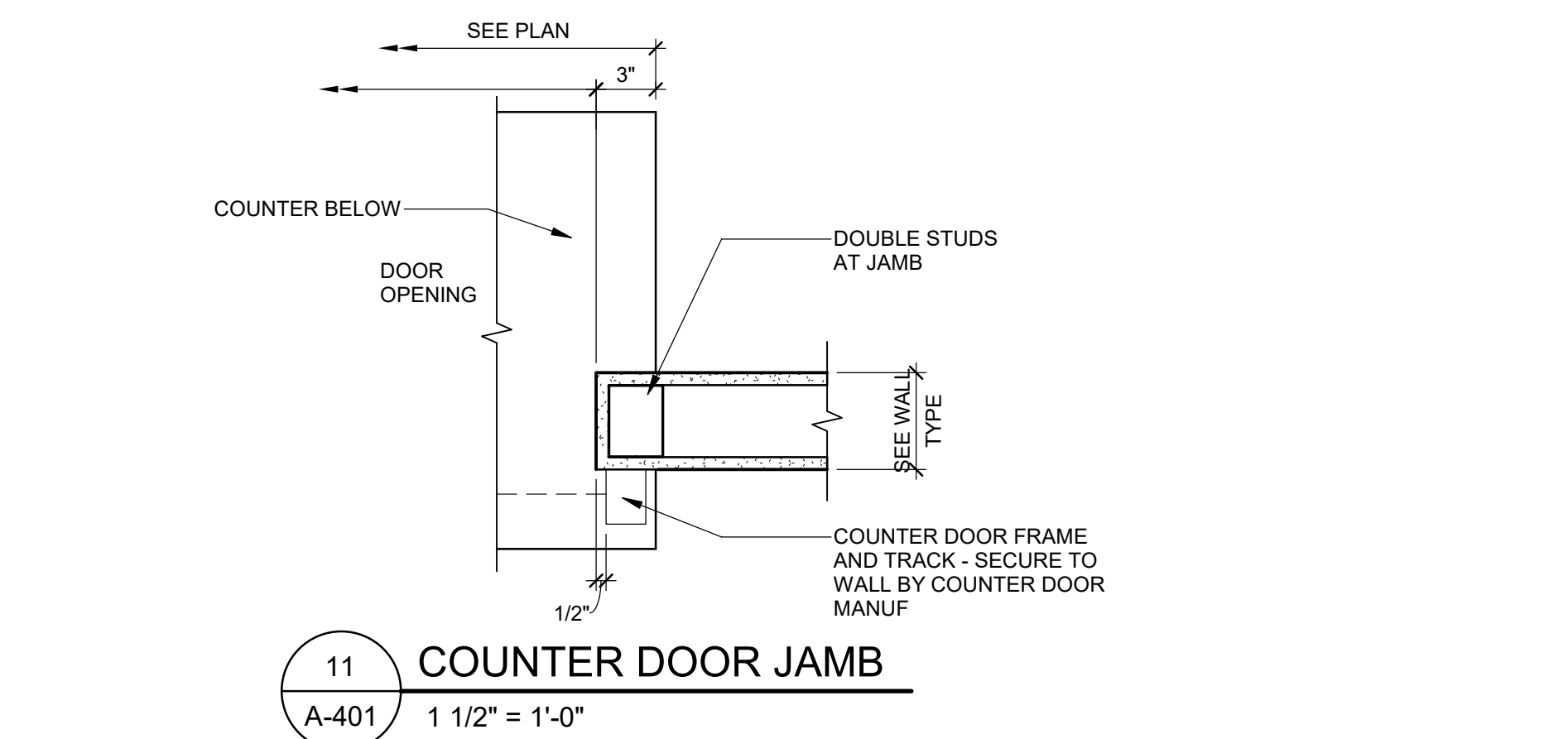
12 WINDOW SILL  
A-401 1 1/2" = 1'-0"



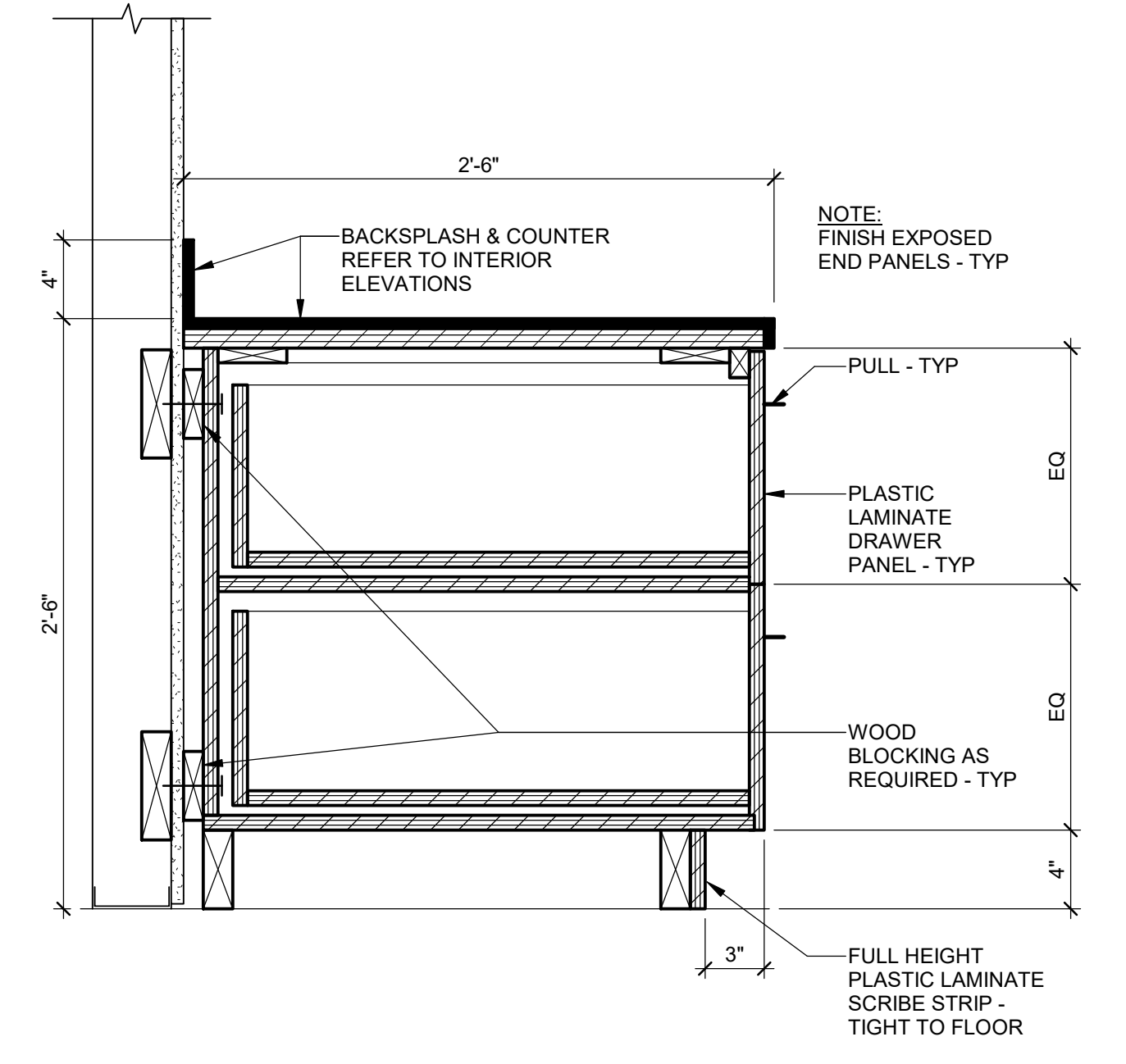
8 SOFFIT DETAIL  
A-111 1 1/2" = 1'-0"



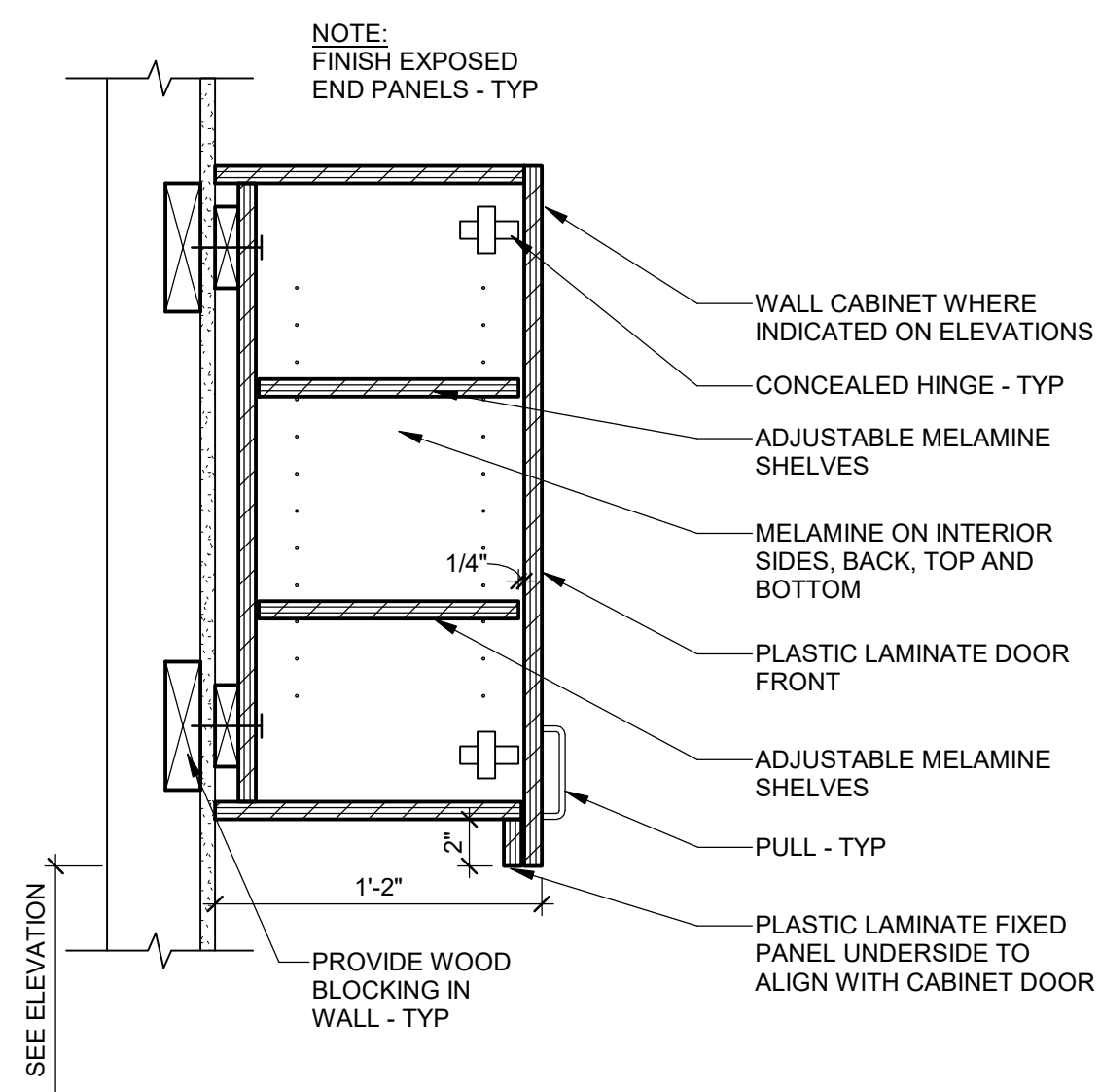
4 COUNTER DETAIL  
1 1/2" = 1'-0"



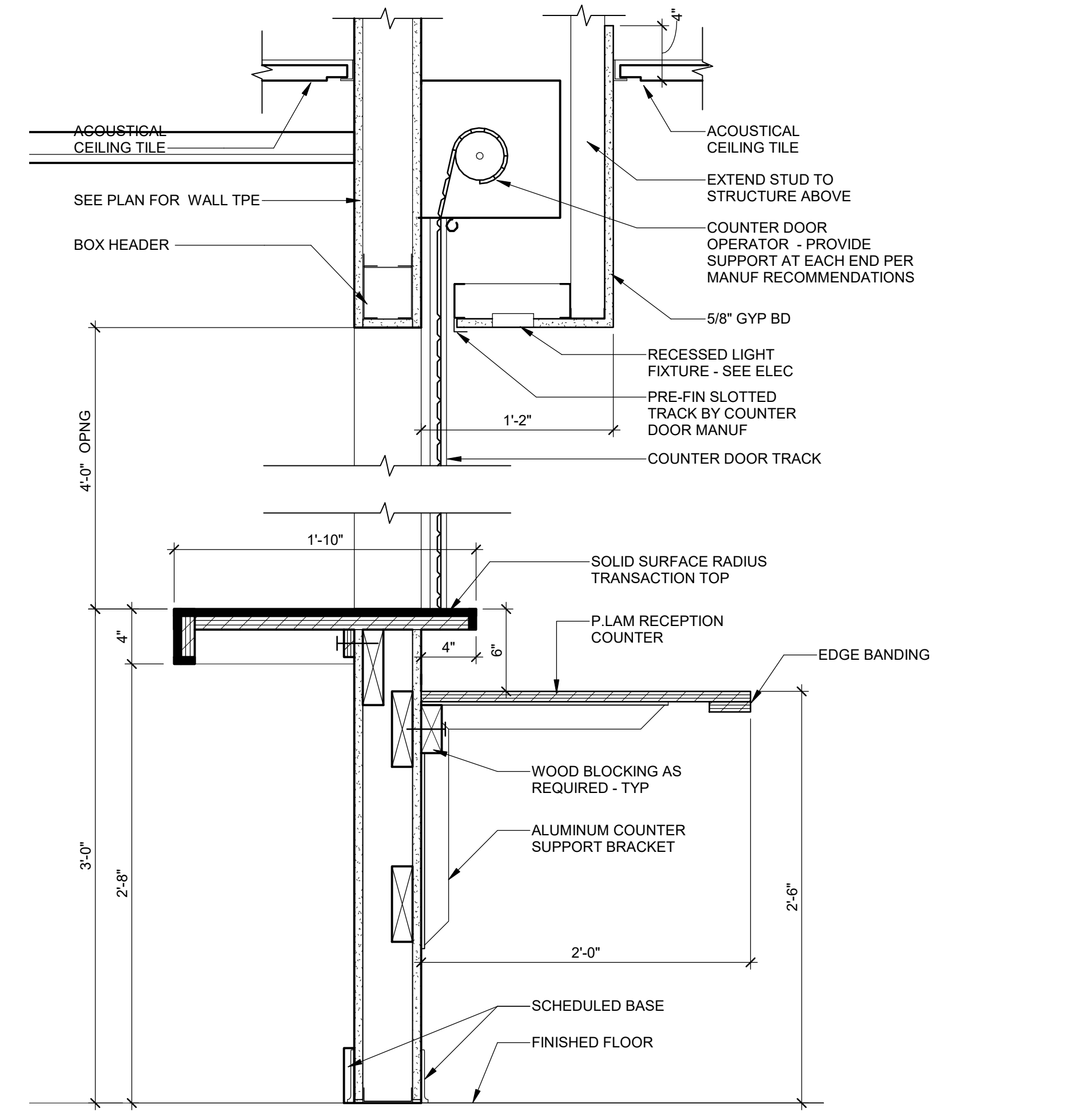
11 COUNTER DOOR JAMB  
A-401 1 1/2" = 1'-0"



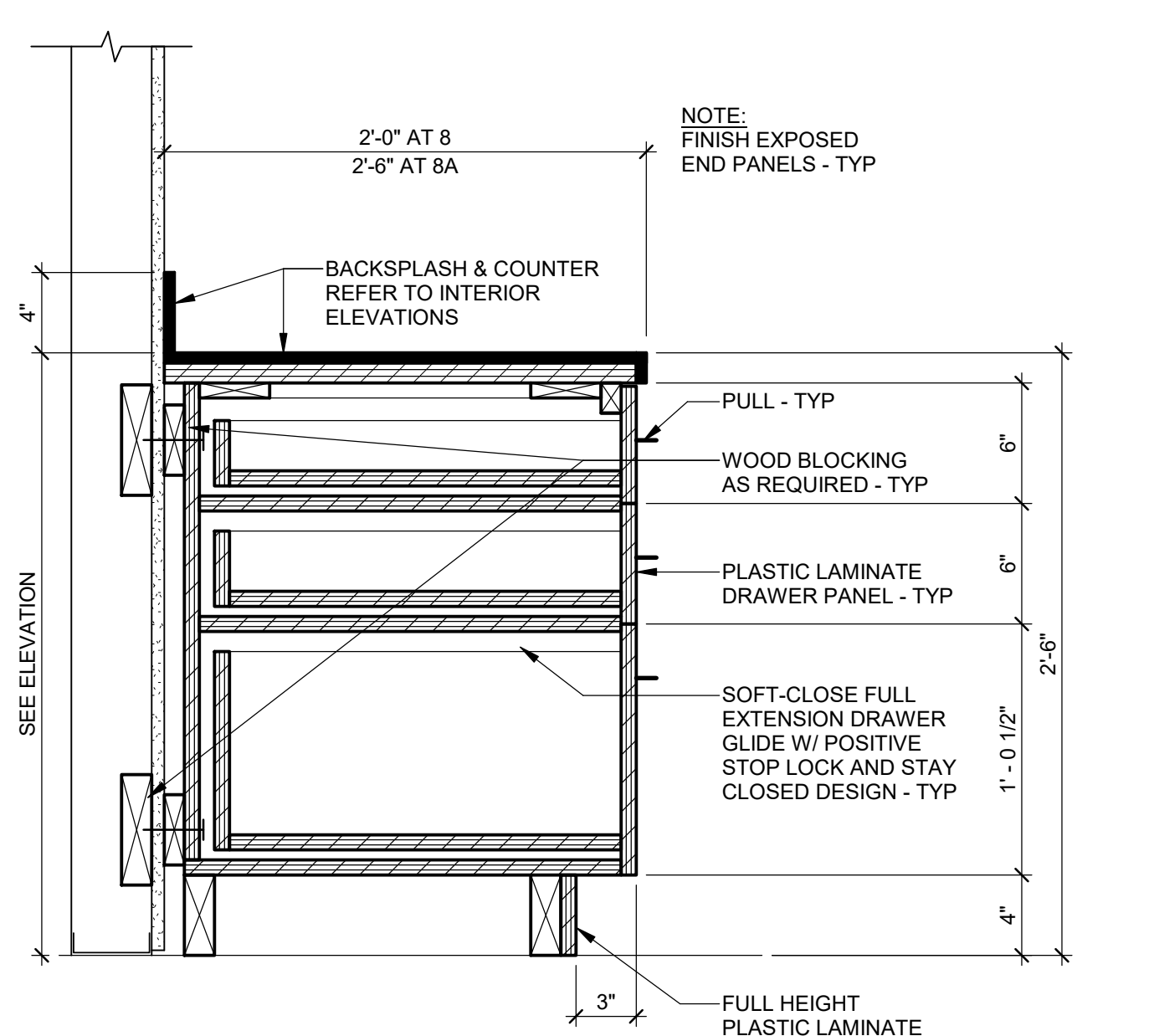
7 BASE CABINET DETAIL  
A-401 1 1/2" = 1'-0"



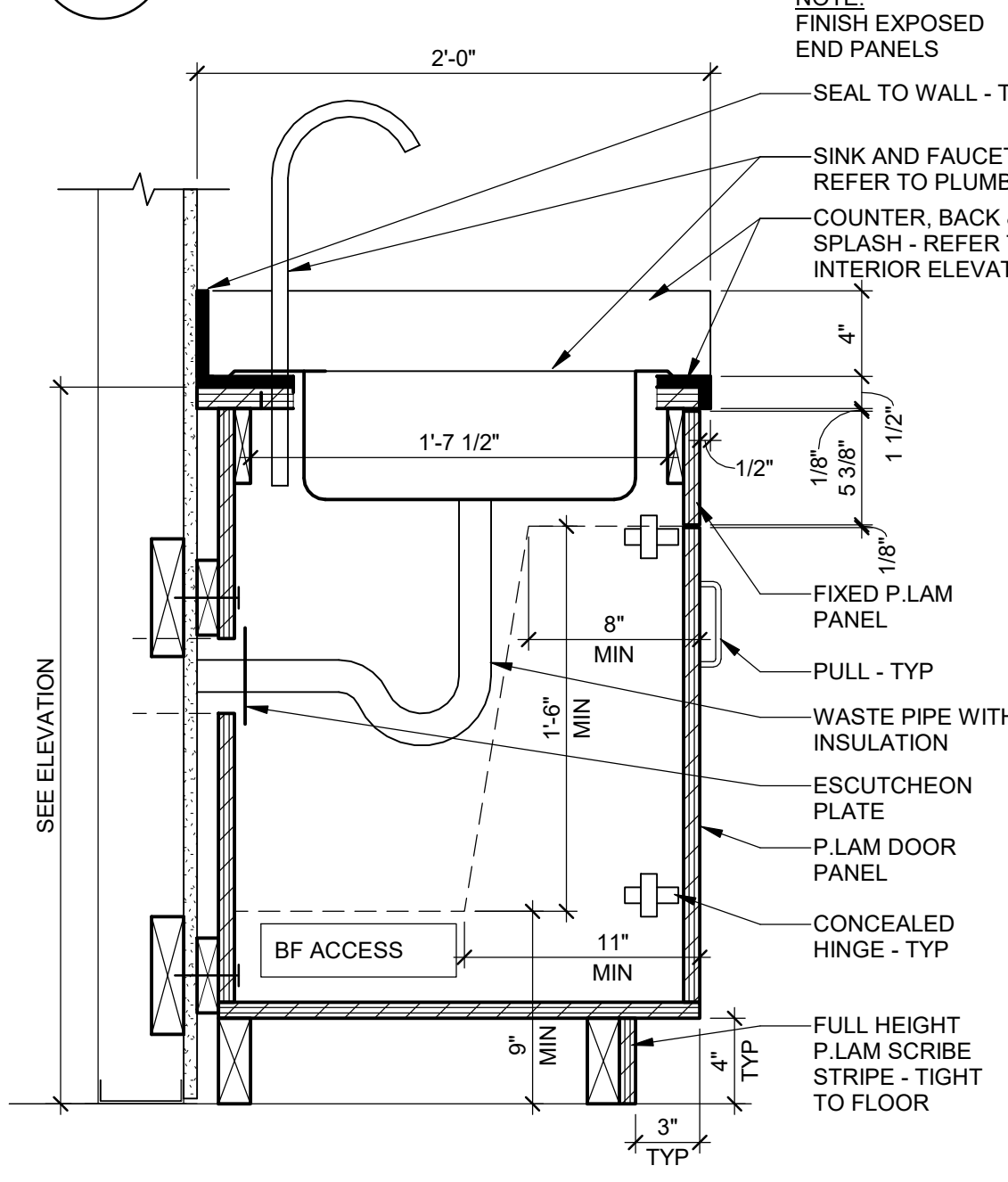
3 UPPER CABINET DETAIL  
A-401 1 1/2" = 1'-0"



10 SHUTTER & TRANSACTION DETAIL  
A-401 1 1/2" = 1'-0"



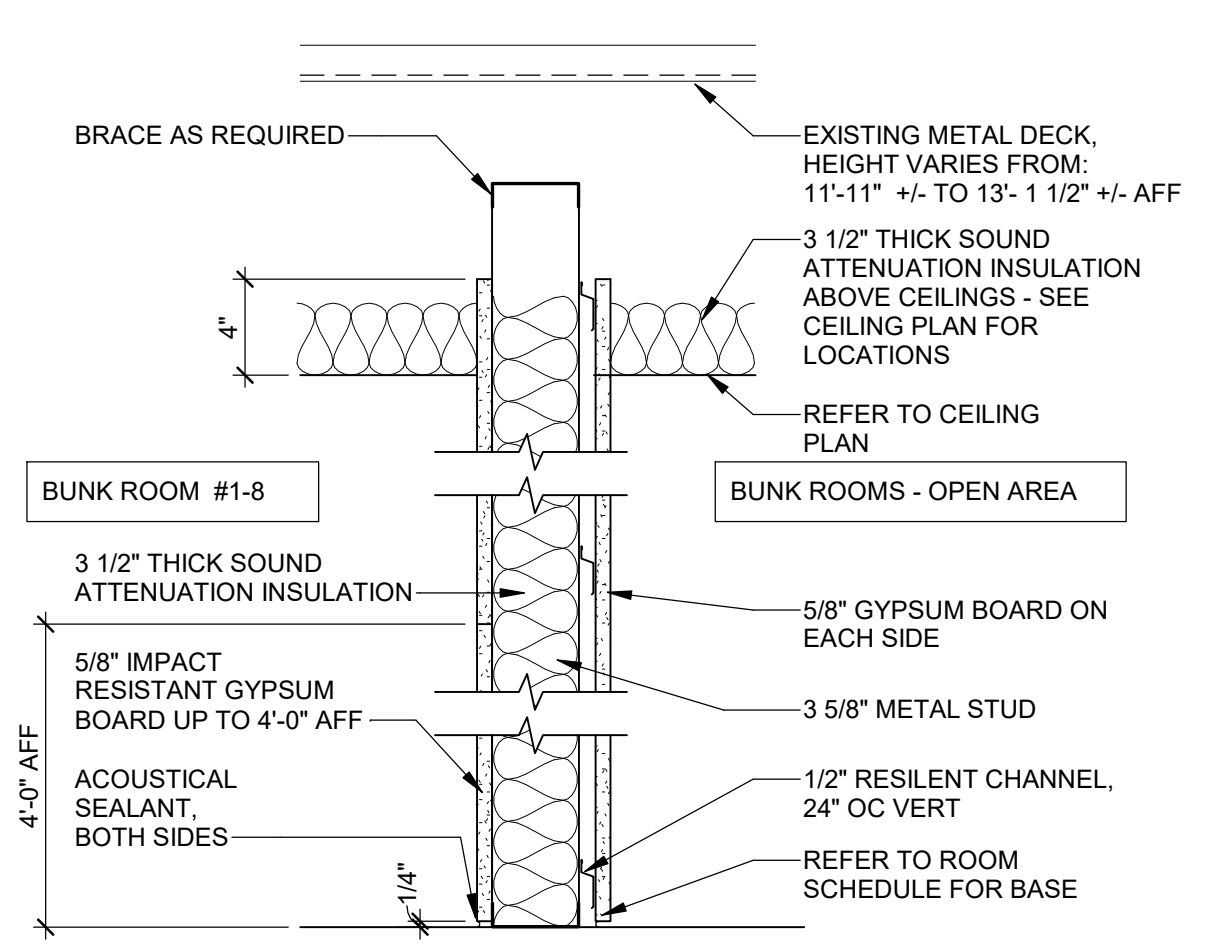
6 BASE CABINET DETAIL  
A-401 1 1/2" = 1'-0"



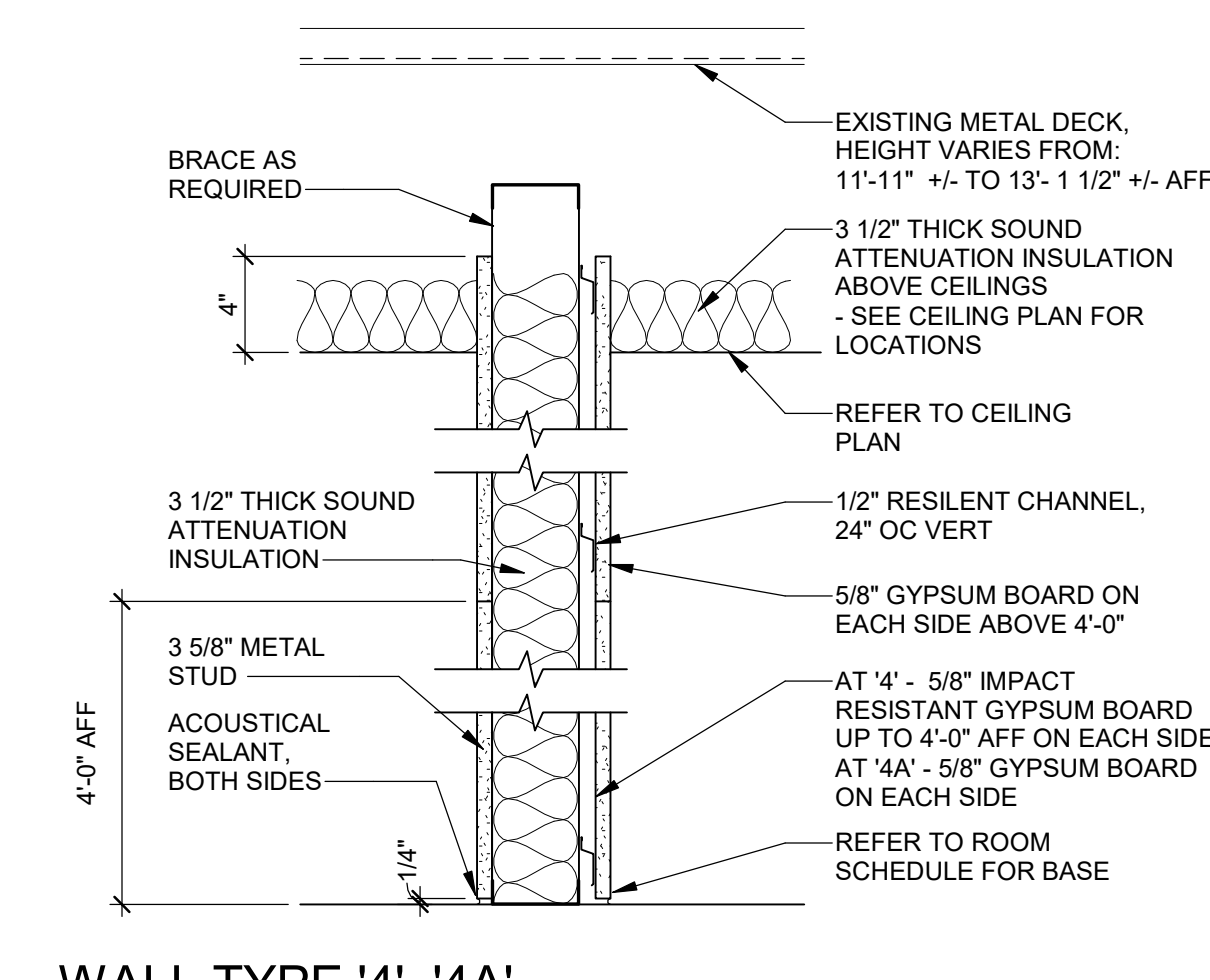
2 BASE CABINET DETAIL  
A-401 1 1/2" = 1'-0"

MILLWORK NOTES

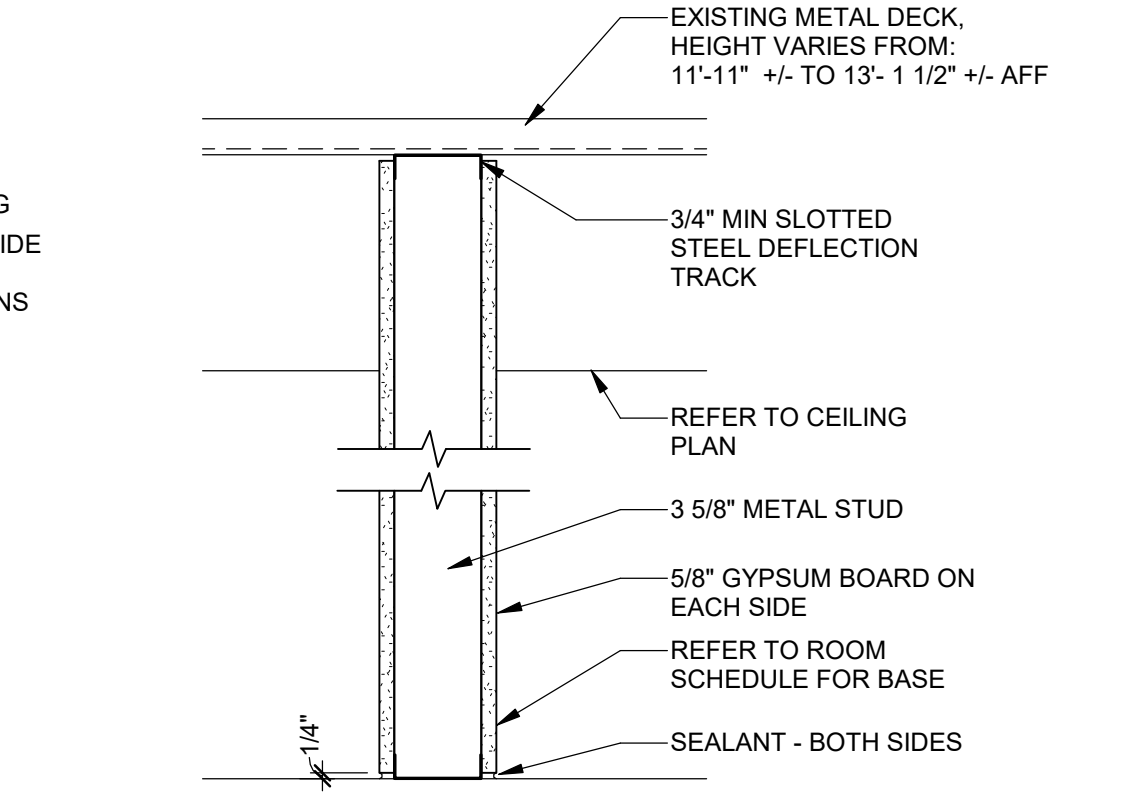
- PROVIDE FILLER STRIPS AS REQUIRED
- ALL EXPOSED ENDS AND BACKS OF CASEWORK SHALL BE FINISHED
- CABINET INSTALLER SHALL CUT CABINETS AS REQUIRED FOR PLUMBING/ELECTRICAL SERVICES AND CABINET INSTALLED EQUIPMENT
- CABINET CONTRACTOR SHALL CAULK BETWEEN COUNTERS, BACKSPLASHES AND WALLS. CAULK TO MATCH ADJACENT SURFACE COLOR. COORDINATE FINAL COLOR SELECTION WITH OWNER AND ARCHITECT
- WHERE CABINETS ARE PLACED FROM WALL TO WALL, VERIFY EXACT SIZE OF CABINET IN THE FIELD AND PROVIDE CABINET FILLERS AS REQUIRED TO CLOSE OFF ALL SIDES AND TOP
- ALL COUNTERTOPS TO BE 24" DEEP UNLESS OTHERWISE NOTED
- WALL CABINETS TO BE 14" DEEP UNLESS OTHERWISE NOTED
- SCRIBE TOE KICK TIGHT TO FLOOR, TOE KICK TO FIT TIGHT TO UNDERSIDE OF CABINET
- SCRIBE BACKSPLASH AND SIDESPLASH TO BE FLUSH WITH THE WALL
- WHERE FINISHED END PANELS ARE REQUIRED, EXTEND AND SCRIBE PANEL TIGHT TO FLOOR TO CONCEAL VARIATIONS IN FLOOR CONSTRUCTION - DO NOT INSTALL BASE
- ALL TOE KICK TO BE PLASTIC LAMINATE. DO NOT APPLY RUBBER BASE ON MILLWORK
- DARK LAMINATE FACE USE BLACK MELAMINE IN THE INTERIOR. LIGHT LAMINATE FACE USE WHITE MELAMINE ON THE INTERIOR.
- CABINET DOOR PULLS: DOUG MOCKETT DP123-SSS SATIN STAINLESS STEEL FINISH
- DRAWER SLIDES ARE TO BE HEAVY DUTY, FULL EXTENSION SLIDE WITH SOFT CLOSE
- CONCEALED CABINET HINGE WITH SOFT SELF CLOSE
- PROVIDE 3MM EDGE BANDING
- CONTRACTOR SHALL BE RESPONSIBLE FOR ALL REQUIRED BLOCKING FOR SUPPORT OF WALL MOUNTED CABINETRY, SHELVING, EQUIPMENT, AND BRACKETS AS REQUIRED
- PROVIDE CAULKING AT MILLWORK TO MATCH ADJACENT SURFACE - VERIFY COLOR WITH ARCHITECT



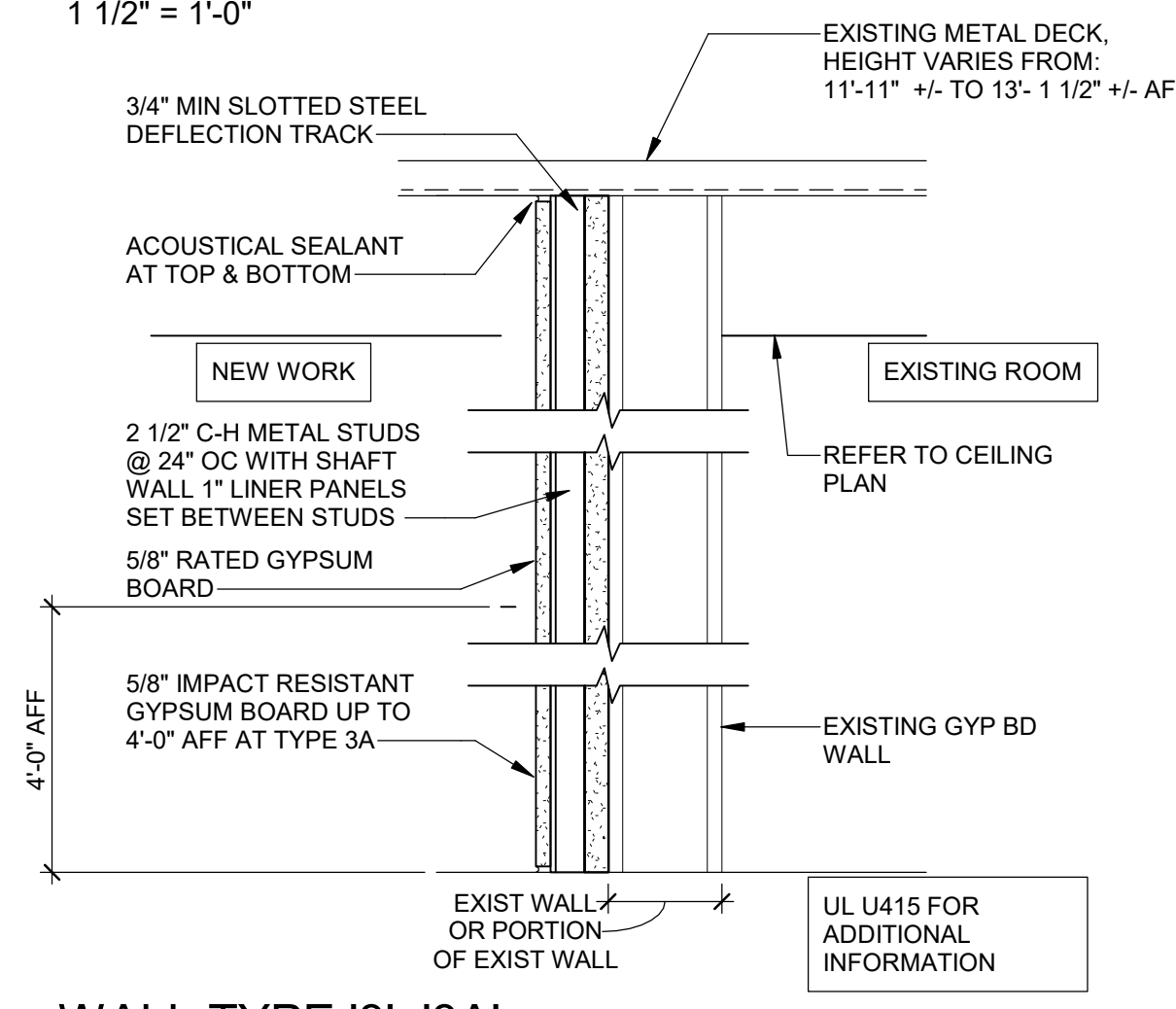
WALL TYPE '5'  
1 1/2" = 1'-0"



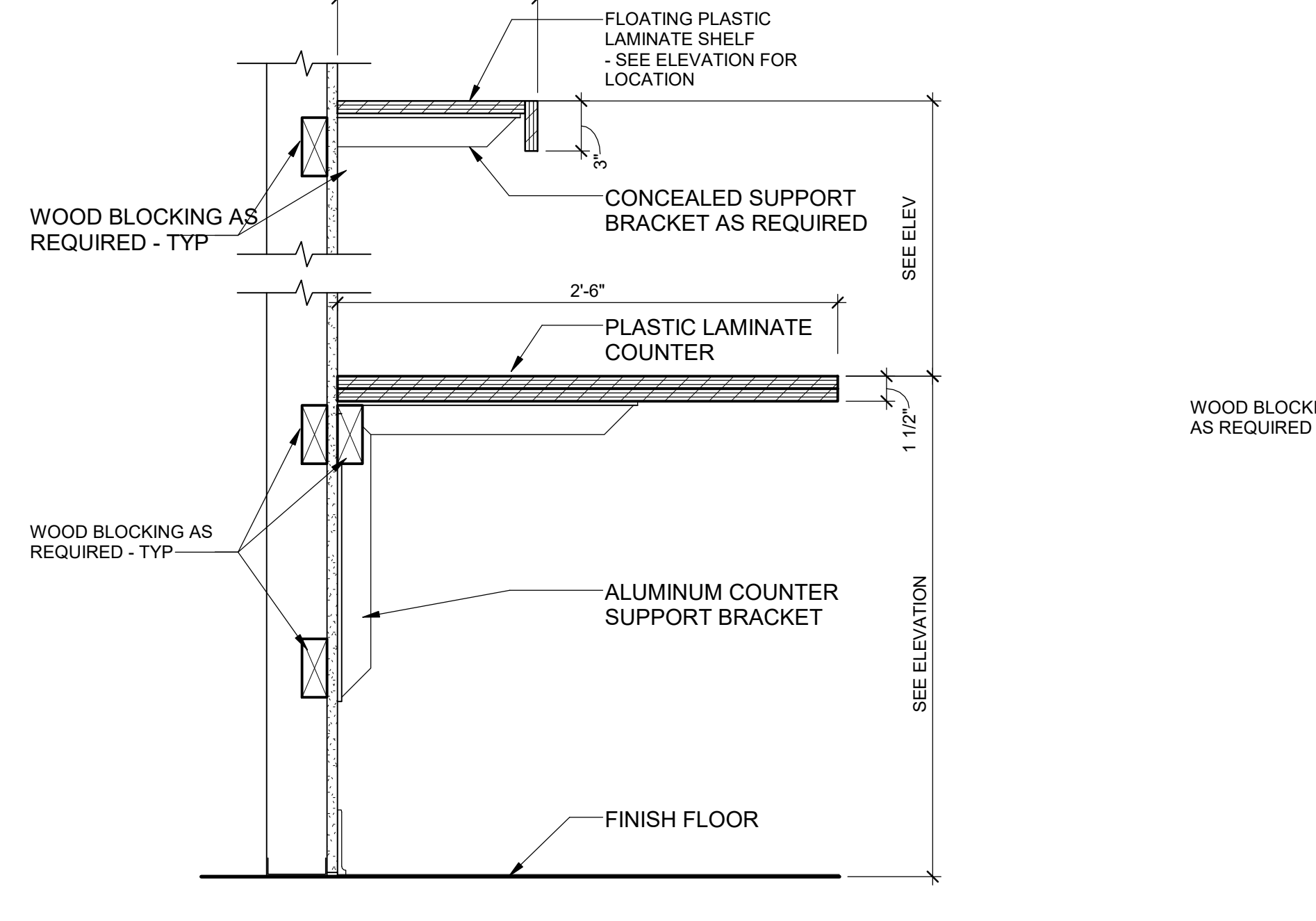
WALL TYPE '4', '4A'  
1 1/2" = 1'-0"



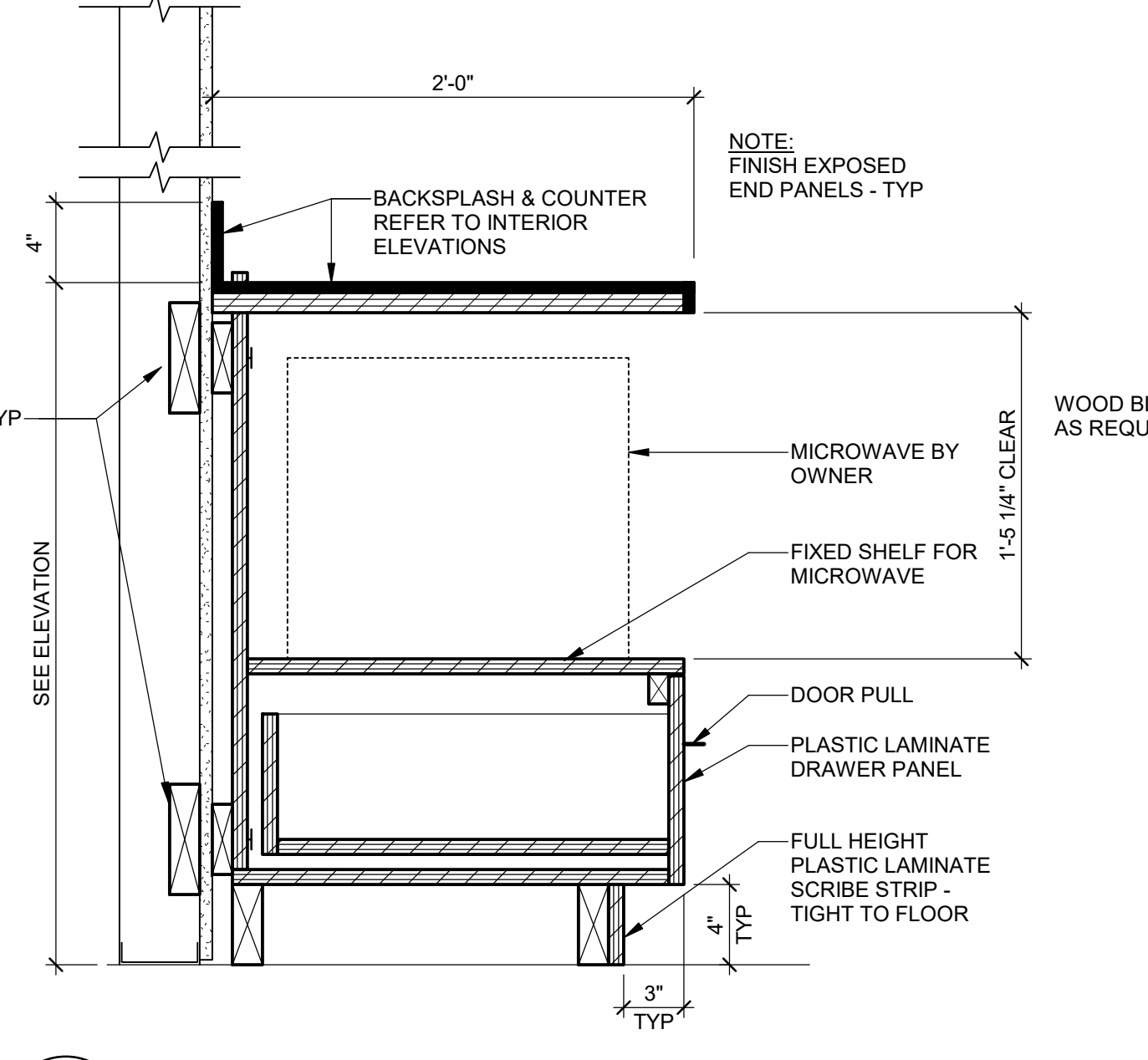
WALL TYPE '8'  
1 1/2" = 1'-0"



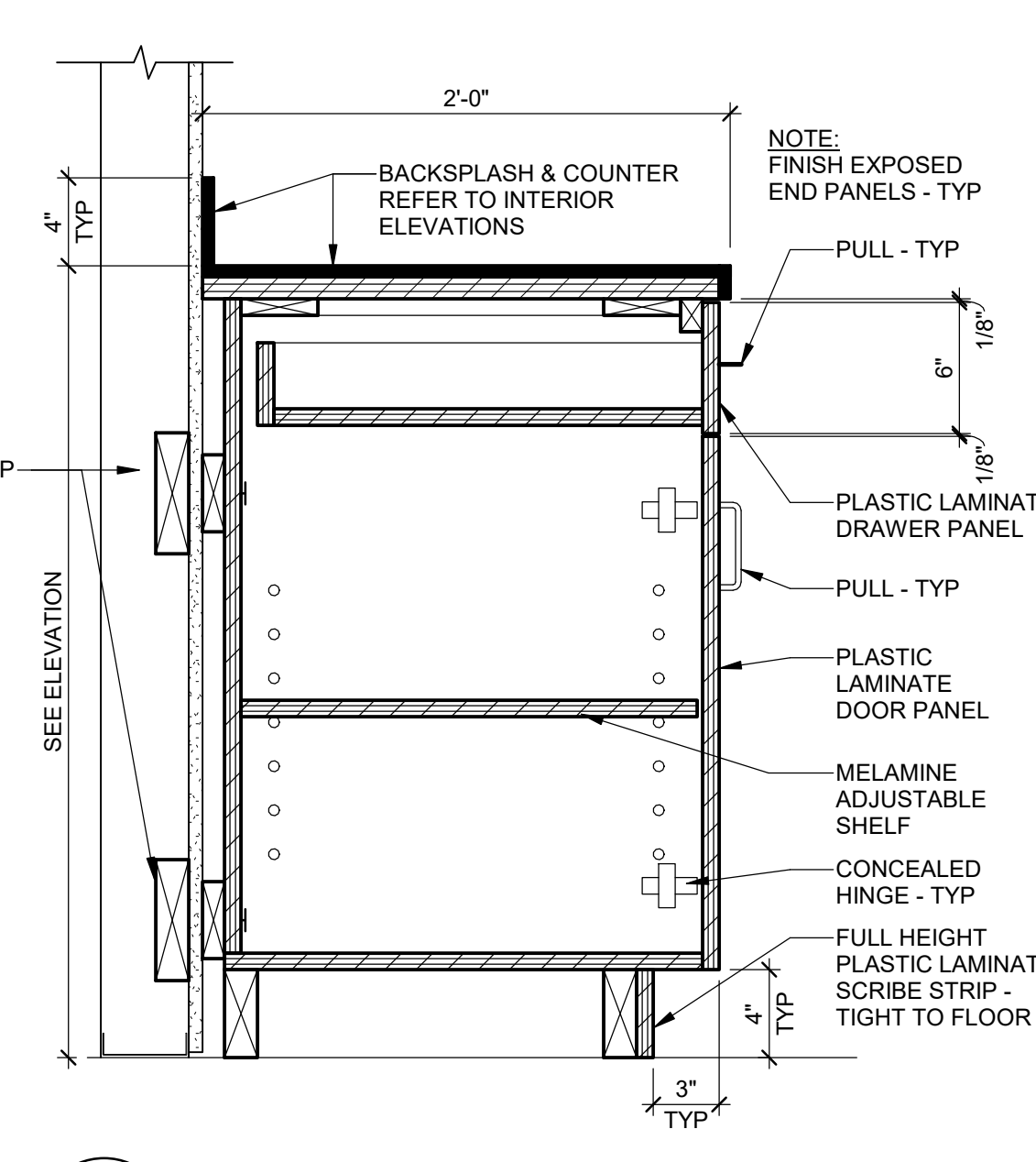
WALL TYPE '3', '3A'  
1 1/2" = 1'-0"



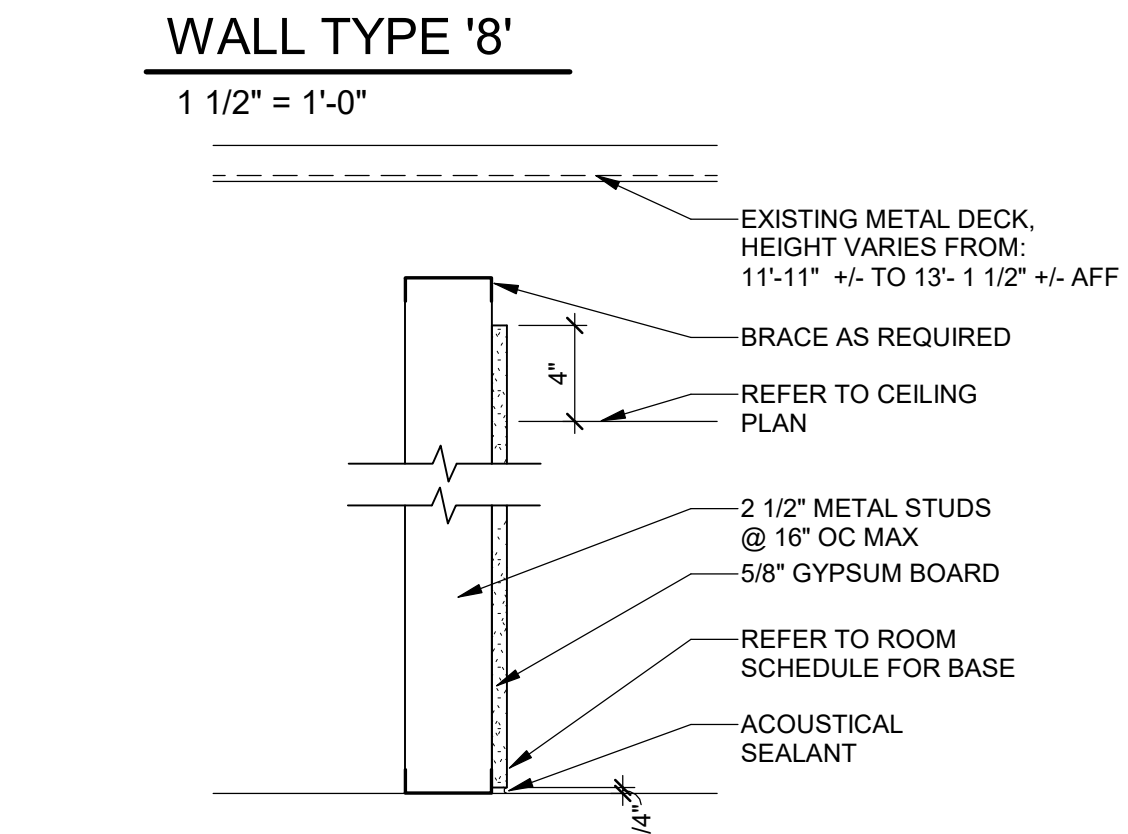
9 COUNTER DETAIL  
A-401 1 1/2" = 1'-0"



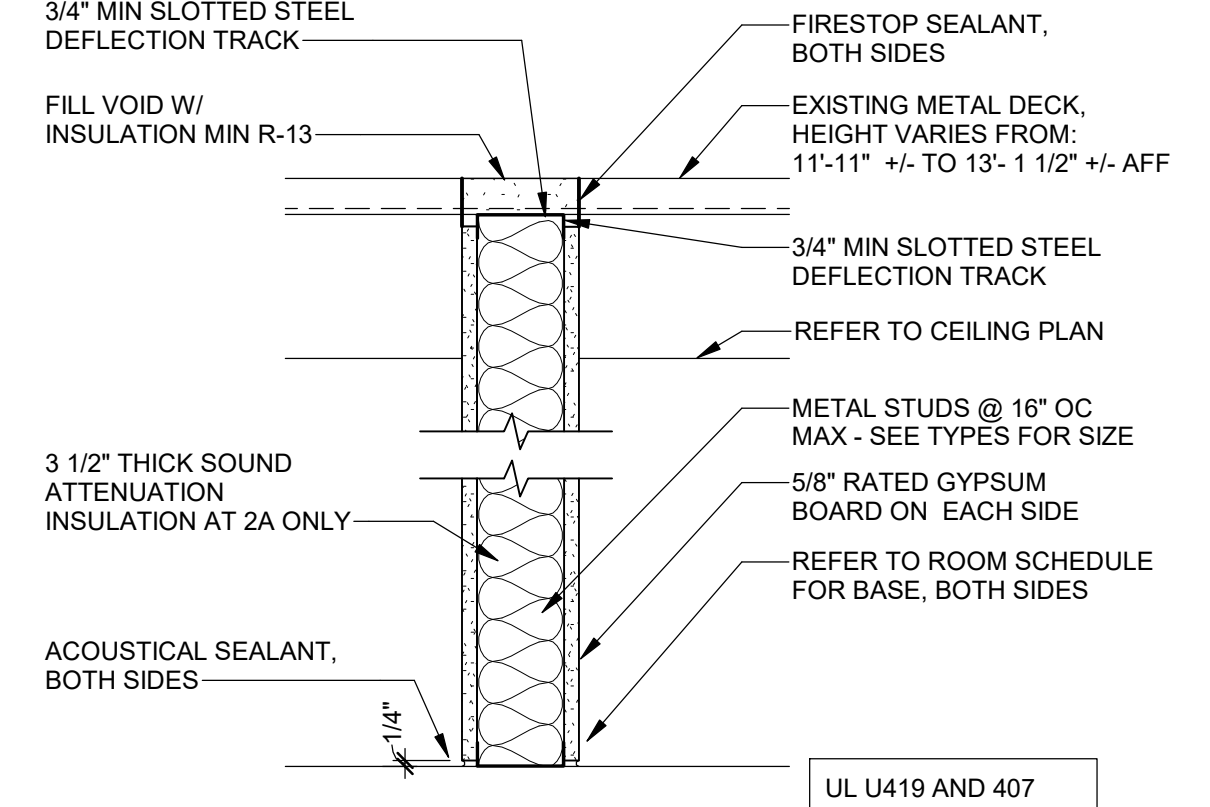
5 BASE CABINET DETAIL  
A-401 1 1/2" = 1'-0"



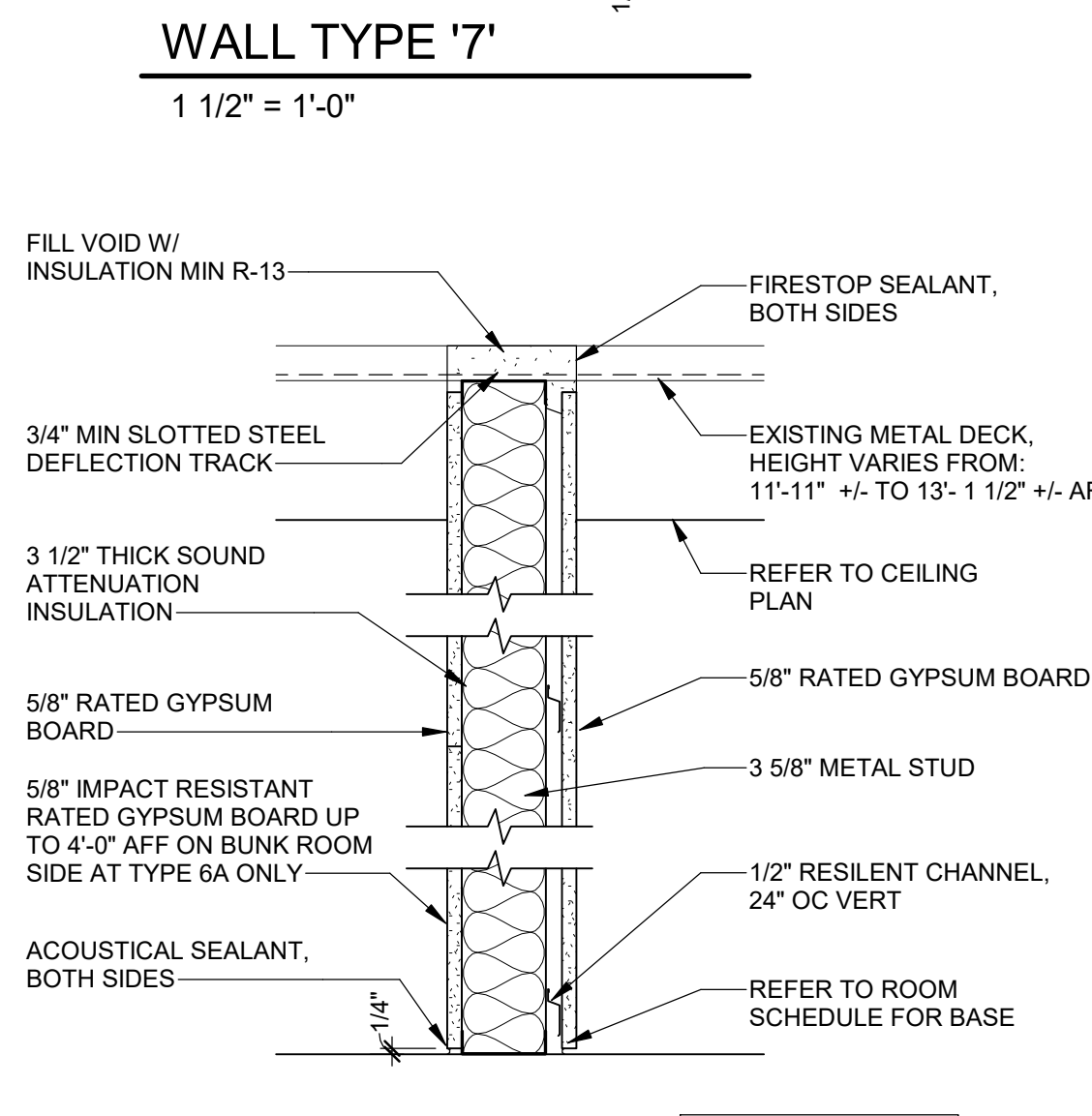
1 BASE CABINET DETAIL  
A-401 1 1/2" = 1'-0"



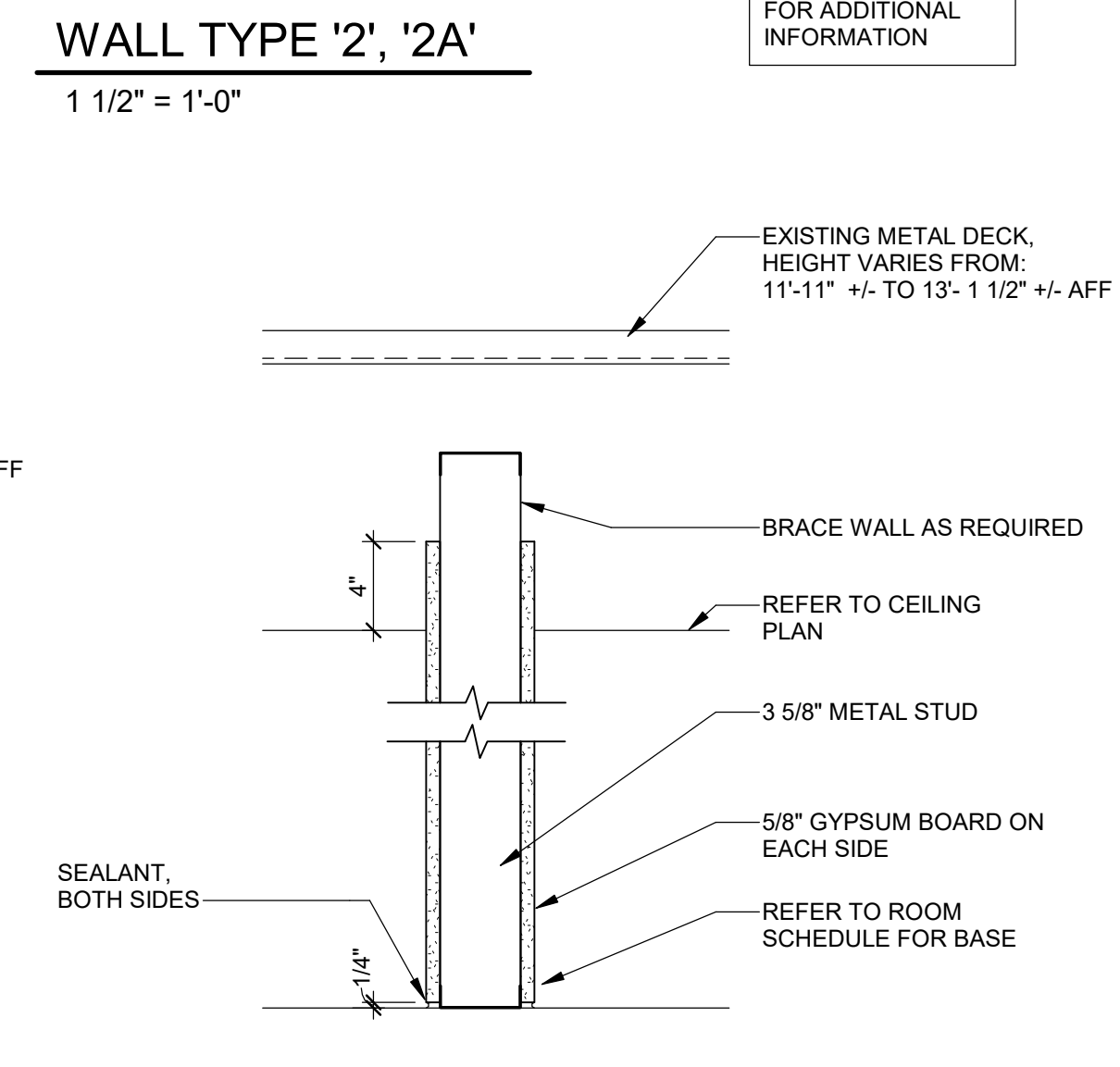
WALL TYPE '6', '6A'  
1 1/2" = 1'-0"



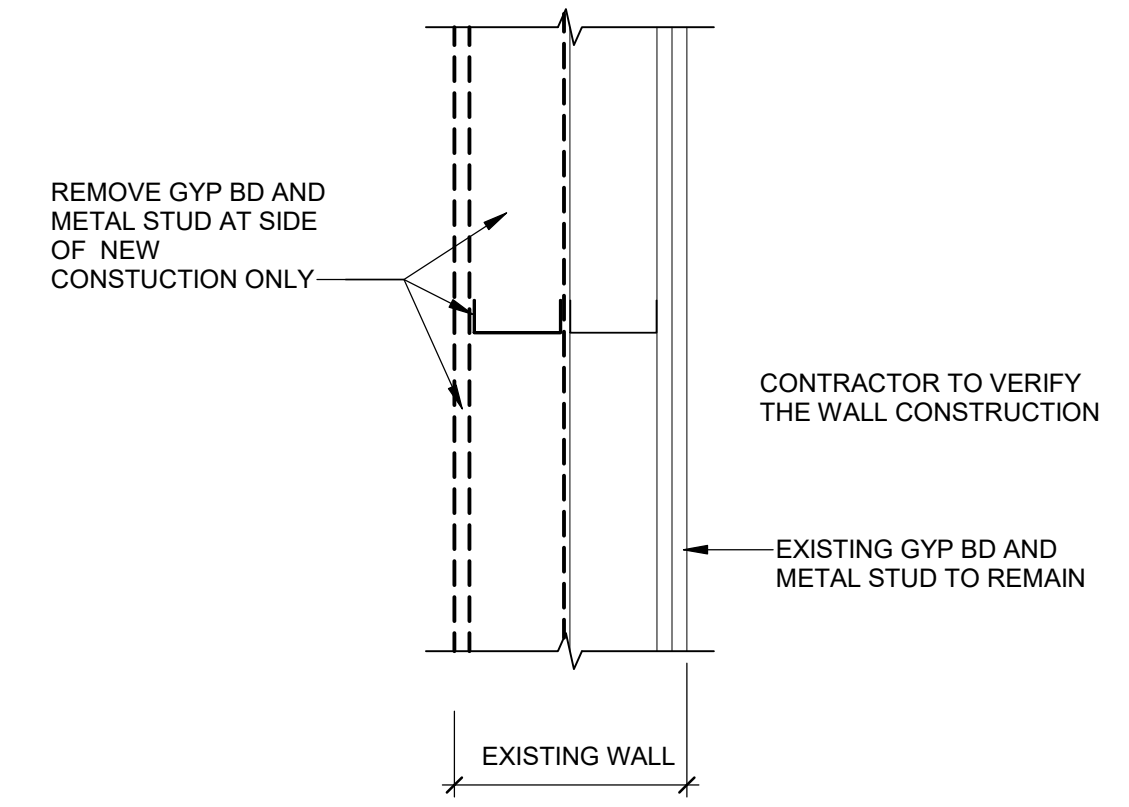
WALL TYPE '2', '2A'  
1 1/2" = 1'-0"



WALL TYPE '7'  
1 1/2" = 1'-0"

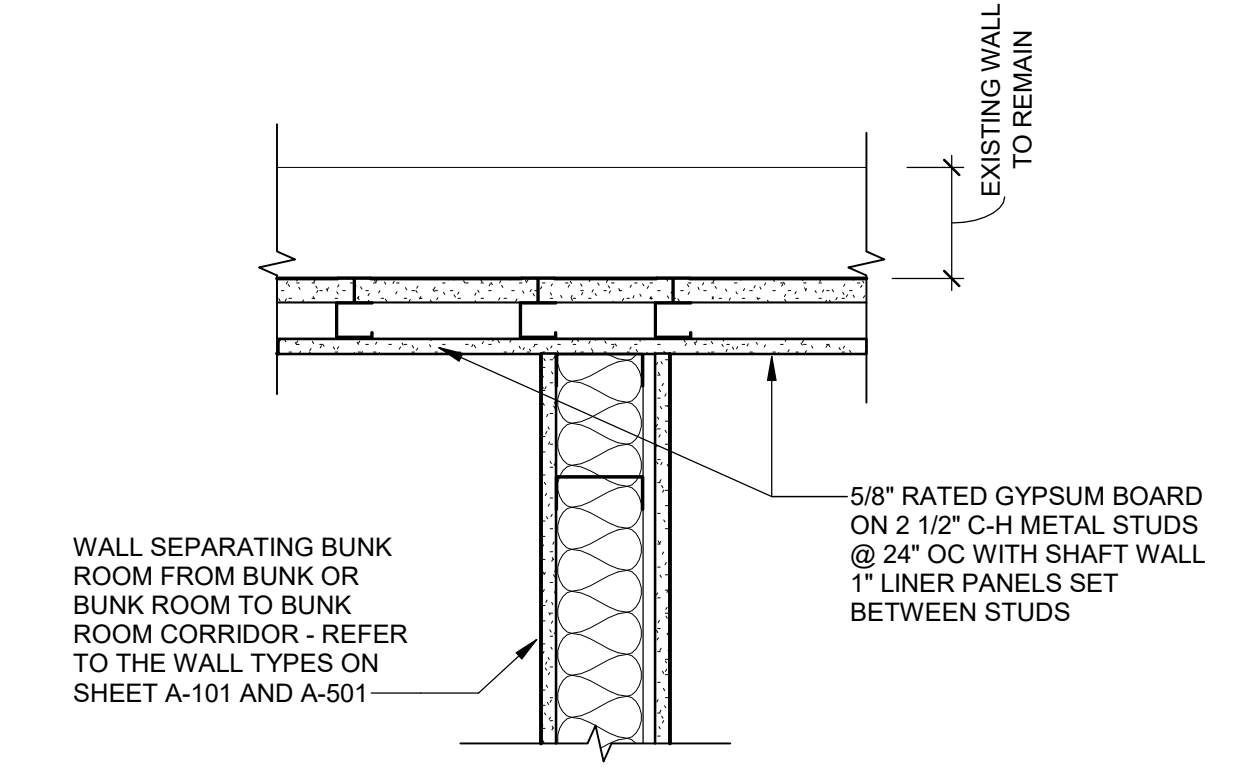


WALL TYPE '1'  
1 1/2" = 1'-0"



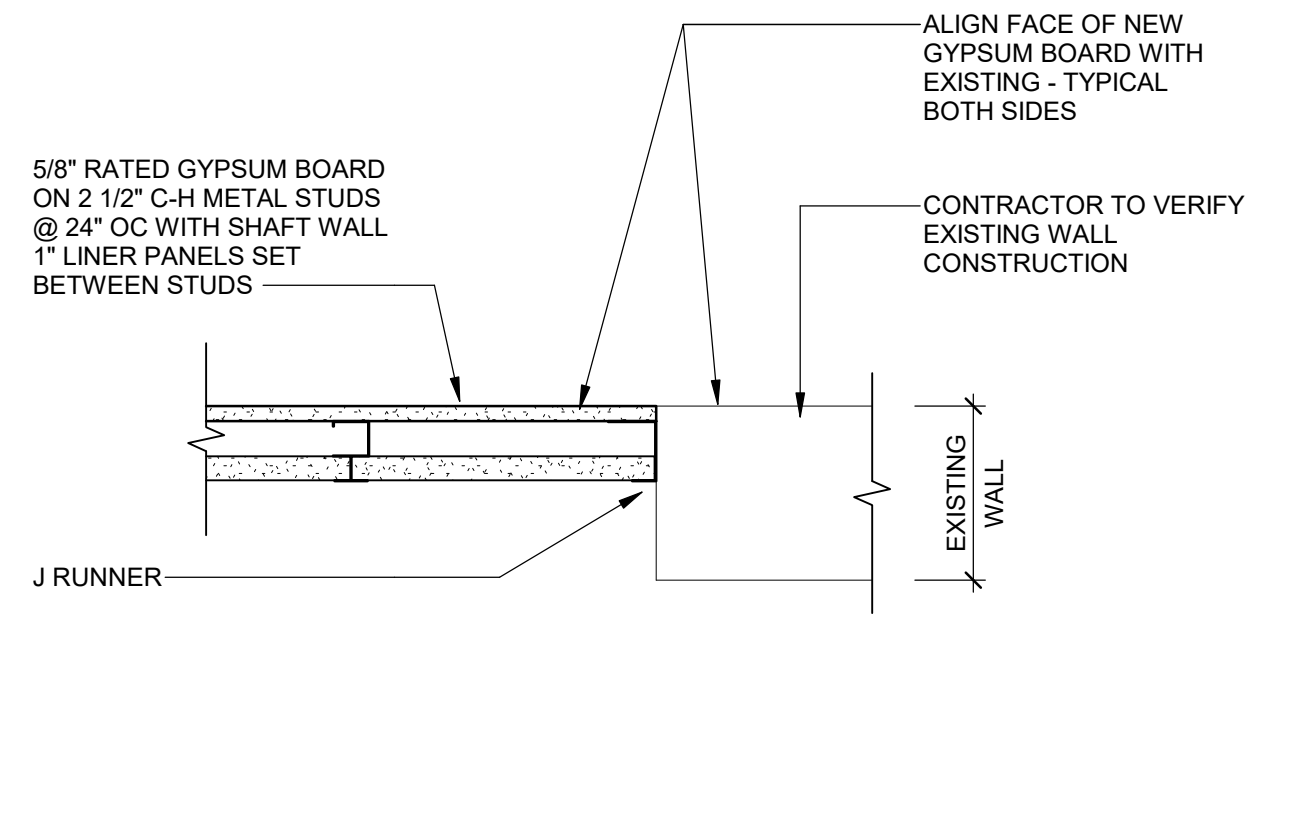
**8**  
A-101 1 1/2" = 1'-0"

**DEMOLITION DETAIL AT DOUBLE STUD WALL**



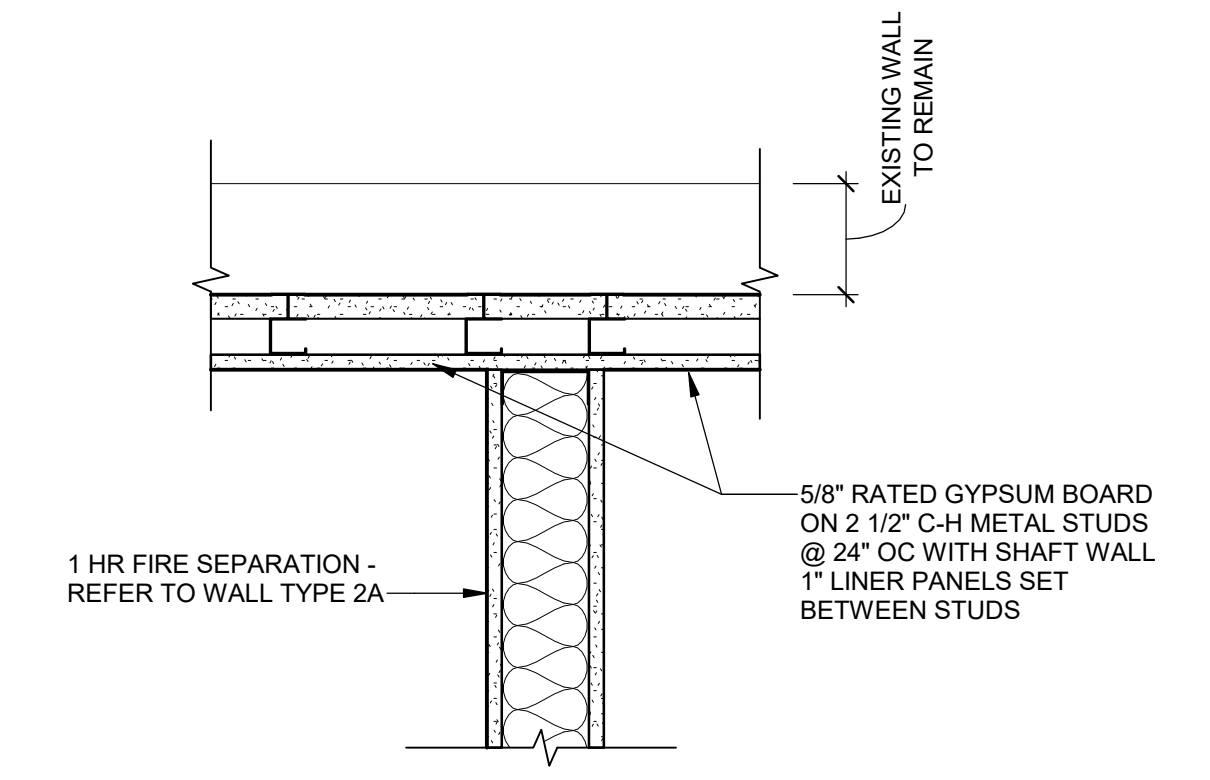
**4**  
A-101 1 1/2" = 1'-0"

**PLAN DETAIL AT SHAFT WALL AND BUNK ROOMS**



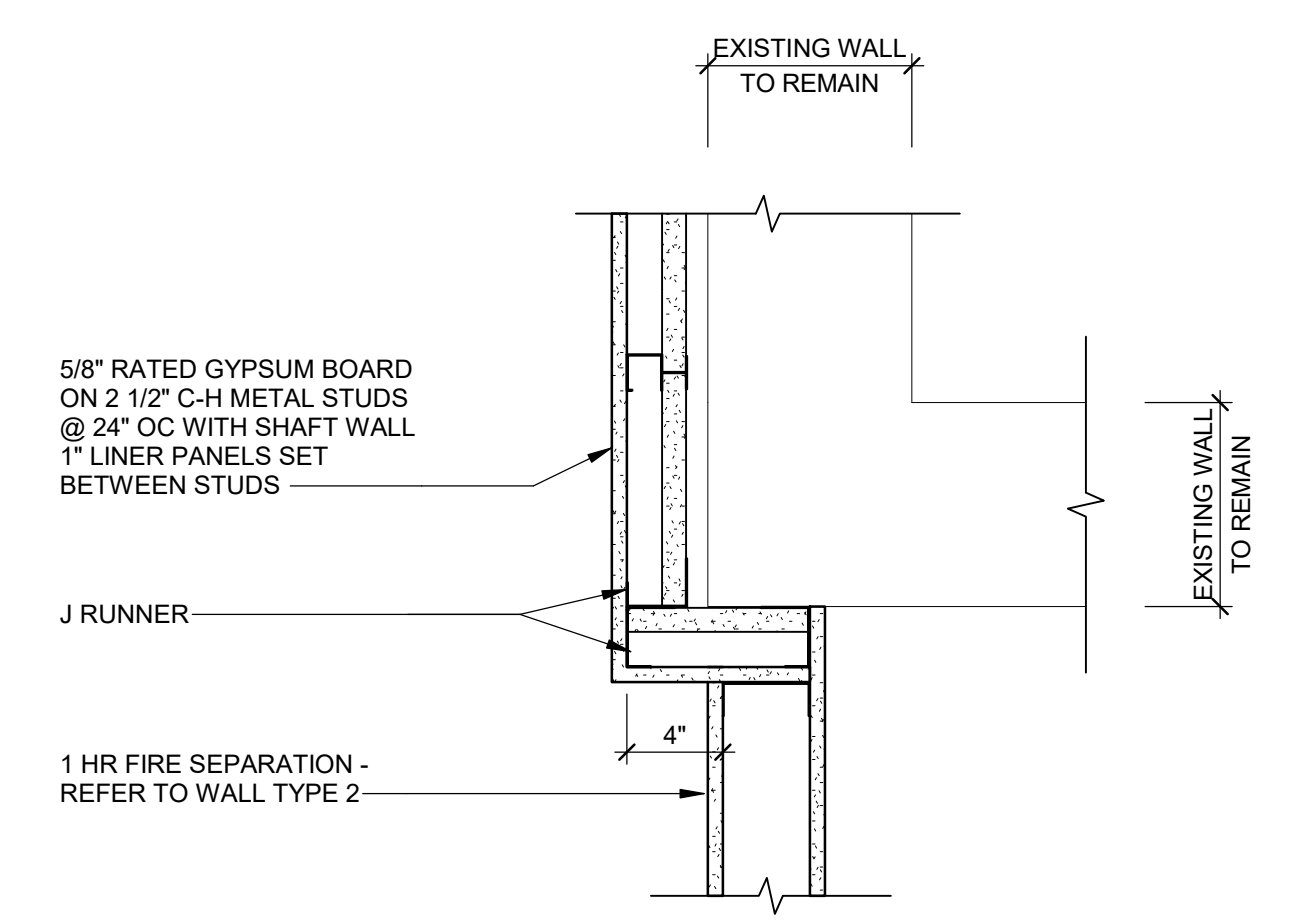
**7**  
A-401 1 1/2" = 1'-0"

**TYPICAL AT NEW SHAFT WALL TO EXISTING SHAFT WALL**



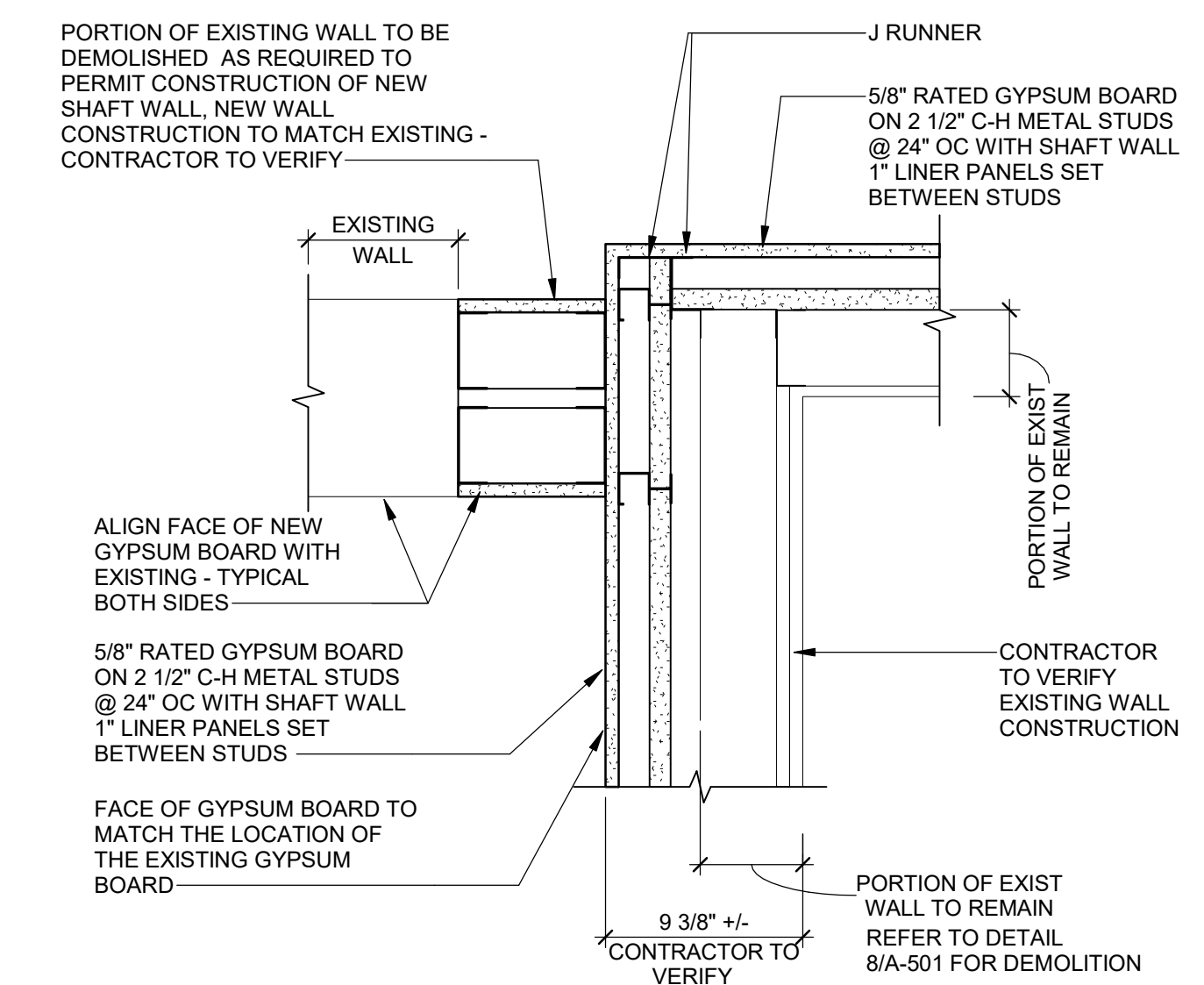
**3**  
A-401 1 1/2" = 1'-0"

**PLAN DETAIL AT SHAFT WALL AND FIRE SEPARATION**



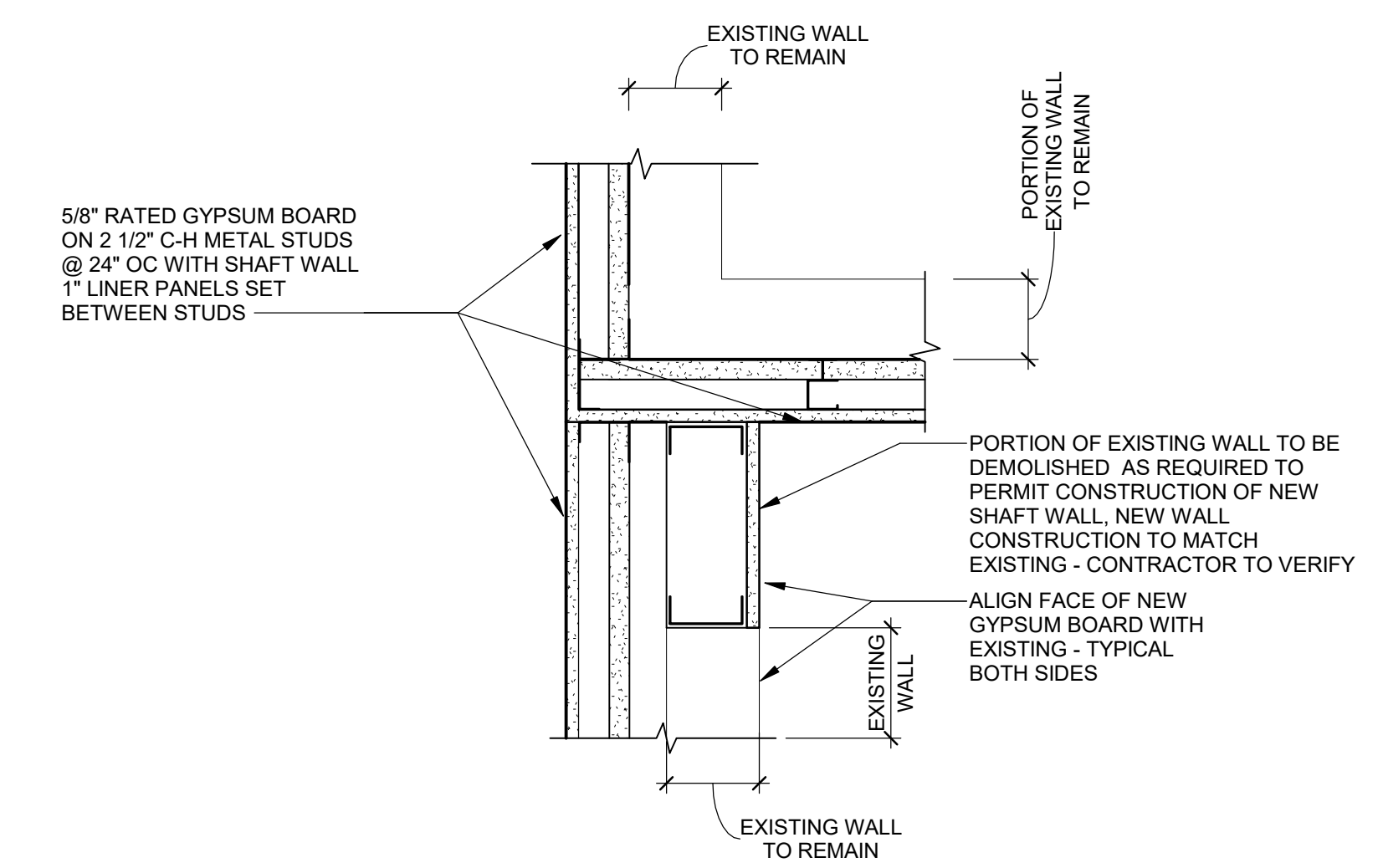
**6**  
A-101 1 1/2" = 1'-0"

**PLAN DETAIL**



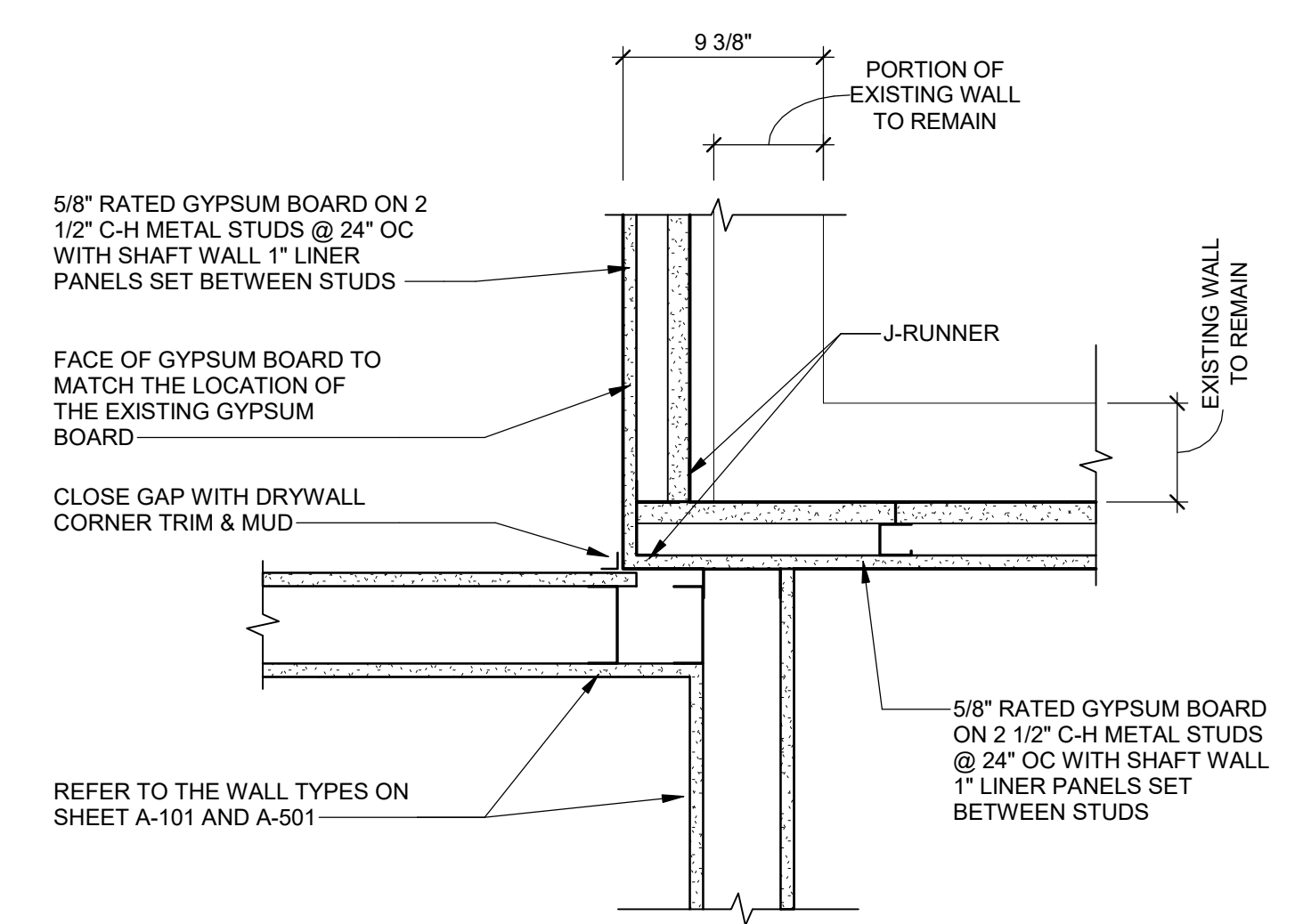
**2**  
A-401 1 1/2" = 1'-0"

**PLAN DETAIL**



**5**  
A-401 1 1/2" = 1'-0"

**PLAN DETAIL**



**1**  
A-401 1 1/2" = 1'-0"

**PLAN DETAIL**



MATERIAL FINISH SCHEDULE						
CODE	MANUFACTURER	ITEM	COLOR	SIZE	REMARKS	
ACT-1	ARMSTRONG	ACOUSTICAL CEILING TILE- CIRRUS	WHITE	24 x 24	15/16" CEILING GRID, WHITE	
CG-1		CORNER GUARD	SATIN ALUMINUM	1 1/2" WING	START AT TOP OF BASE - REFER TO ELEVATIONS FOR ADDITIONAL INFORMATION	
CG-2		CORNER GUARD TO ENCASE WALL THICKNESS	SATIN ALUMINUM		START AT TOP OF BASE - REFER TO ELEVATIONS FOR ADDITIONAL INFORMATION	
CPT-1	TARKETT	CARPET TILE STYLE: 11488 FABRICATE	36216 NIGHTTIME	9 x 36	DIRECT GLUE DOWN, INSTALLATION:	
CPT-2	TARKETT	CARPET TILE STYLE: 11472 SOUNDBLOCK	88204 CEDAR DECK	24 x 24	DIRECT GLUE DOWN, INSTALLATION:	
FRP-1	MARLITE	FIBERGLASS REINFORCED PANELS AT MOP SINKS	P-199 BRITE WHITE - PEBBLED TEXTURE	40" HIGH PANEL	INSTALL ABOVE WALL, BASE WITH TRIM ACCESSORIES	
GRT-1	CUSTOM BUILDING PRODUCTS	GROUT FOR PCT FLOOR	#546 CAPE GRAY		3/16" GROUT JOINT	
LVT-1	MOHAWK GROUP	LUXURY VINYL TILE - HOT & HEAVY COLLECTION BOLDER COO10	832 RIVER ROCK	36 x 36	DIRECT GLUE DOWN FALL SPREAD, INSTALLATION:	
P.LAM-1	WILSONART	BASE AND WALL CABINET	LOW LINE 7998K-18 LINEARITY FINISH		AEON SCRATCH RESISTANT	
P.LAM-2	FORMICA	COUNTER FOR RECEPTION, FIRE INSPECTORS, WORKROOM	NEO CLOUD MATT FINISH 6314-58			
PCT-1	DALTILE	PORCELAIN CERAMIC TILE - FLOOR	LINDEN POINT - GRIGIO	12 x 24 x 5/16		
PCT B-1	DALTILE	PORCELAIN CERAMIC TILE - BASE	LINDEN POINT - GRIGIO	3 x 12	INSTALL ONLY AT PAINTED WALLS	
PT-1	SHERWIN WILLIAMS	GENERAL WALL PAINT	CEILING BRIGHT WHITE SW 7007		FINISH: SATIN AT GENERAL AREAS; EPOXY AT WET AREAS	
PT-2	SHERWIN WILLIAMS	ACCENT PAINT	GRAY SCREEN SW7071		FINISH: SATIN AT GENERAL AREAS; EPOXY AT WET AREAS	
PT-3	SHERWIN WILLIAMS	ACCENT PAINT, AND DOOR FRAMES	ONLINE SW7072		SATIN FINISH FOR WALLS, SEMI-GLOSS FOR DOOR FRAMES	
PT-4	SHERWIN WILLIAMS	ACCENT PAINT	BRACING BLUE SW6242		FINISH: SATIN AT GENERAL AREAS; EPOXY AT WET AREAS	
RB-1	ROPPE	RUBBER WALL BASE	193 BLACK BROWN			
SSM-1	CORIAN	WINDOW SILL	DEEP SPACE	4" HIGH		
SSM-2	FORMICA	KITCHEN, TRANSACTION COUNTER AT RECEPTION	770 BOTTLE GLASS QUARTZ			
SSM-3	WILSONART	OPTION 2 FOR KITCHEN, TRANSACTION COUNTER AT RECEPTION	BLUESTONE 9074EA (5)			
TR-1	TARKETT, TANDUS CENTIVA	MET02-METALEDGE DEUX TRIM	00176 BRASS		TRANSITION BETWEEN CARPET AND LVT	
TR-2	DALTILE	THRESHOLD	G771 ABSOLUTE BLACK GRANITE	2 x 36 x 5/8"	DOUBLE BEVEL WITH POLISH FINISH	
TR-3	ROPPE	EDGE GUARD	193 BLACK BROWN			
TR-4	ROPPE	ADAPTER TRANSITION STRIP	193 BLACK BROWN	1" WIDE		
TR-5	SCHLUTER	SCHIENE	SATIN ANODIZED ALUMINUM (AE)		TRANSITION AT EXISTING QUARRY TILE TO CORRIDOR CARPET	
VCT-1	ARMSTRONG	VINYL COMPOSITION TILE, STANDARD EXCELON	52180 HEMATITE	12 x 12		
WD-1	VT ARCHITECTURAL WOOD DOORS	WOOD DOORS	SPECIES: SELECT WHITE BIRCH RAVINE, RA16			
WIN-1	PHIFER SHEERWEAVE BASIC	ROLLER SHADE MATERIAL - 5% OPEN STYLE	V22 CHARCOAL/GRAY		FASCIA COVER, CLEAR ANODIZED, BEAD CHAIN, STAINLESS STEEL, BOTTOM BAR, OPEN POCKET, CLUTCH LOCATION, RIGHT SIDE, CLUTCH COLOR: BLACK; FABRIC ORIENTATION: REGULAR ROLL (FROM BACK OF ROLL), LIGHT GAP REDUCTION: L ANGLE	

ROOM FINISH SCHEDULE																								
ROOM NUMBER	ROOM NAME	FLOOR MATL	BASE MATL	NORTH				EAST				SOUTH				WEST				WAINS MATL	CEILING		REMARKS	ROOM NUMBER
				MATL	FINISH	MATL	FINISH	MATL	FINISH	MATL	FINISH	MATL	FINISH	MATL	FINISH	MATL	FINISH	MATL	FINISH					
101	LOBBY	EXIST TILE	RB-1	EXIST WALL	EXIST BRICK	EXIST WALL	EXIST BRICK	EXIST WALL	EXIST BRICK	EXIST WALL	EXIST BRICK	EXIST WALL	EXIST BRICK	-	EXIST WD	-							101	
201	LOBBY	CPT-1	RB-1	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-1	GYP BD	PT-2	GYP BD	PT-1	-	ACT-1	FF	1						201	
202	CORRIDOR	CPT-1	RB-1	GYP BD	PT-1	GYP BD	PT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-1	-	ACT-1	FF							202	
203	EXIST STAIR	EXIST	EXIST	EXIST CMU	PT-2	EXIST CMU	PT-2	EXIST CMU	PT-2	EXIST CMU	PT-2	EXIST CMU	PT-2	-	ACT-1	FF							203	
204	TOILET	PCT-1	PCT-B-1	GYP BD	PT-2	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-4	-	ACT-1	FF	5						204	
205	JANITOR'S CLOSET	VCT-1	RB-1	GYP BD	PT-1	GYP BD	PT-1	GYP BD	PT-1	GYP BD	PT-1	GYP BD	PT-1	-	ACT-1	FF	3						205	
206	IT	EXIST TILE	EXIST TILE	EXIST GYP BD/ TILE	PT-1	EXIST GYP BD/ TILE	PT-1	EXIST GYP BD/ TILE	PT-1	EXIST GYP BD/ TILE	PT-1	EXIST GYP BD/ TILE	PT-1	-	EXIST GYP BD	PT-1							206	
207	CORRIDOR	CPT-1	RB-1	GYP BD	PT-1	GYP BD	PT-3	GYP BD	PT-3	GYP BD	PT-1	GYP BD	PT-1	-	ACT-1	FF							207	
210	CORRIDOR	CPT-1	RB-1	GYP BD	PT-1	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-1	GYP BD	PT-1	-	ACT-1	FF							210	
211	RECEPTION	CPT-1	RB-1	GYP BD	PT-3	GYP BD	PT-1/PT-2	GYP BD	PT-4	GYP BD	PT-2/PT-4	GYP BD	PT-2/PT-4	-	ACT-1/GYP BD	FF/PT-4	1, 4						211	
212	CONFERENCE	CPT-2	RB-1	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2/PT-4	-	ACT-1	FF	1, 2						212	
213	CLERK	CPT-1	RB-1	GYP BD	PT-1	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-1	GYP BD	PT-1	-	ACT-1	FF							213	
214	CORRIDOR	CPT-1	RB-1	GYP BD	PT-1/PT-3	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-1	GYP BD	PT-1	-	ACT-1	FF							214	
215	TOILET	PCT-1	PCT-B-1	GYP BD	PT-2	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-2	GYP BD	PT-4	-	ACT-1	FF	5						215	
216	KITCHEN	LVT-1	RB-1	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-4	GYP BD	PT-4	-	ACT-1	FF							216	
217	WORKROOM	CPT-1	RB-1	GYP BD	PT-1	GYP BD	PT-3	GYP BD	PT-3	GYP BD	PT-1	GYP BD	PT-1	-	ACT-1	FF							217	
218	FIRE INSPECTORS	CPT-2	RB-1	GYP BD	PT-2	GYP BD	PT-1/PT-2	GYP BD	PT-1/PT-2	GYP BD	PT-2	GYP BD	PT-2	-	ACT-1	FF							218	
219	POLE #1	CPT-2	RB-1	GYP BD	PT-1	GYP BD	PT-1	GYP BD	PT-1	GYP BD	PT-4	GYP BD	PT-1	-	ACT-1	FF							219	
221	CORRIDOR	CPT-1	RB-1	GYP BD	PT-2	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-1	-	ACT-1	FF							221	
222	FIRE MARSHALL	CPT-2	RB-1	GYP BD	PT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	-	ACT-1	FF	1, 2						222	
223	EMC	CPT-2	RB-1	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	-	ACT-1	FF	1, 2						223	
224	ASSIST FIRE CHIEF	CPT-2	RB-1	GYP BD	PT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	-	ACT-1	FF	1, 2						224	
225	ASSIST FIRE CHIEF	CPT-2	RB-1	GYP BD	PT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	-	ACT-1	FF	1, 2						225	
226	FIRE CHIEF	CPT-2	RB-1	GYP BD	PT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	-	ACT-1	FF	1, 2						226	
227	TOILET	PCT B-1	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-4	-	EXIST GYP BD	PT-2	5							227	
228	TOILET	PCT-1	PCT-B-1	GYP BD	PT-2	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-4	GYP BD	PT-4	-	EXIST GYP BD	PT-1	5						228	
229	CORRIDOR	CPT-1	RB-1	GYP BD	PT-1	GYP BD	PT-1	GYP BD	PT-1	GYP BD	PT-4	GYP BD	PT-1/PT-2	-	ACT-1	FF	1, 2						229	
231	BUNK ROOMS	CPT-1	RB-1	GYP BD	PT-1	GYP BD	PT-1/PT-2	GYP BD	PT-1	GYP BD	PT-1	GYP BD	PT-1	-	ACT-1	FF							231	
232	BUNK #1	CPT-1	RB-1	GYP BD	PT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	-	ACT-1	FF							232	
233	BUNK #2	CPT-1	RB-1	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-4	GYP BD	PT-2	-	ACT-1	FF							233	
234	BUNK #3	CPT-1	RB-1	GYP BD	PT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	-	ACT-1	FF							234	
235	BUNK #4	CPT-1	RB-1	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	-	ACT-1	FF							235	
236	BUNK #5	CPT-1	RB-1	GYP BD	PT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	-	ACT-1	FF							236	
237	BUNK #6	CPT-1	RB-1	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-4	GYP BD	PT-2	-	ACT-1	FF							237	
238	POLE #2	CPT-1	RB-1	GYP BD	PT-1	GYP BD	PT-1	GYP BD	PT-1	GYP BD	PT-1	GYP BD	PT-1	-	ACT-1	FF							238	
239	BUNK #7	CPT-1	RB-1	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-4	GYP BD	PT-2	-	ACT-1	FF							239	
240	BUNK #8	CPT-1	RB-1	GYP BD	PT-4	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	GYP BD	PT-2	-	ACT-1	FF							240	

**ABBREVIATIONS**

ACT	ACOUSTICAL CEILING TILE
CG	CORNER GUARD
C-MAR	CULTURED MARBLE
CPT	CARPET TILE
CT	CERAMIC TILE
EPOXY	EPOXY FLOORING
GL-MOS	GLASS MOSAIC TILE
MAT	WALK OFF MAT
MBO	MARKER BOARD
P-COAC	POLISHED CONCRETE
P-COAC-GL	POLISH CONCRETE WITH BROADCAST GLASS PIECES
PCT	PORCELAIN CERAMIC TILE
PLAM	PLASTIC LAMINATE
PT	PAINT
RB	RUBBER BASE
RF	RUBBER FLOORING
SF	SPORTS FLOORING
SSM	SOLID SURFACE MATERIAL
TBD	TACKBOARD
TR	TRANSITION
VIN-P	VINYL PLAN
WIN	WINDOW TREATMENT



**FINISH NOTES**

- PROVIDE CORNER GUARDS AT ALL OUTSIDE CORNERS AT GYPSUM BOARD WALLS
- PROVIDE FLOOR TRANSITION MATERIAL UNDERNEATH DOOR LEAF OR AT CHANGE OF MATERIAL
- REFER TO THE FINISH PLAN FOR ACCENT WALLS, TILE WALLS AND FLOOR MATERIAL TRANSITIONS
- CEILING DIFFUSERS IN LAY IN CEILING, WHITE
- SPRINKLER HEAD
- ALL WALLS TO BE PT-1 UNLESS NOTED OTHERWISE
- 3MM EDGE BANDING, CHARTER INDUSTRIES F912 STORM
- CONTRACTOR TO PROVIDE FLOOR FINISH MATERIAL TRANSITIONS AT ALL CHANGE OF FLOOR MATERIALS - REFER TO SPEC SECTION
- WALL OUTLETS: WHITE SWITCHES, WHITE FACE PLATES, WHITE

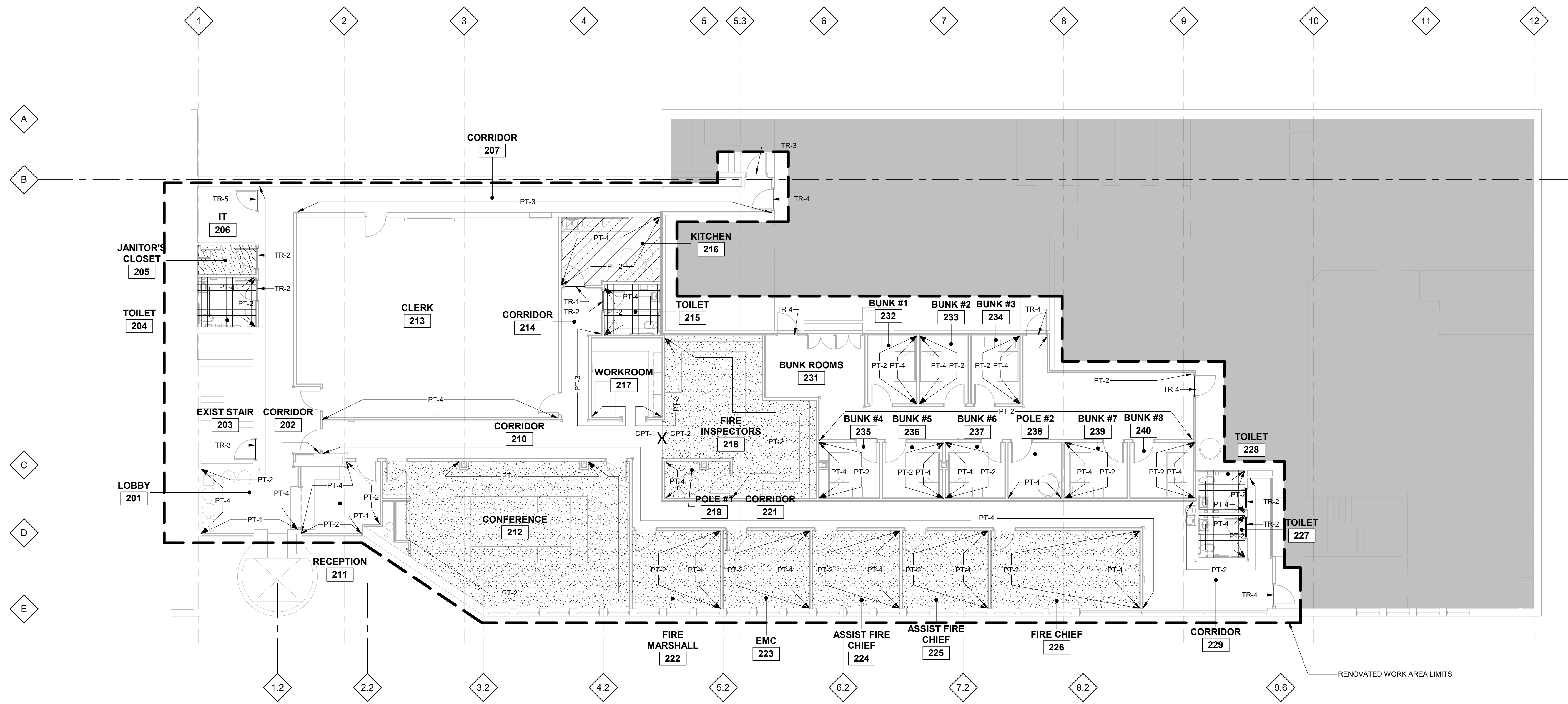
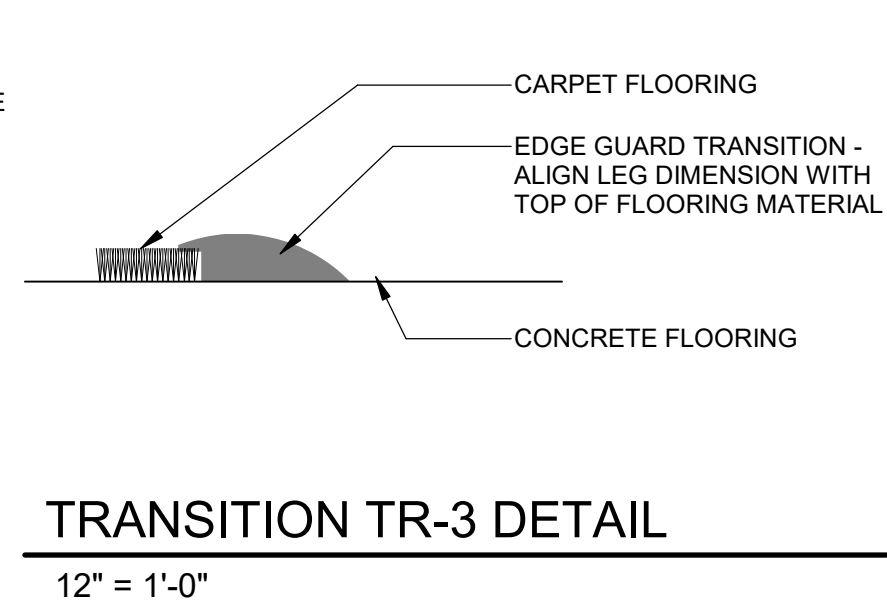
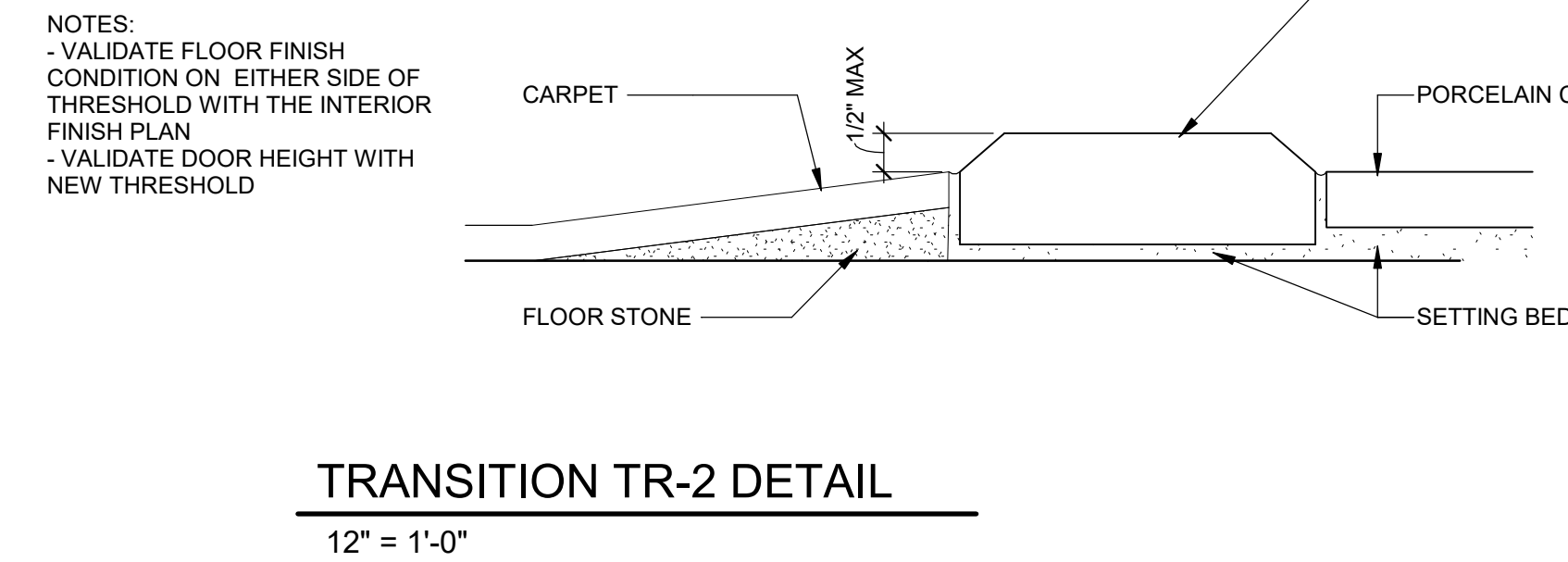
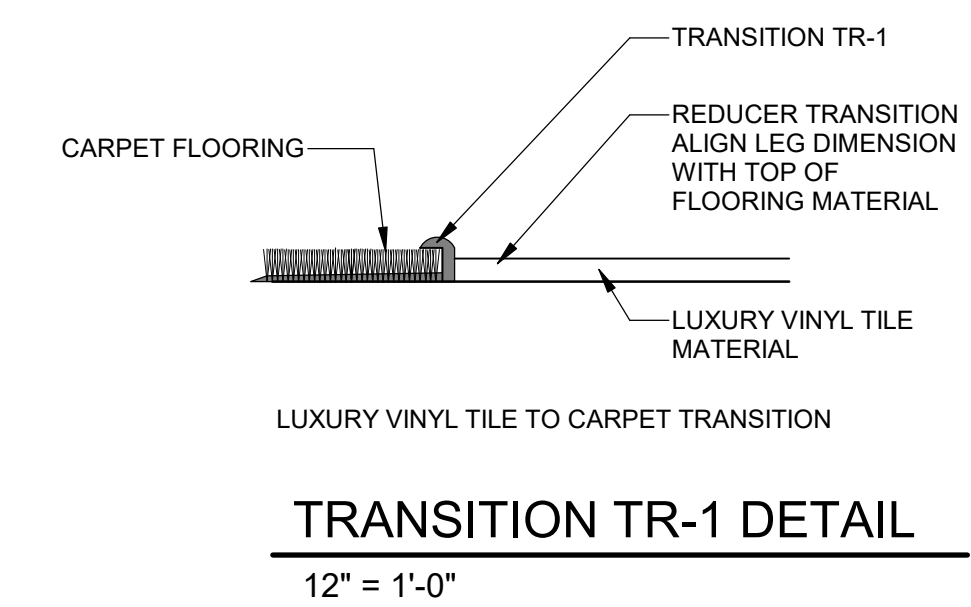
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**SCHEDULE REMARKS**

- ROLLER SHADE: WIN-1
- WINDOW SILL: SSM-1
- FRP PANELS WITH ALL TRIM ACCESSORIES - REFER TO FINISH PLAN FOR EXTENT OF WALL MATERIAL
- TRANSACTION COUNTER: SSM-1 WITH CENTERLINE HIDDEN SUPPORT BRACKET, WORKSTATION COUNTER: PLAM-2, PROVIDE (3) 2" DIAMETER GROMMET - COORD LOCATION WITH OWNER
- LOCATE RESTROOM SIGNAGE OUTSIDE OF TOILET ROOMS - 9"x9"x1/8" ACRYLIC RESTROOM SIGN WITH ACRYLIC COPY, BRALLE, AND TAPE MOUNT - RAL BLUE BACKGROUND AND WHITE GRAPHICS

Project Title: ANN ARBOR FIRE STATION NO.1 RENOVATION

Date: 11-11-2021 12-08-2021 02-04-2022 02-15-2022  
 Issued For: OWNER REVIEW ISSUED FOR PLAN REVIEW PLAN REVIEW RESUBMITTAL BIDDING



**FINISH LEGEND**

[Pattern]	CPT-1, TYP UNLESS OTHERWISE NOTED
[Pattern]	CPT-2
[Pattern]	LVT-1
[Pattern]	PCT-1
[Pattern]	VCT-1
[Arrow]	DIRECTION OF FINISH

SECOND FLOOR FINISH PLAN  
 1/8" = 1'-0"

PA/PE: REF PM: GM CH: AP:  
 CAD Drawing File: A-601.DWG  
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 Project Number: 221015.00  
 Sheet Title: ROOM FINISH SCHEDULE  
 Sheet Number: A-601

DOOR SCHEDULE																
DOOR NUMBER	LOCATION	DOOR OPENING SIZE	DOOR THICK	DOOR			FRAME			RATING (MIN)	HARD WARE	DETAILS			REMARKS	DOOR NUMBER
				TYPE	MATL	FINISH	TYPE	MATL	FINISH			HEAD	JAMB	SILL		
101A	LOBBY	3'-0" x 7'-0"	-	D-EX	-	-	F-EX	-	-	-	01	-	-	-	4, 6	101A
203A	EXIST STAIR	3'-0" x 7'-0"	1 3/4"	NL4	WDS	-	F1	F-EX	-	90	02	1A-611	2A-611	-	5, 6	203A
204A	TOILET	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	03	1A-611	2A-611	-	-	204A
205A	JANITOR'S CLOSET	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	04	1A-611	2A-611	-	-	205A
206A	IT	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	F-EX	PT-3	-	07	-	-	-	2, 5, 6	206A
207A	CORRIDOR	3'-0" x 7'-0"	1 3/4"	NL4	WDS	-	F1	HM	PT-3	45	06	-	-	-	2	207A
207B	CORRIDOR	3'-0" x 7'-0"	1 3/4"	NL4	WDS	-	F1	F-EX	PT-3	90	02	-	-	-	5, 6	207B
210A	CORRIDOR	3'-0" x 7'-0"	1 3/4"	NL4	WDS	-	F1	HM	PT-3	-	08	1A-611	2A-611	-	2	210A
211A	RECEPTION	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	211A
211B	RECEPTION	6'-0" x 4'-0"	-	OHC-C	AL	FF	OHC-C	AL	FF	-	-	10A-501	11A-501	-	-	211B
212A	CONFERENCE	3'-0" x 7'-0"	1 3/4"	NL4	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	212A
212B	CONFERENCE	3'-0" x 7'-0"	1 3/4"	NL4	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	212B
213A	CLERK	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	11A	1A-611	2A-611	-	1	213A
213B	CLERK	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	07	1A-611	2A-611	-	1	213B
213C	CLERK	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	F-EX	PT-3	-	11	-	-	-	1, 5, 6	213C
215A	TOILET	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	03	1A-611	2A-611	-	-	215A
216A	KITCHEN	3'-0" x 7'-0"	1 3/4"	NL4	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	216A
219A	POLE #1	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	45	12	1A-611	2A-611	-	-	219A
222A	FIRE MARSHALL	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	13	1A-611	2A-611	-	-	222A
223A	EMC	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	13	1A-611	2A-611	-	-	223A
224A	ASSIST FIRE CHIEF	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	13	1A-611	2A-611	-	-	224A
225A	ASSIST FIRE CHIEF	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	13	1A-611	2A-611	-	-	225A
226A	FIRE CHIEF	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	13	1A-611	2A-611	-	-	226A
227A	TOILET	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	03	-	-	-	-	227A
228A	TOILET	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	03	-	-	-	-	228A
229A	CORRIDOR	3'-0" x 7'-0"	1 3/4"	NL4	WDS	-	F1	HM	PT-3	45	10A	1A-611	2A-611	-	3	229A
231A	BUNK ROOMS	3'-0" x 7'-0"	1 3/4"	NL4	WDS	-	F1	HM	PT-3	45	12	3A-611	4A-611	-	-	231A
231B	BUNK ROOMS	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	45	14	3A-611	4A-611	-	-	231B
231C	BUNK ROOMS	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	45	14	3A-611	4A-611	-	-	231C
231D	BUNK ROOMS	2'-0" x 7'-0" (PR)	1 3/4"	FL	WDS	-	F2	HM	PT-3	45	15	3A-611	4A-611	-	-	231D
231E	BUNK ROOMS	2'-0" x 7'-0" (PR)	1 3/4"	FL	WDS	-	F2	HM	PT-3	45	15	3A-611	4A-611	-	-	231E
232A	BUNK #1	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	232A
233A	BUNK #2	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	233A
234A	BUNK #3	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	234A
235A	BUNK #4	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	235A
236A	BUNK #5	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	236A
237A	BUNK #6	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	237A
238A	POLE #2	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	45	12	1A-611	2A-611	-	-	238A
239A	BUNK #7	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	239A
240A	BUNK #8	3'-0" x 7'-0"	1 3/4"	FL	WDS	-	F1	HM	PT-3	-	09	1A-611	2A-611	-	-	240A

**ABBREVIATIONS**

AL	ALUMINUM
CES	CARPET EDGE STRIP
EX	EXISTING
FF	FACTORY FINISH
FRP	FIBERGLASS REINFORCED POLYESTER
HM	HOLLOW METAL
KDM	KNOCK DOWN METAL
MAR	MARBLE
MET	METAL (SOLID CORE JEN-WELD PANEL DOOR)
OHC-C	OVER-HEAD SHUTTER - PARTIAL HEIGHT
PT	PAINT
RF	REFINISH EXISTING DOOR
RFM	REFINISHED REDIFRAME
RRS	RESILIENT REDUCER STRIP
STL	STEEL
ST STL	STAINLESS STEEL
TG	TEMPERED GLASS
WD	WOOD
WDH	WOOD (HOLLOW CORE)
WDS	WOOD (SOLID CORE)



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**DOOR NOTES**

- NOTIFY ARCHITECT IF ANY DISCREPANCIES ARE FOUND
- CONTRACTOR TO PROVIDE CONSTRUCTION CORES AND WORK WITH OWNER TO INSTALL FINAL KEYING
- CONTINUOUS PERIMETER SEALANT AROUND FRAMES, TYPICAL
- PROVIDE SAFETY GLASS IN ALL LOCATIONS WHERE REQUIRED BY CODE - ALL SAFETY GLASS TO BE TYPE II
- ALL WOOD DOORS TO BE WD-1. REFER TO MATERIAL FINISH SCHEDULE
- CONTRACTOR IS RESPONSIBLE FOR SIZING ALL DOOR FRAMES TO ACCOMMODATE VARYING WALL THICKNESS. REFER TO WALL TYPES ON SHEETS A-501 AND DOOR DETAILS SHOWN ON THIS SHEET.

**SCHEDULE REMARKS**

- CARD ACCESS WITH CAMERA
- CARD ACCESS
- EXISTING CARD READER - REMOVE AND REUSE WITH NEW DOOR
- DOOR TO HAVE CAMERA, AND INTERCOM
- PAINT EXISTING HOLLOW METAL FRAME
- CONTRACTOR TO REWORK EXISTING DOOR FRAME TO ACCOMMODATE NEW DOOR HARDWARE

Seal:

Client:

**CITY OF ANN ARBOR**  
ANN ARBOR MI

Project Title:

**ANN ARBOR FIRE STATION NO.1 RENOVATION**

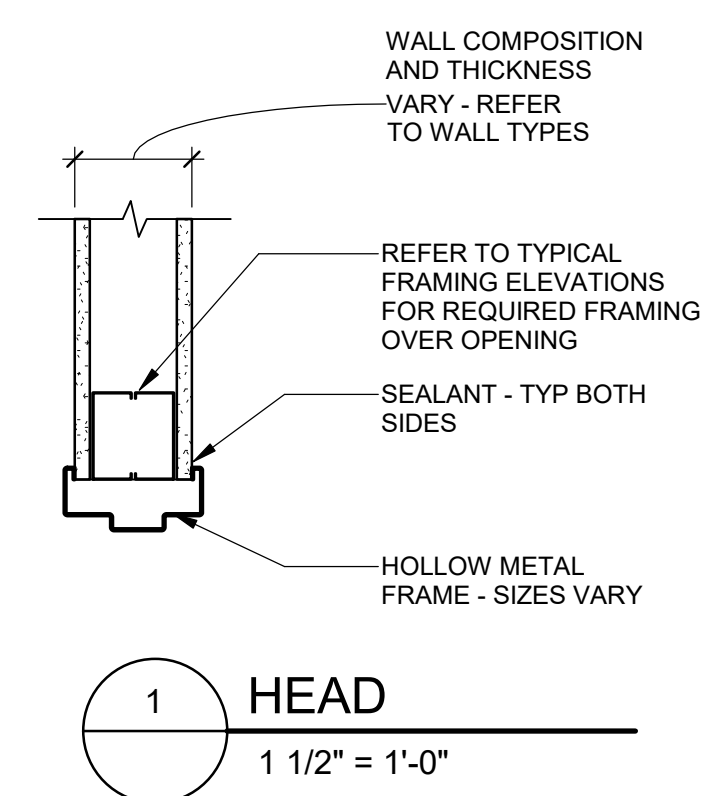
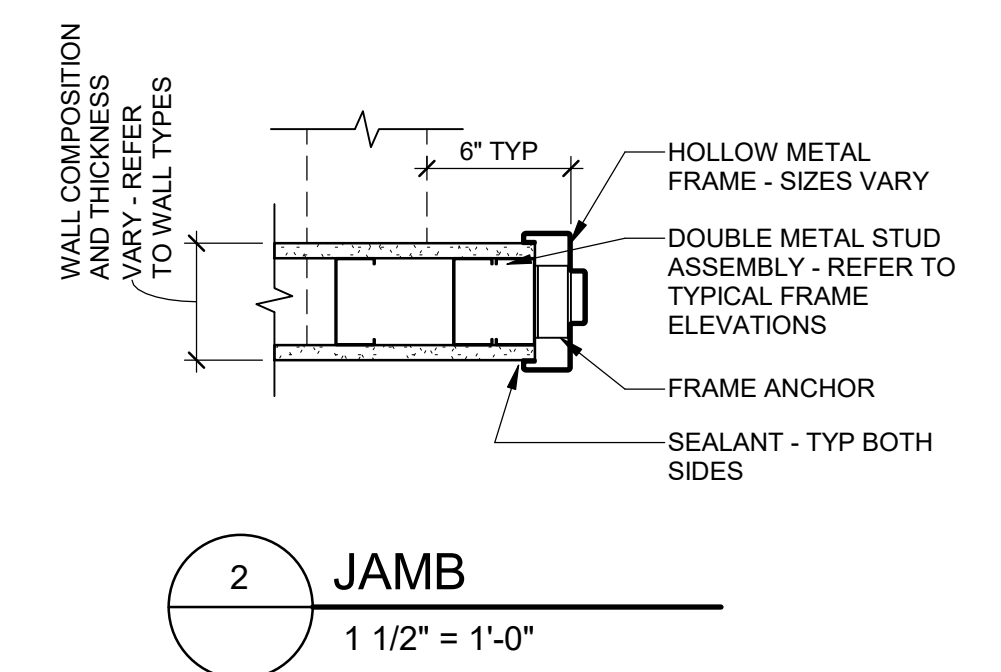
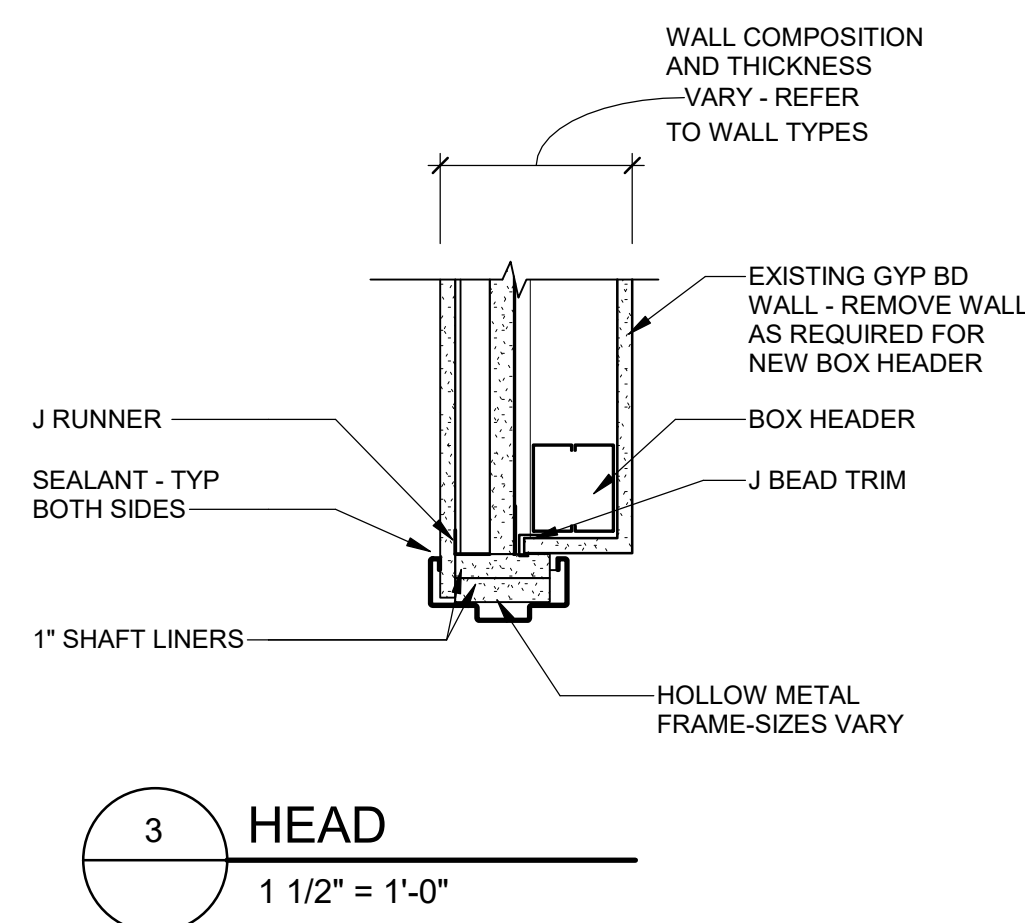
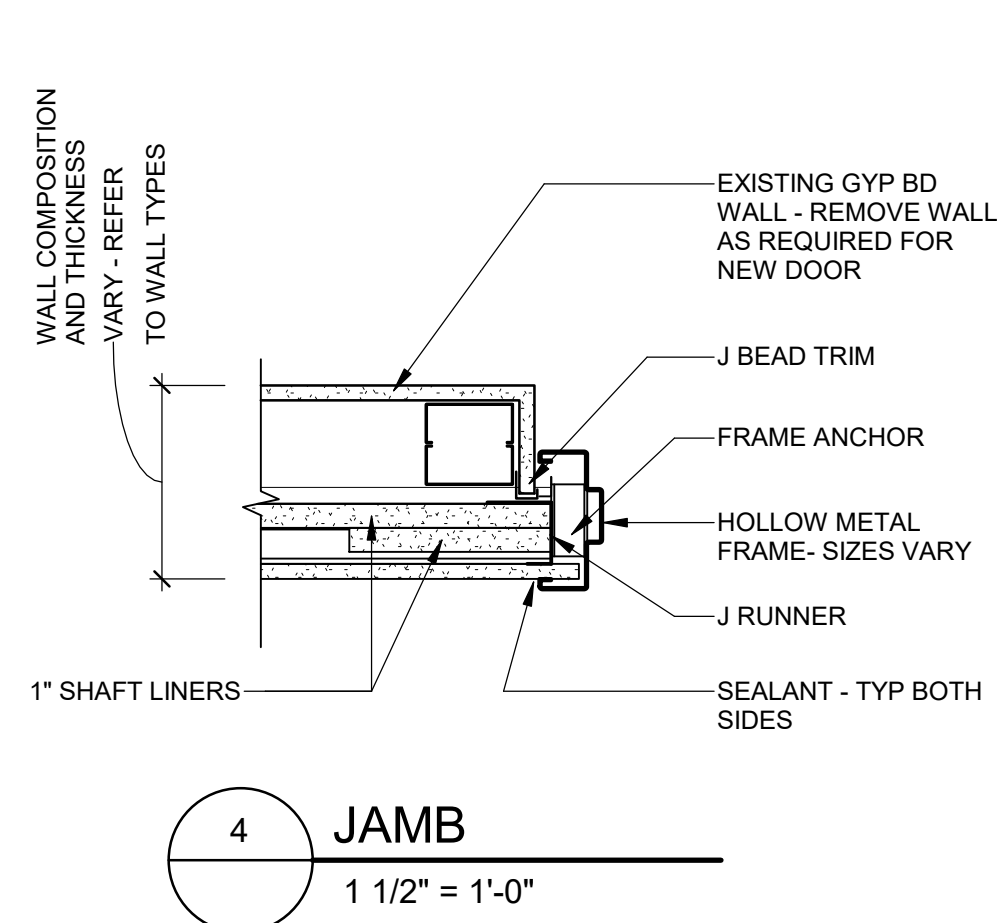
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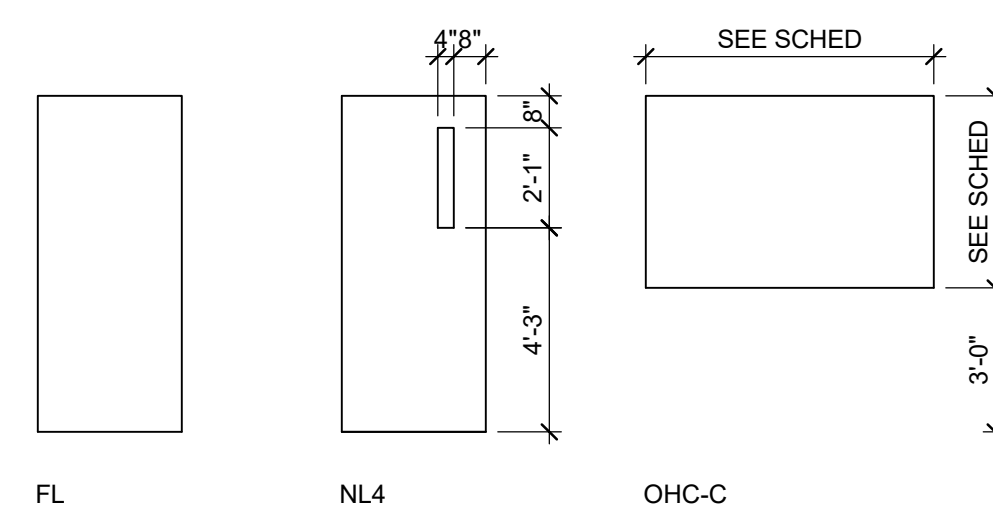
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**DOOR SCHEDULE AND DETAILS**

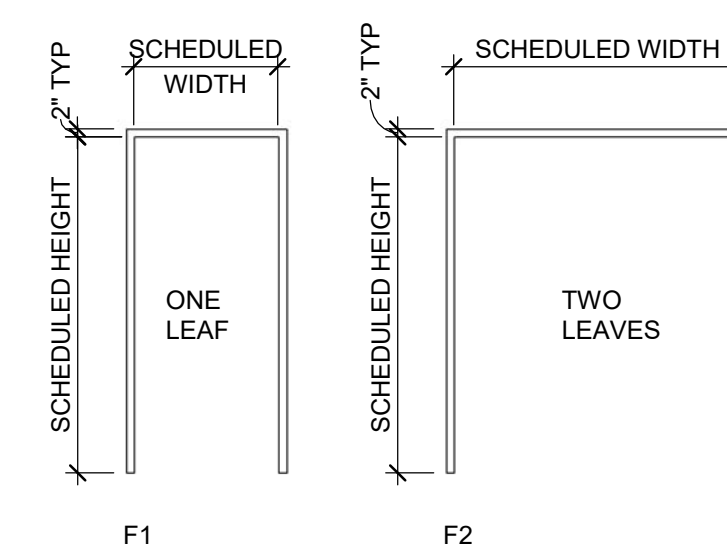
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**DOOR TYPES**



**FRAME TYPES**





**MECHANICAL ABBREVIATION LIST**

ABBREVIATION	DESCRIPTION	ABBREVIATION	DESCRIPTION	ABBREVIATION	DESCRIPTION
A	COMPRESSED AIR	FD	FLOOR DRAIN	PACU	PACKAGED AIR CONDITIONING UNIT
AL	ALUMINUM	FFD	FUNNEL FLOOR DRAIN	PBD	PARALLEL BLADE DAMPER
ALC	ALUMINUM CLADDING	FFH	FIRE HOSE CABINET	PCC	PUMPED CONDENSATE
ACC	AIR COOLED CONDENSER	FHC	FIRE HOSE RACK	PCW	PROCESS COOLING WATER
ACQU	AIR COOLED CONDENSING UNIT	FHR	FIRE HOSE VALVE	PCWR	PROCESS COOLING WATER RETURN
AD	ACCESS DOOR	FFV	FULL LOAD AMPS	PFC	PROCESS COOLING WATER SUPPLY
AD	AREA DRAIN	FLA	FLOOR	PD	PRESSURE DROP (FEET OF WATER)
AE	AIR EXTRACTOR	FLR	FLOOR METER	PH	PERMETER HEAT
AFT	ABOVE FINISHED FLOOR	FM	FLOW MEASURING STATION	PHR	PERMETER HEAT RETURN
AHU	AIR HANDLING UNIT	FMS	FEET PER MINUTE	PHS	PERMETER HEAT SUPPLY
ALT	ALTERNATE	FP	FAN POWERED (AIR) TERMINAL UNIT	PNL	PANEL
AMP	AMPERE	FPTU	FAN POWERED (AIR) TERMINAL UNIT	PPM	PARTS PER MILLION
APD	AIR PRESSURE DROP	FS	FLOOR SINK	PPS	PRESSURE
AR	ARGON	FT	FOOT	PRV	PRESSURE REDUCING VALVE
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONING ENGINEERS	FSEC	FOOD SERVICE EQUIPMENT CONTRACTOR	PSAN	PUMPED SANITARY
ASR	AUTOMATIC SPRINKLER RISER	FT	FEET	PSI	POUNDS PER SQUARE INCH
ATD	AIR TRANSFER DUCT	FTR	FINNED TUBE RADIATION	PSIA	POUNDS PER SQUARE INCH - ABSOLUTE
AUX	AUXILIARY	FV	FACE VELOCITY	PSIG	POUNDS PER SQUARE INCH - GAUGE
AV	ACID VENT	G	NATURAL GAS	PW	PURIFIED WATER
AVTR	ACID VENT THROUGH ROOF	GA	GAUGE	PWR	PURIFIED WATER RETURN
AW	ACID WASTE	GAL	GALLON	PWS	PURIFIED WATER SUPPLY
BAS	BUILDING AUTOMATION SYSTEM	GRH	GRAVITY RELIEF HOOD	(R)	RELOCATED
BCU	BLOWER COIL UNIT	GPH	GALLONS PER HOUR	R	RETURN GRILLE OR REGISTER
BDD	BACKDRAFT DAMPER	GPM	GALLONS PER MINUTE	RA	RETURN AIR
BFF	BELOW FINISHED FLOOR	GSAN	GREASE SANITARY WASTE	RAT	RETURN AIR TEMPERATURE
BFP	BACKFLOW PREVENTER	H	HYDROGEN	RC	RAIN CONDUCTOR
BHP	BRAKE HORSEPOWER	HB	HOSE BIBB	RCP	RADIANT CEILING PANEL
BOD	BOTTOM OF DUCT	HC	HEATING COIL	RD	REQUIRED
BOP	BOTTOM OF PIPE	HD	HOT DECK	REF	REQUIRED
BTU	BRITISH THERMAL UNIT	HEPA	HIGH EFFICIENCY PARTICULATE ARRESTANCE	RF	ROOF EXHAUST FAN
BTUH	BRITISH THERMAL UNIT PER HOUR	HL	HIGH LIMIT	RF	RETURN FAN
BVC	BEVERAGE CONDUIT	HOA	HAND/OFF/AUTO	RH	RELATIVE HUMIDITY
BWV	BACKWASH VALVE	HP	HORSEPOWER	RL	REFRIGERANT LIQUID
C	COMMON	HP	HORSEPOWER	RLA	RELIEF AIR
CAP	CAPACITY	HPCW	HIGH PRESSURE DOMESTIC COLD WATER	RPW	REVOLUTIONS PER MINUTE
CAV	CONSTANT AIR VOLUME	HPHW	HIGH PRESSURE DOMESTIC HOT WATER	RPH	REDUCED PRESSURE BACKFLOW PREVENTION DETECTION ASSY
CB	CATCH BASIN	HPHWR	HIGH PRESSURE DOMESTIC HOT WATER RETURN	RPZA	REDUCED PRESSURE BACKFLOW PREVENTION ZONE ASSY
CC	COOLING COIL	HPL	HEAT PUMP LOOP	RS	REFRIGERANT SUCTION
CD	COLD DECK	HPLR	HEAT PUMP LOOP RETURN	RTU	ROOFTOP UNIT
CD	CONDENSATE DRAIN	HPLS	HEAT PUMP LOOP SUPPLY	S	SUPPLY AIR DIFFUSER OR GRILLE
CFD	CONTRACTOR FURNISHED, CONTRACTOR INSTALLED	HR	HOUR	SA	SOUND ATTENUATOR
CFH	CUBIC FEET PER HOUR	HTG	HEATING	SA	SUPPLY AIR
CFM	CUBIC FEET PER MINUTE	HV	HEATING VENTILATING	SAN	SANITARY WASTE
CH	CHILLER	HVA	HEATING, VENTILATING, AIR CONDITIONING	SAT	SUPPLY AIR TEMPERATURE
CHW	CHILLED WATER	HWH	HOT WATER HEATING	SECT	SECTION
CHWR	CHILLED WATER RETURN	HWR	HOT WATER HEATING RETURN	SCCR	SHORT CIRCUIT CURRENT RATING
CHWS	CHILLED WATER SUPPLY	HWS	HOT WATER HEATING SUPPLY	SF	SUPPLY FAN
CLS	COILING	HW	DOMESTIC HOT WATER	SF	SHOWER
CND	CONDENSATE (SPECIFIC PSIG)	HW	DOMESTIC HOT WATER (SPECIFIC TEMP °F)	SK	SINK
CND	CONDENSATE (SPECIFIC PSIG)	HWR	DOMESTIC HOT WATER RETURN	SMR	SNOW MELT RETURN
CO	CLEAN OUT	HZ	HERTZ	SNM	SNOW MELT SUPPLY
CO2	CARBON DIOXIDE	IAQ	INDOOR AIR QUALITY	SP	STATIC PRESSURE
CONT	CONTINUATION OR CONTINUED	ID	INSIDE DIAMETER	SPEC	SPECIFICATION
CONTR	CONTRACTOR	IE	INVERT ELEVATION	SPIR	SPRINKLER
CONV	CONVECTOR	IH	INTAKE HOOD	SQFT	SQUARE FOOT/SQUARE FEET
COP	COEFFICIENT OF PERFORMANCE	IN	INCHES	S/S	START/STOP
CP	CIRCULATING PUMP	IR	INFRARED HEATER	SK	SERVICE SINK
CRU	CONDENSATE RETURN UNIT	IR	INDIRECT WASTE	STD	STANDARD
CSS	CLINICAL SERVICE SINK	IW	INDIRECT WASTE	STK	STACK
CT	COOLING TOWER	J	JANITOR'S CLOSET	STM	STEAM
CUH	CABINET UNIT HEATER	JC	JOCKEY PUMP	STM	STEAM (SPECIFIC PSIG)
CW	CONDENSATE RETURN UNIT	KA	THOUSAND AMP	S/W	SUMMER/WINTER
CWF	CONDENSATE RETURN UNIT - FILTERED	KW	KILOWATT	SW	SWITCH
CWR	CONDENSATE WATER RETURN	KWH	KILOWATT-HOUR	T	TRANSFER GRILLE
CWS	CONDENSATE WATER SUPPLY	LAT	LEAVING AIR TEMPERATURE	TC	TEMPERATURE CONTROL
D&T	DRIP AND TRAP	LAB	LABORATORY	TC	TEMPERING COIL
DA	DISCHARGE AIR	LAV	LABORATORY	TC	TEMPERATURE CONTROL PANEL
DA	DISCHARGE AIR TEMPERATURE	LDB	LEAVING DRY BULB	TD	TRENCH DRAIN
DAT	DRY BULB	LBS	POUNDS	TEMP	TEMPERATURE
DDC	DIRECT DIGITAL CONTROL	LDB	LEAVING DRY BULB	TEMP	TEMPERATURE
DEG	DEGREE	LPC	LOW PRESSURE CONDENSATE	TH	TERMINAL HEATING
DFU	DRAINAGE FIXTURE UNITS	LPS	LOW PRESSURE STEAM	THA	TOTAL HEAT ABSORBED
DIA	DIAMETER	LPS	LOW PRESSURE STEAM	THR	TERMINAL HEATING RETURN
DMPR	DAMPER	LRA	LOCKED ROTOR AMPS	THR	TOTAL HEAT REJECTED
D/N	DAY/NIGHT	LWB	LEAVING WET BULB	THS	TERMINAL HEATING SUPPLY
DN	DOWN	LWT	LEAVING WATER TEMPERATURE	TPD	TEPID WATER
DNZ	DOWNSPOUT NOZZLE	MA	MIXED AIR	TSP	TOTAL STATIC PRESSURE
DT	DUCT SILENCER	MAT	MIXED AIR TEMPERATURE	(AIR) TU	(AIR) TERMINAL UNIT
DT	DRAIN TILE	MAU	MAKE-UP AIR UNIT	TV	TURNING VANES
DTC	DRAIN TILE CONNECTION	MAX	MAXIMUM	TW	TEMPERED WATER
DWH	DOMESTIC WATER HEATER	MBH	MILLION BRITISH THERMAL UNITS PER HOUR	TYP	TYPICAL
DWG	DRAWING	MCA	MEDICAL COMPRESSED AIR	UH	UNIT HEATER
(E)	EXISTING	MCA	MINIMUM CIRCUIT AMPACITY	UL	UNDERWRITER'S LABORATORY
EA	EXHAUST GRILLE OR REGISTER	MCC	MOTOR CONTROL CENTER	UN	UNLESS OTHERWISE NOTED
EA	EXHAUST AIR	MECH	MECHANICAL	UR	URINAL
EAT	ENTERING AIR TEMPERATURE	MEZZ	MEZZANINE	UV	UNIT VENTILATOR
EC	EXPANSION COMPENSATOR	MFR	MANUFACTURER	V	VALVE
ECUH	ELECTRIC CABINET UNIT HEATER	MH	MANHOLE	V	VENT
EDB	ENTERING DRY BULB	MI	MINIMUM	V	VACUUM
EER	ENERGY EFFICIENCY RATIO	MIN	MINIMUM	VAC	VACUUM
EES	EMERGENCY EYE WASH / SHOWER	MISC	MISCELLANEOUS	VAV	VARIABLE AIR VOLUME
EEW	EMERGENCY EYE WASH	MMBH	MILLION BRITISH THERMAL UNITS PER HOUR	VB	VACUUM BREAKER
EF	EXHAUST FAN	MOP	MAXIMUM OVERCURRENT PROTECTION	VD	VOLUME DAMPER (MANUALLY ADJUSTABLE)
EFF	EFFICIENCY	MPS	MOUNTED	VOL	VOLUME
EHC	ELECTRIC HEATING COIL	MTD	MOUNTED	VFC	VARIABLE FREQUENCY CONTROLLER
EJ	EXPANSION JOINT	MTR	MANUAL AIR VENT	VTR	VENT THROUGH ROOF
EL	ELEVATION	MV	MEDICAL VACUUM	VTU	VENTURI TERMINAL UNIT
ELEC	ELECTRICAL	MYAC	MEDICAL VACUUM	VUV	VERTICAL UNIT VENTILATOR
EMS	ENERGY MANAGEMENT SYSTEM	N	NITROGEN	W	WASTE
ERL	ENERGY RECOVERY LOOP	N2O	NITROUS OXIDE	W&V	WASTE AND VENT
ERLR	ENERGY RECOVERY LOOP RETURN	NZ	NOISE CRITERIA	W&VD	WASTE ANESTHETIC GAS DISPOSAL
ERLS	ENERGY RECOVERY LOOP SUPPLY	NC	NORMALLY CLOSED	WB	WET BULB
ERU	ENERGY RECOVERY UNIT	NC	NORMALLY CLOSED	WC	WATER CLOSET
ESH	EMERGENCY SHOWER	NCTC	NORMALLY CLOSED TIMED CLOSED	WC	WATER CLOSER
ESP	EXTERNAL STATIC PRESSURE	NCTO	NORMALLY CLOSED TIMED OPEN	WC	WATER COLUMN
EUH	ELECTRIC UNIT HEATER	NFPA	NATIONAL FIRE PROTECTION ASSOCIATION	WG	WATER GAUGE
EWB	ENTERING WET BULB	NOTC	NORMALLY OPEN TIMED CLOSED	WH	WALL HYDRANT
EWC	ELECTRIC WATER COOLER	NOTO	NORMALLY OPEN TIMED OPEN	WMSD	WASHING MACHINE SUPPLY AND DRAIN BOX
EWT	ENTERING WATER TEMPERATURE	NOT IN CONTRACT	NOT IN CONTRACT	WPD	WATER PRESSURE DROP
EXH	EXHAUST	NO	NORMALLY OPEN	WPT	WALL HYDRANT
F	FIRE PROTECTION	NOM	NOMINAL	WTR	WATER
F	DEGREES FAHRENHEIT	NPW	NON POTABLE COLD WATER	WTR	WATER
F&B	FACE AND BYPASS	O	OXYGEN	WTR	WATER
F&T	FLOAT AND THERMOSTATIC	OA	OUTSIDE AIR	ZVB	ZONE VALVE BOX
FA	FACE AREA	OAT	OUTSIDE AIR TEMPERATURE		
FOU	FAN COIL UNIT	OB	OPPOSED BLADE DAMPER		
		OC	ON CENTER/CENTER TO CENTER		
		OD	OUTSIDE DIAMETER		
		OED	OPEN ENDED DUCT		
		OFCD	OWNER FURNISHED, CONTRACTOR INSTALLED		
		OFOD	OWNER FURNISHED, OWNER INSTALLED		
		OL	OVERLOAD		
		ORD	OVERFLOW RAIN CONDUCTOR		
		ORD	OVERFLOW ROOF DRAIN		
		OS&Y	OUTSIDE SCREW AND YOKE		
		OY	OUTLET VELOCITY		
		OWS	OPERATOR WORKSTATION		

**TEMPERATURE CONTROL - PARTIAL SYMBOLS LIST**

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CARBON DIOXIDE SENSOR		OCCUPANCY SENSOR
	CARBON MONOXIDE SENSOR		PRESSURE TRANSMITTER
	DIFFERENTIAL PRESSURE TRANSMITTER		STATIC PRESSURE SENSOR OR PROBE
	FLOW METER		VALVE - 2 WAY CONTROL VALVE
	GUARD FOR STAT OR SENSOR		VALVE - 3 WAY CONTROL VALVE
	HUMIDISTAT OR HUMIDITY SENSOR (AS DEFINED ON TC DRAWINGS)		THERMOSTAT OR TEMPERATURE SENSOR (AS DEFINED ON TC DRAWINGS)

NOTE: LIST OF ADDITIONAL SYMBOLS & ABBREVIATIONS ASSOCIATED WITH TEMPERATURE CONTROLS ARE IDENTIFIED ON TC DRAWINGS.

**MECHANICAL SYMBOL LIST**

PIPING SYMBOLS		DUCTWORK SYMBOLS	
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	AIR VENT - AUTOMATIC		AIR TERMINAL UNIT
	AIR VENT - MANUAL		AIR TERMINAL UNIT WITH HEATING COIL
	BACKFLOW PREVENTER		VENTURI AIR TERMINAL UNIT
	CIRCULATING PUMP		VENTURI AIR TERMINAL UNIT WITH HEATING COIL
	CLEAN OUT - IN FLOOR		DAMPER - HORIZONTAL FIRE (EXISTING, NEW)
	CLEAN OUT - FLANGE		DAMPER - HORIZONTAL FIRE / SMOKE (EXISTING, NEW)
	DIRECTION OF PITCH - DOWN		DAMPER - SMOKE (EXISTING, NEW)
	FINNED TUBE RADIATION		DAMPER - VERTICAL FIRE (EXISTING, NEW)
	FIRE PROTECTION - SIAMESE CONNECTION - FREE STANDING		DAMPER - VERTICAL FIRE / SMOKE (EXISTING, NEW)
	FIRE PROTECTION - SIAMESE CONNECTION - WALL MOUNTED		DAMPER - BACK DRAFT
	FIRE PROTECTION - SPRINKLER HEAD, CONCEALED		DAMPER - MOTORIZED
	FIRE PROTECTION - SPRINKLER HEAD, PENDANT		DAMPER - VOLUME (MANUALLY ADJUSTABLE)
	FIRE PROTECTION - SPRINKLER HEAD, UPRIGHT		DIFFUSER - BLANK OFF
	FIRE PROTECTION - SPRINKLER HEAD, SIDEWALL		DIFFUSER - LINEAR SLOT
	FLOOR DRAIN		DIFFUSER - SQUARE OR RECTANGULAR
	FLOOR DRAIN - ELEVATION		DUCT CROSS SECTION - SUPPLY
	FLOOR DRAIN - FUNNEL		DUCT CROSS SECTION - RETURN
	FLOOR DRAIN - FUNNEL, ELEVATION		DUCT CROSS SECTION - EXHAUST
	FLOW MEASURING DEVICE (FOR TEST AND BALANCING)		DUCT - FLEXIBLE CONNECTION
	FLOW SWITCH		DUCT - FLEXIBLE DUCT
	FLOW METER		DUCT TAKE-OFF - ROUND CONICAL
	HOSE BIBB		DUCT TAKE-OFF - RECTANGULAR WITH SHOE TAP
	MANHOLE		ELBOW - RECTANGULAR WITH TURNING VANES
	OPEN SITE DRAIN		ELBOW - RECTANGULAR / ROUND SMOOTH RADIUS
	PIPE - ANCHOR		ELBOW DOWN - RECTANGULAR
	PIPE - CAP OR PLUG		ELBOW DOWN - ROUND
	PIPE - ELBOW DOWN		ELBOW UP - RECTANGULAR
	PIPE - EXPANSION JOINT OR COMPENSATOR		ELBOW UP - ROUND
	PIPE - FLANGE		FAN - AXIAL
	PIPE - HOSE AND BRAID FLEXIBLE CONNECTION		FAN - CENTRIFUGAL (ELEVATION)
	PIPE - RUBBER FLEXIBLE CONNECTION		HEATING COIL
	PIPE - TEE DOWN		INCLINED DROP IN DIRECTION OF AIRFLOW
	PIPE - TEE UP		INCLINED RISE IN DIRECTION OF AIRFLOW
	PIPE - UNION		INTAKE OR RELIEF HOOD
	PRESSURE AND TEMPERATURE TEST PLUG		REGISTER - RETURN OR EXHAUST
	PRESSURE GAUGE AND COCK		REGISTER - RETURN WITH BOOT
	REDUCER - CONCENTRIC		REGISTER - TRANSFER GRILLE
	REDUCER - ECCENTRIC		ROOF EXHAUST FAN
	ROOF/OVERFLOW DRAIN		TRANSITION - CONCENTRIC
	STEAM TRAP - FLOAT AND THERMOSTATIC		TRANSITION - ECCENTRIC
	STEAM TRAP - BUCKET		UNIT HEATER - HORIZONTAL THROW
	STRAINER		UNIT HEATER - VERTICAL THROW
	STRAINER WITH VALVE AND BLOW-OFF		SECTION OR PLAN NUMBER
	THERMOMETER		SECTION OR PLAN NUMBER
	TRAP		SECTION OR PLAN NUMBER
	VALVE - ANGLE		SECTION OR PLAN NUMBER

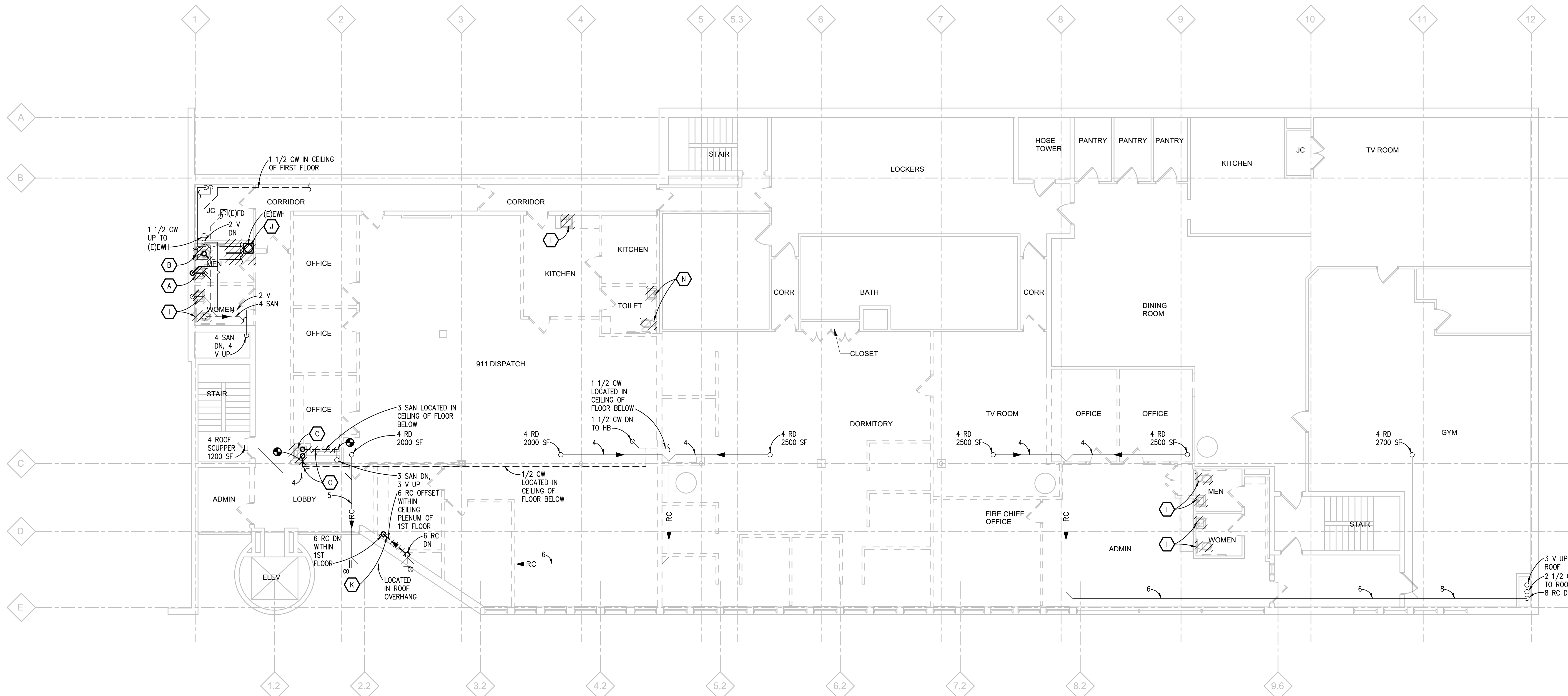


**MECHANICAL DEMOLITION GENERAL NOTES:**

1. ANY INTERRUPTION OF EXISTING SERVICES AND/OR EQUIPMENT SHALL BE PERFORMED AT A TIME APPROVED IN ADVANCE BY THE OWNER'S REPRESENTATIVE.
2. THESE DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL EXTENT OF THE WORK. ACTUAL ROUTING AND SIZES OF EXISTING PIPING AND DUCTWORK MIGHT DIFFER TO A LIMITED EXTENT FROM WHAT IS SHOWN. MAJOR DISCREPANCIES BETWEEN THE DRAWINGS AND ACTUAL EXISTING CONDITIONS SHALL BE REPORTED TO THE ENGINEER.
3. THE EXACT EXTENT OF DEMOLITION SHALL BE AS REQUIRED BY THE NEW WORK.
4. ALL MECHANICAL ITEMS TO BE REMOVED SHALL BE REMOVED COMPLETE, INCLUDING ALL RELATED ITEMS SUCH AS HANGERS, SUPPORTS, CONTROLS, ETC. CAP ALL OPEN ENDED PIPES AND DUCTWORK.

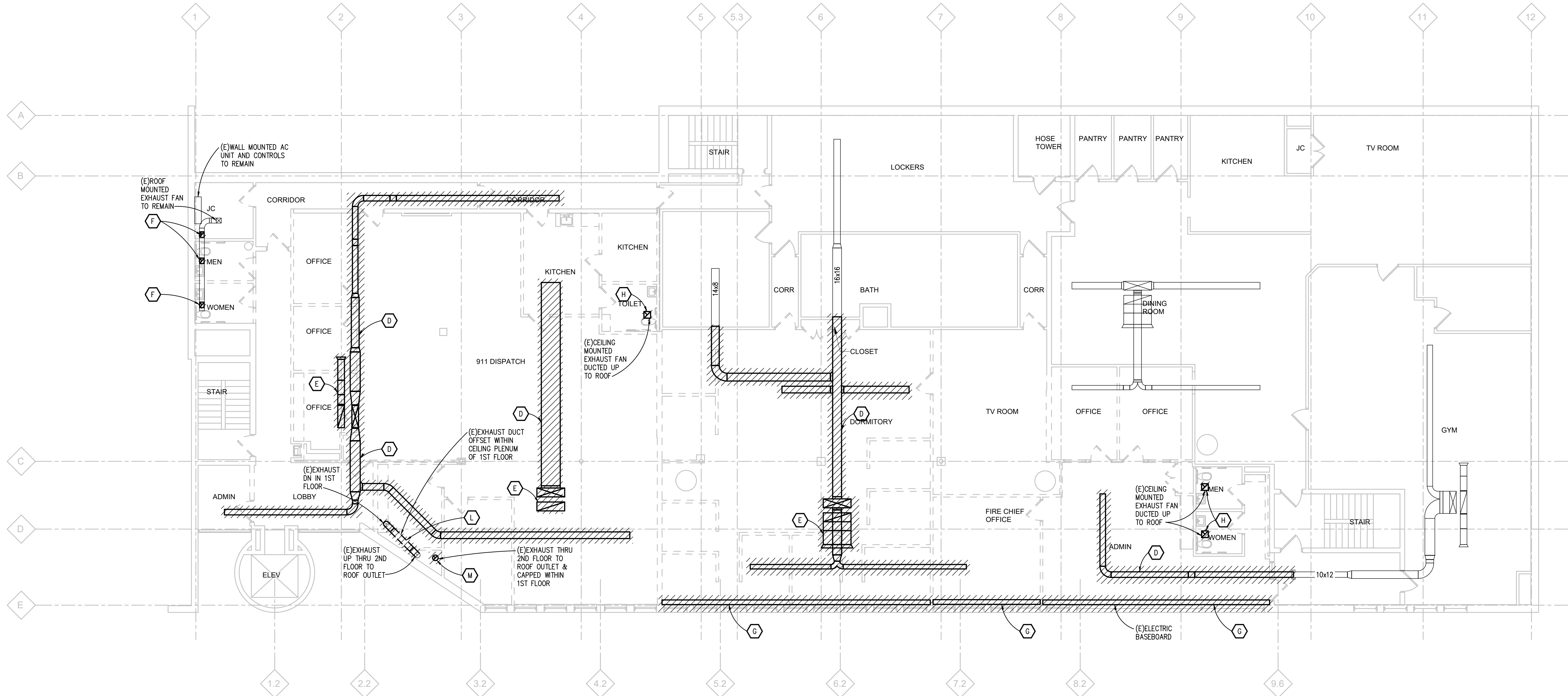
**DEMOLITION KEY NOTES:**

- A. REMOVE EXISTING LAVATORY, CARRIER, AND CAP PIPING BACK WITHIN WALL.
- B. REMOVE EXISTING WATER CLOSET AND PIPING AS REQUIRED TO FACILITATE NEW INSTALLATION OF JANITORS SINK. REFER TO NEW WORK PLANS.
- C. REMOVE EXISTING DRINKING FOUNTAIN, SUPPORTS, AND ASSOCIATED COMPONENTS COMPLETE. REMOVE EXISTING PIPING BACK TO MAINS AND CAP.
- D. REMOVE EXISTING SUPPLY AIR DUCTWORK, INSULATION, HANGERS, DAMPERS, AND ASSOCIATED DIFFUSERS BACK TO LOCATION INDICATED.
- E. REMOVE EXISTING RETURN AIR DUCTWORK, HANGERS, DAMPERS, AND ASSOCIATED COMPONENTS BACK TO LOCATION INDICATED.
- F. REMOVE EXISTING EXHAUST GRILLES AND DUCTWORK AS REQUIRED TO FACILITATE INSTALLATION OF NEW GRILLE.
- G. REMOVE EXISTING ELECTRIC PERIMETER FINNED TUBE RADIATION, ELECTRICAL CONNECTION, AND CONTROLS COMPLETE.
- H. REMOVE EXISTING CEILING MOUNTED EXHAUST FAN. PREPARE EXISTING DUCTWORK FOR NEW CONNECTION.
- I. REMOVE EXISTING PLUMBING FIXTURE COMPLETE. REMOVE ASSOCIATED PIPING AS REQUIRED TO FACILITATE THE INSTALLATION OF NEW FIXTURE, REFER TO NEW WORK PLANS.
- J. REMOVE AND RELOCATE EXISTING ELECTRIC DOMESTIC WATER HEATER, PIPING, AND ASSOCIATED COMPONENTS. REFER TO NEW WORK PLANS FOR NEW LOCATION.
- K. REMOVE EXISTING RAIN CONDUCTOR PIPING FROM ELBOW WITHIN THE 2ND FLOOR CEILING PLENUM DN TO THE 1ST FLOOR CEILING PLENUM. REMOVE PIPING OFFSETTING WITHIN 1ST FLOOR CEILING PLENUM BACK TO 1ST FLOOR RISER AND PREPARE RISER FOR NEW CONNECTION. 1ST FLOOR RISER IS TO REMAIN. CONTRACTOR TO VERIFY EXACT LOCATION AND ROUTE. REFER TO NEW WORK PLAN FOR INTENT OF WORK.
- L. REMOVE EXISTING EXHAUST DUCTWORK FROM ELBOW WITHIN THE 2ND FLOOR CEILING PLENUM DN TO THE 1ST FLOOR CEILING PLENUM. REMOVE DUCTWORK OFFSETTING WITHIN 1ST FLOOR CEILING PLENUM BACK TO 1ST FLOOR RISER AND PREPARE RISER FOR NEW CONNECTION. 1ST FLOOR RISER IS TO REMAIN. CONTRACTOR TO VERIFY EXACT LOCATION AND ROUTE. REFER TO NEW WORK PLAN FOR INTENT OF WORK.
- M. EXISTING DUCT IS CAPPED BELOW 1ST FLOOR CEILING. REMOVE EXISTING EXHAUST DUCT PASSING THROUGH 2ND FLOOR TO UNDERSIDE OF ROOF. CAP ROOF OUTLET WEATHERTIGHT. CONTRACTOR TO VERIFY EXACT LOCATION AND ROUTE.
- N. TEMPORARILY REMOVE EXISTING WATER CLOSET AND LAVATORY TO ALLOW FOR NEW CONSTRUCTION OF FIRE-RATED SHAFT WALL. RE-INSTALL IN PREVIOUS LOCATION.



**SECOND FLOOR PLUMBING DEMOLITION PLAN**

SCALE: 1/8" = 1' - 0"



**SECOND FLOOR SHEET METAL DEMOLITION PLAN**

SCALE: 1/8" = 1' - 0"

THE FOLLOWING DIMENSION EQUALS ONE INCH WHEN PRINTED TO SCALE.

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**PLUMBING GENERAL NOTES:**

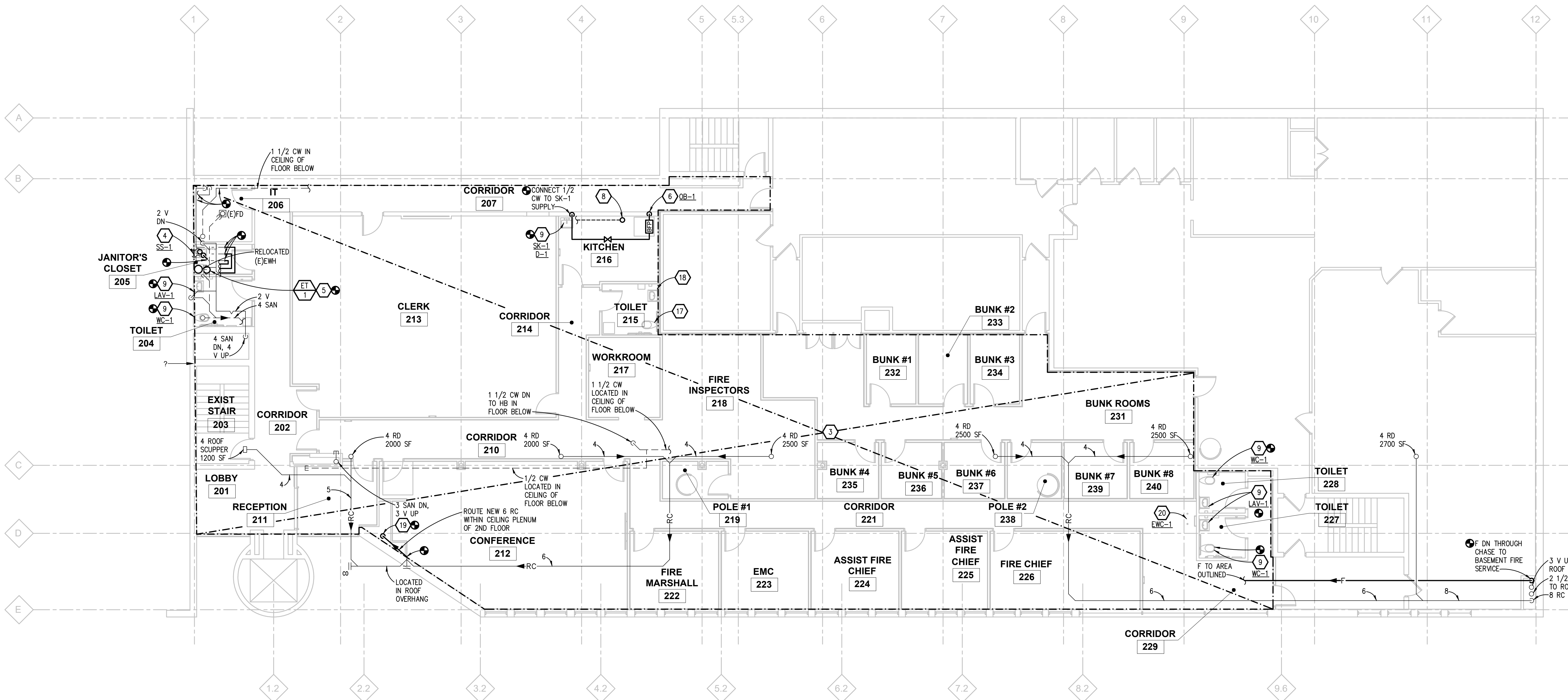
- THESE DRAWINGS ARE DIAGRAMMATIC, AND REPRESENT THE GENERAL INTENT AND ARRANGEMENT OF SYSTEMS. THEY ARE NOT TO BE CONSIDERED FABRICATION/COORDINATION/SHOP DRAWINGS. COORDINATION WITH OTHER TRADES IS REQUIRED. PROVIDE THE ADDITIONAL FITTINGS AND OFFSETS THAT WILL BE REQUIRED TO COMPLETE EACH SYSTEM AND TO AVOID INTERFERENCES WITH ALL OTHER SYSTEMS INCLUDING THE STRUCTURE, SHEET METAL, OTHER PIPING SYSTEMS, ELECTRICAL CONDUITS, BUS DUCTS, CABLE TRAY, LIGHT FIXTURES, ETC. AND/OR OTHER SPACE CONSTRAINTS.
- INSTALL SYSTEMS SUCH THAT REQUIRED CLEARANCE AND SERVICE ACCESS SPACE IS PROVIDED AROUND ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AND AROUND ANY COMPONENTS WHICH REQUIRE SERVICE ACCESS.
- PIPING SHALL NOT BE INSTALLED ABOVE ELECTRICAL TRANSFORMERS, SWITCHBOARDS, PANELBOARDS OR MOTOR CONTROL CENTERS.
- COORDINATE AND PROVIDE ACCESS DOORS WITHIN INACCESSIBLE CEILING, SHAFT, AND CHASE AREAS FOR ALL COMPONENTS WHICH REQUIRE SERVICE ACCESS. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING TYPES.
- PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL SYSTEMS.
- REFER TO ARCHITECTURAL PLANS FOR DIMENSIONED LOCATIONS OF PLUMBING FIXTURES.
- HOT AND COLD WATER PIPING RUN-OUTS TO LAVATORIES AND SINKS SHALL BE 1/2" UNLESS OTHERWISE NOTED.
- PLUMBING VENT PIPING THROUGH ROOF SHALL BE LOCATED A MINIMUM OF 10'-0" FROM ANY FRESH AIR INTAKE LOCATION AND A MINIMUM OF 18" CLEAR FROM THE INSIDE FACE OF PARAPET.
- PROVIDE CODE REQUIRED CLEARANCE FOR ALL CLEANOUTS INSTALLED IN SANITARY WASTE AND VENT PIPING.

**SHEET METAL GENERAL NOTES:**

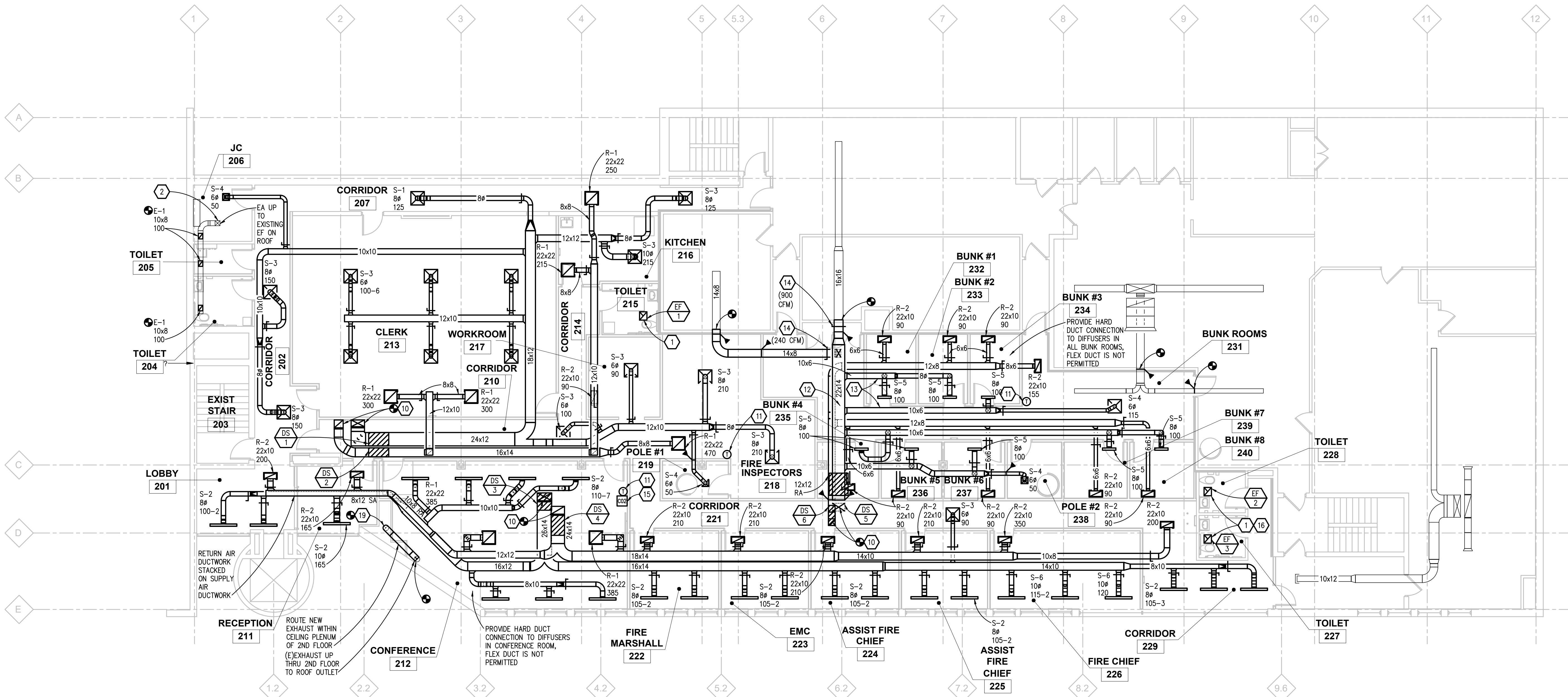
- THESE DRAWINGS ARE DIAGRAMMATIC, AND REPRESENT THE GENERAL INTENT AND ARRANGEMENT OF SYSTEMS. THEY ARE NOT TO BE CONSIDERED FABRICATION/COORDINATION/SHOP DRAWINGS. COORDINATION WITH OTHER TRADES IS REQUIRED. PROVIDE THE ADDITIONAL FITTINGS AND OFFSETS THAT WILL BE REQUIRED TO COMPLETE EACH SYSTEM AND TO AVOID INTERFERENCES WITH ALL OTHER SYSTEMS INCLUDING THE STRUCTURE, PIPING SYSTEMS, ELECTRICAL CONDUITS, BUS DUCTS, CABLE TRAY, LIGHT FIXTURES, ETC. AND/OR OTHER SPACE CONSTRAINTS.
- INSTALL SYSTEMS SUCH THAT REQUIRED CLEARANCE AND SERVICE ACCESS SPACE IS PROVIDED AROUND ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AND AROUND ANY COMPONENTS WHICH REQUIRE SERVICE ACCESS.
- PIPING AND DUCTWORK SHALL NOT BE INSTALLED ABOVE ELECTRICAL TRANSFORMERS, SWITCHBOARDS, PANELBOARDS OR MOTOR CONTROL CENTERS.
- COORDINATE AND PROVIDE ACCESS DOORS WITHIN INACCESSIBLE CEILING, SHAFT, AND CHASE AREAS FOR ALL COMPONENTS WHICH REQUIRE SERVICE ACCESS. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING TYPES.
- PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL SYSTEMS.
- REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR DIMENSIONED LOCATION OF GRILLES, REGISTERS, AND DIFFUSERS.
- REFER TO TEMPERATURE CONTROLS STANDARD MOUNTING HEIGHTS DETAIL FOR ELEVATIONS OF WALL MOUNTED TEMPERATURE DEVICES.

**CONSTRUCTION KEY NOTES:**

- RECONNECT OUTLET OF FAN TO EXISTING DUCT THRU ROOF.
- REBALANCE EXISTING ROOF MOUNTED EXHAUST FAN TO 350 CFM.
- IN AREA OUTLINED, PROVIDE WET PIPE FIRE PROTECTION SYSTEM IN ACCORDANCE WITH NFPA 13.
- ROUTE 1/2 CW, 1/2 HW, AND 3 SAN FROM MAINS IN CEILING OF 1ST FLOOR TO NEW SERVICE SINK.
- CONNECT NEW ET-1 AND VALVES TO EXISTING WATER HEATER. REFER TO DETAIL ON M-601.
- ROUTE 1/2 CW TO REFRIGERATOR OUTLET BOX BEHIND LOCATION OF REFRIGERATOR. PROVIDE BACKFLOW PREVENTOR AND ISOLATION VALVE ABOVE CEILING. COORDINATE EXACT LOCATION OF OUTLET WITH ARCHITECT AND OWNER.
- RECONNECT EXISTING SUPPLY AIR DIFFUSERS TO NEW DUCT MAIN.
- CONNECT 1/2 HW TO SINK AND ROUTE PIPING UNDER COUNTER TO LOCATION OF COUNTER MOUNTED COFFEE MAKER, COORDINATE EXACT LOCATION WITH ARCHITECT AND OWNER.
- RECONNECT NEW PLUMBING FIXTURE TO EXISTING PIPING. MODIFY AND EXTEND PIPING AS REQUIRED TO FACILITATE THE INSTALLATION OF NEW FIXTURE.
- MODIFY AND EXTEND EXISTING ROOF TOP CONNECTION TO FACILITATE NEW CONNECTION TO EXISTING ROOF TOP.
- NEW ROOF TOP UNIT THERMOSTAT.
- ROUTE TIGHT TO BOTTOM OF DECK.
- ROUTE THROUGH OPEN WEB JOIST.
- BALANCE DAMPER TO AIRFLOW INDICATED.
- NEW CO2 SENSOR FOR ASSOCIATED EXISTING RTU.
- REPAIR EXISTING DRYWALL CEILING TO MATCH EXISTING AS REQUIRED FOR INSTALLATION OF NEW FAN.
- TEMPORARILY REMOVE AND RE-INSTALL WATER CLOSET TO ALLOW FOR CONSTRUCTION OF FIRE-RATED SHAFT WALL. PROVIDE NEW BOLT CAPS.
- TEMPORARILY REMOVE AND RE-INSTALL LAVATORY TO ALLOW FOR NEW CONSTRUCTION OF FIRE-RATED SHAFT WALL. REPLACE TRAP AND SANITARY PIPING AND PROVIDE NEW PROTECTIVE SHIELDING PIPING ENCLOSURES.
- CONNECT NEW RAIN CONDUCTOR PIPING TO EXISTING RAIN CONDUCTOR RISER WITHIN 1ST FLOOR. MATCH EXISTING PIPING MATERIAL.
- CONNECT 1/2 CW, 1/2 VENT AND 1 1/2 SAN FROM EXISTING PLUMBING WITHIN WALL TO CWC.



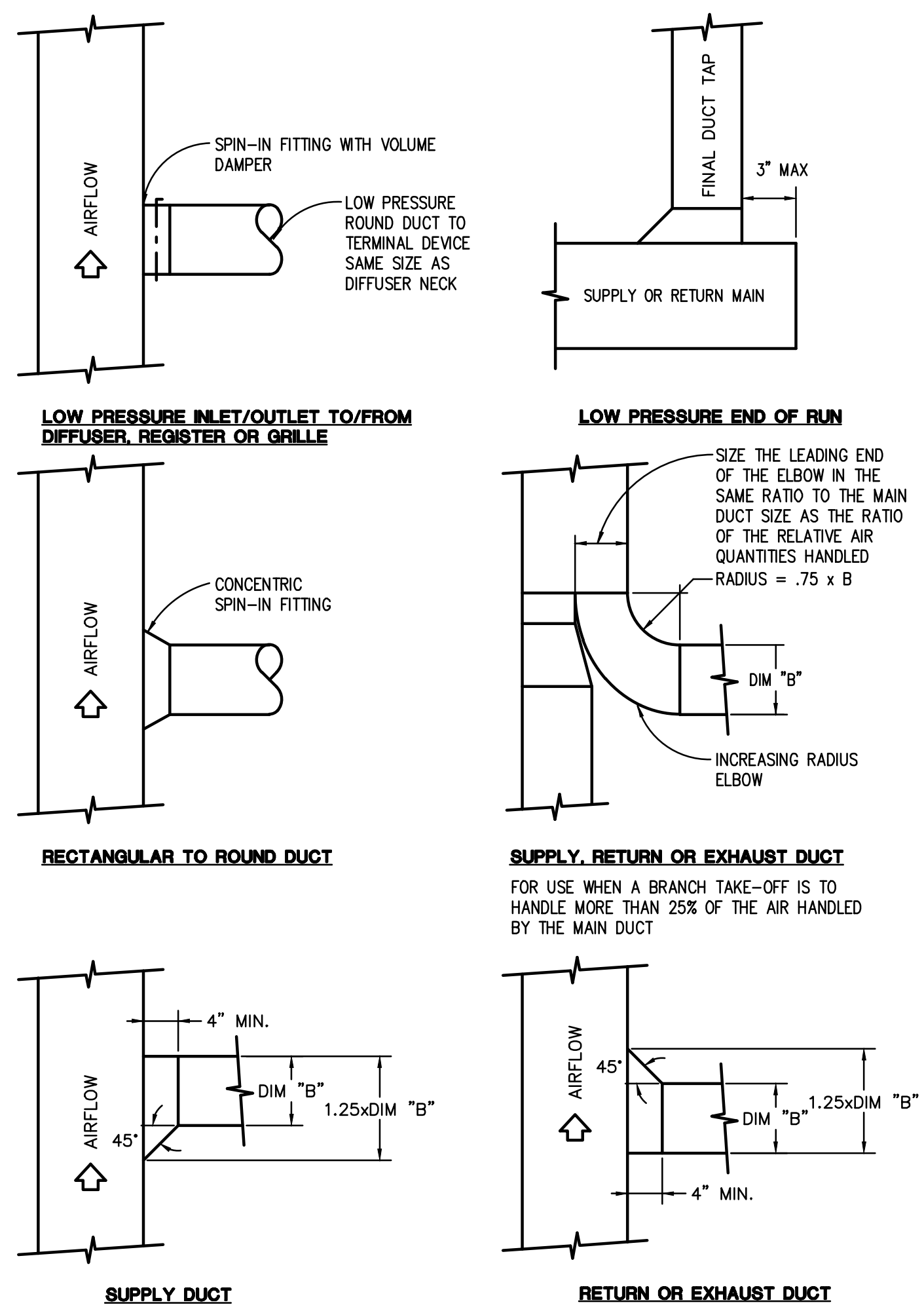
**SECOND FLOOR PLUMBING PLAN**  
SCALE: 1/8" = 1'-0"



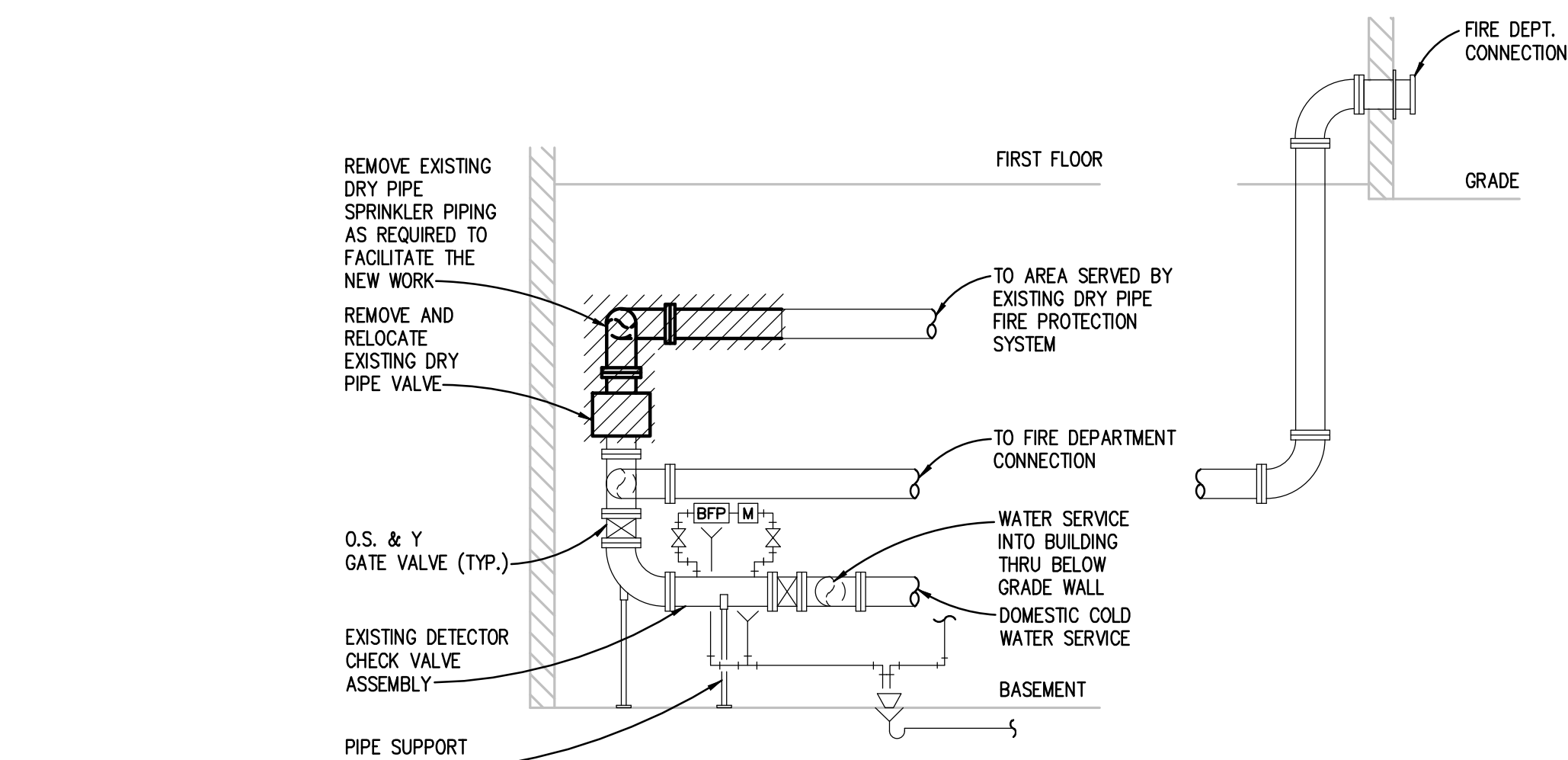
**SECOND FLOOR SHEET METAL PLAN**  
SCALE: 1/8" = 1'-0"

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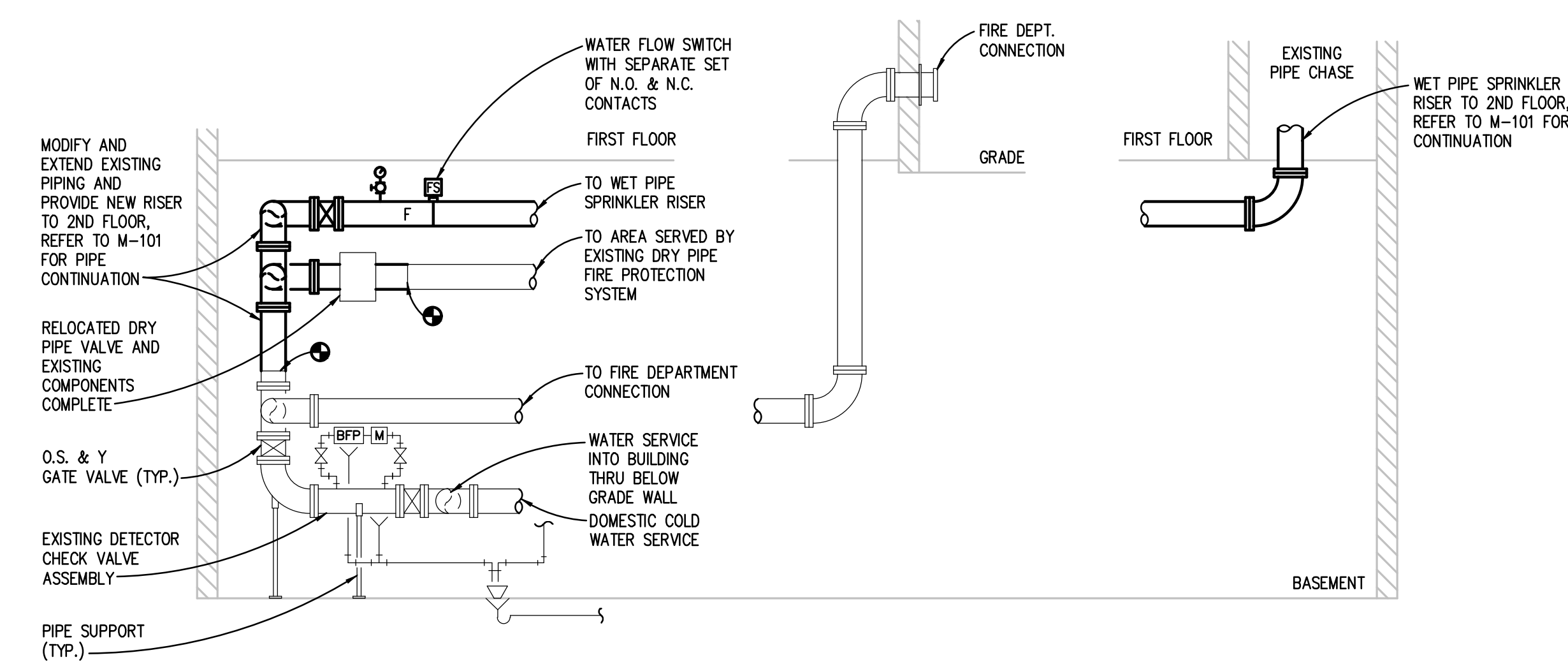
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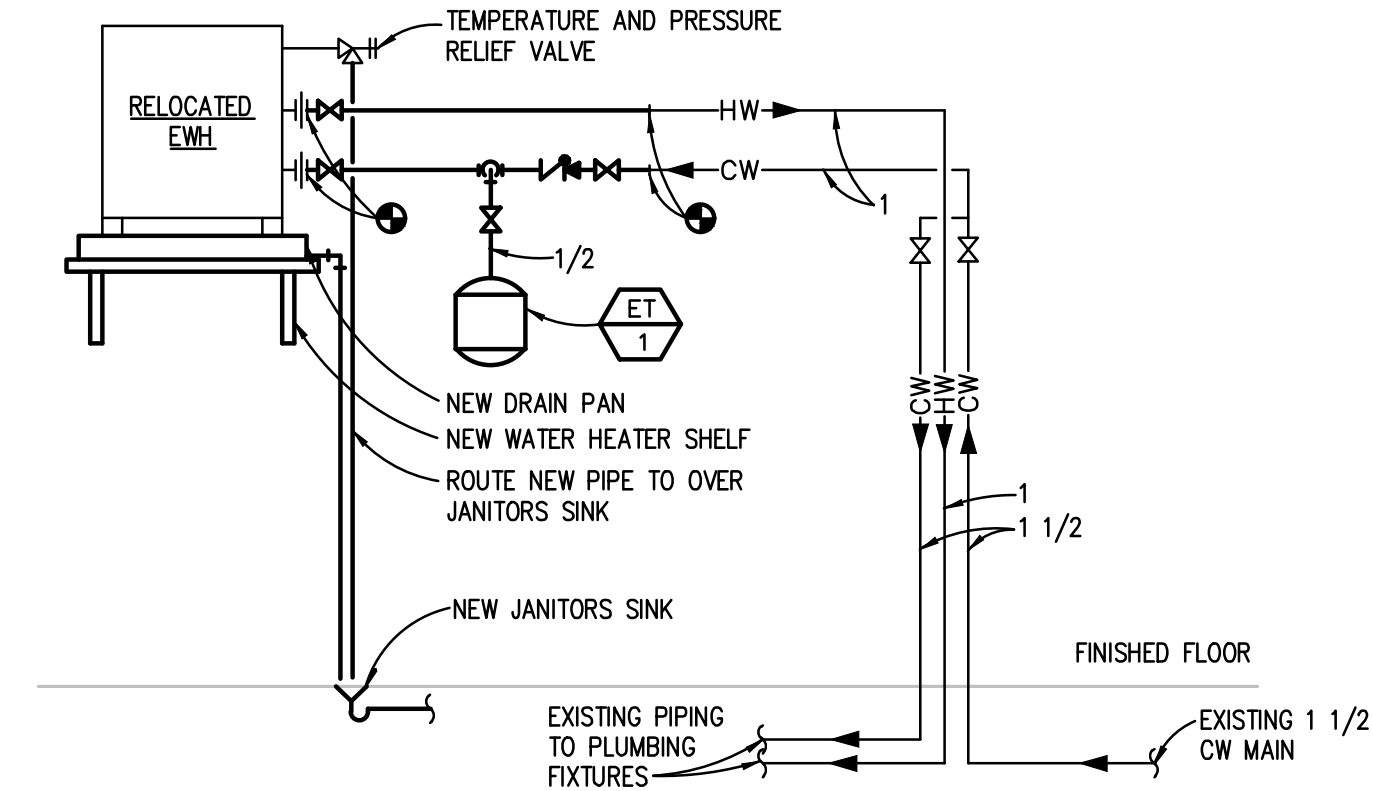
**RECTANGULAR DUCT BRANCH TAKE-OFF DETAILS**  
NO SCALE



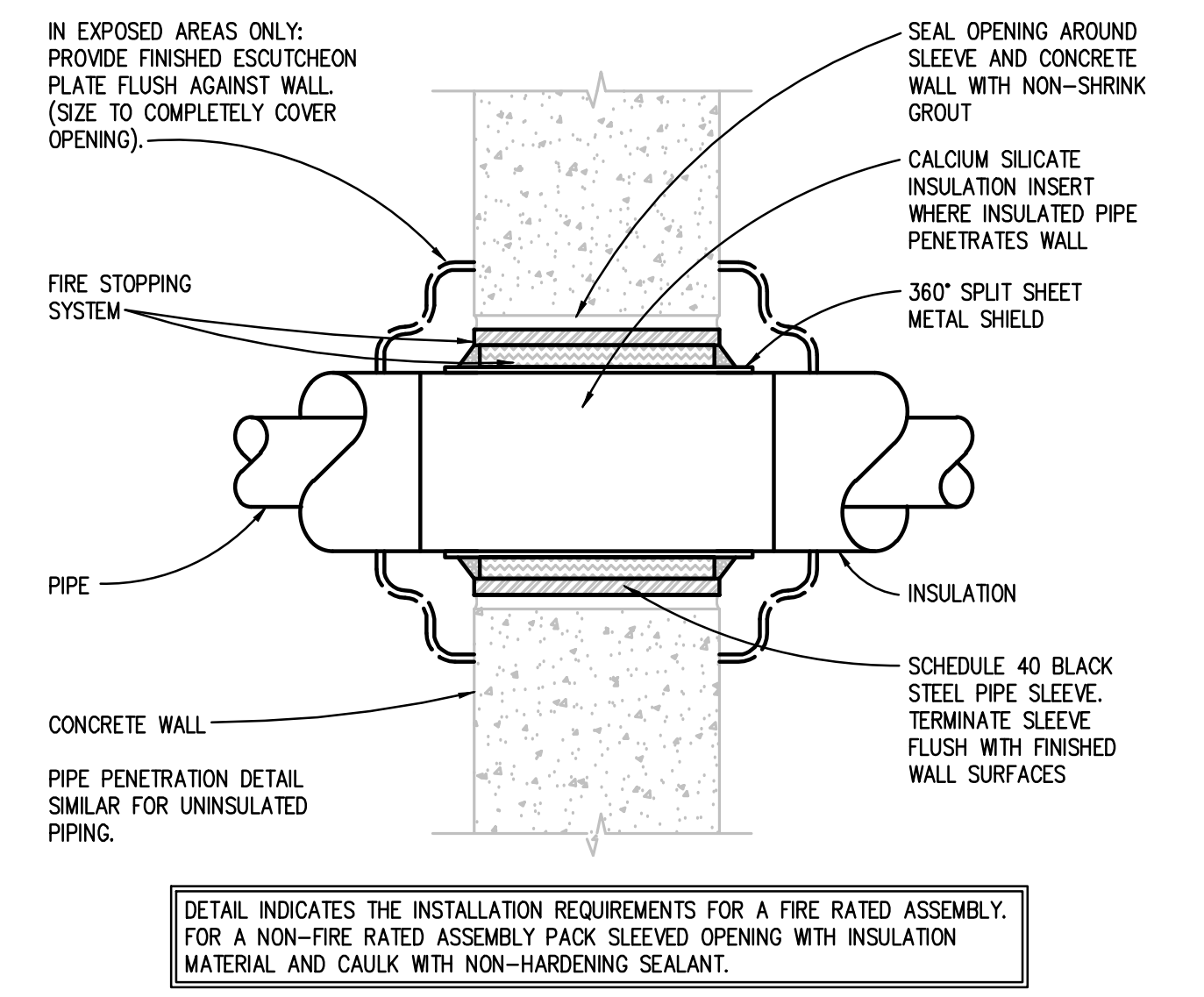
**DEMOLITION AUTOMATIC SPRINKLER RISER PIPING DIAGRAM**  
NO SCALE



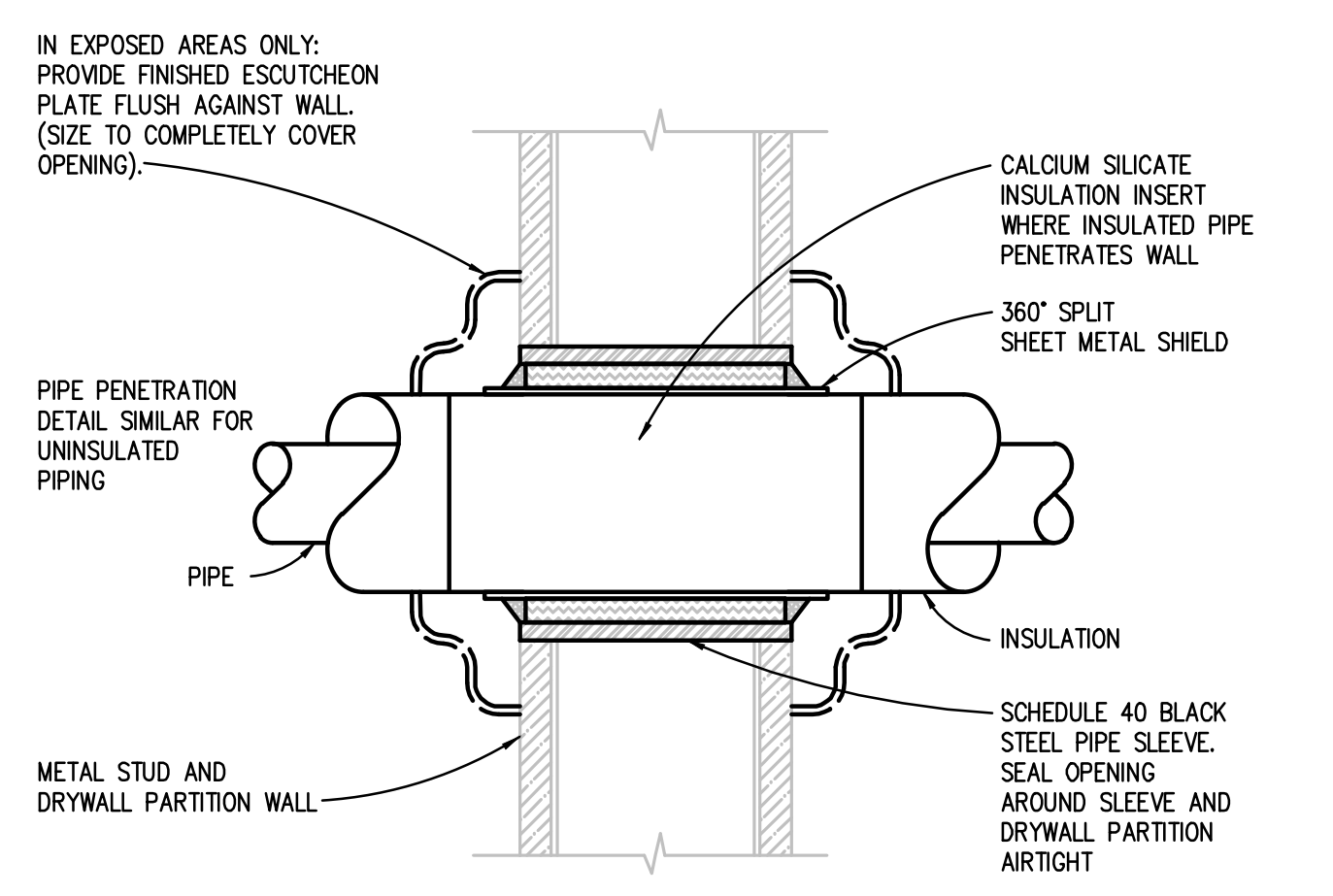
**NEW WORK AUTOMATIC SPRINKLER RISER PIPING DIAGRAM**  
NO SCALE



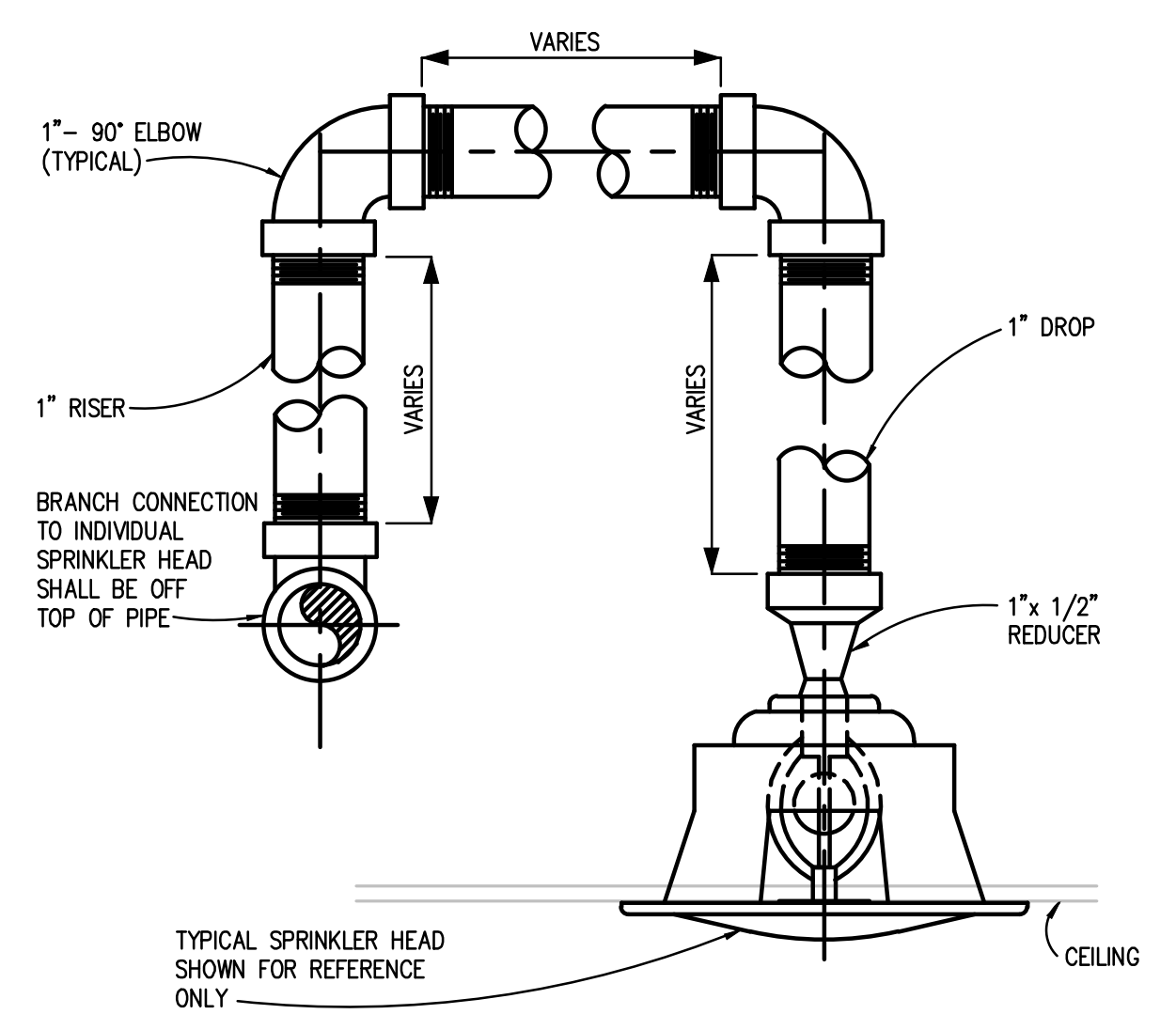
**ELECTRIC WATER HEATER PIPING DIAGRAM**  
NO SCALE



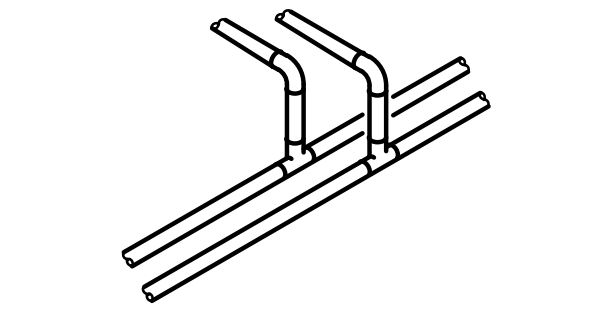
**FIRE RATED AND NON-FIRE RATED POURED CONCRETE OR BLOCK WALL PIPE PENETRATION DETAIL**  
NO SCALE



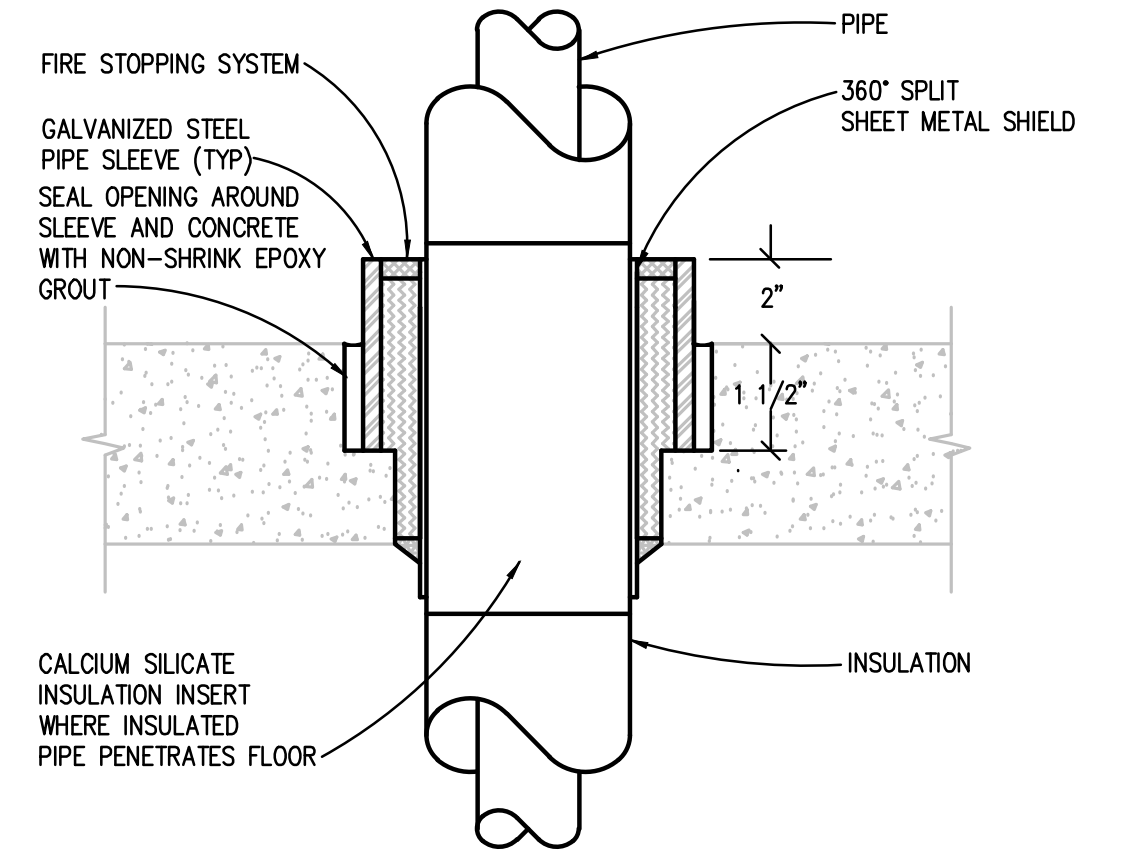
**FIRE RATED AND NON-FIRE RATED METAL STUD AND DRYWALL PARTITION WALL PIPE PENETRATION DETAIL**  
NO SCALE



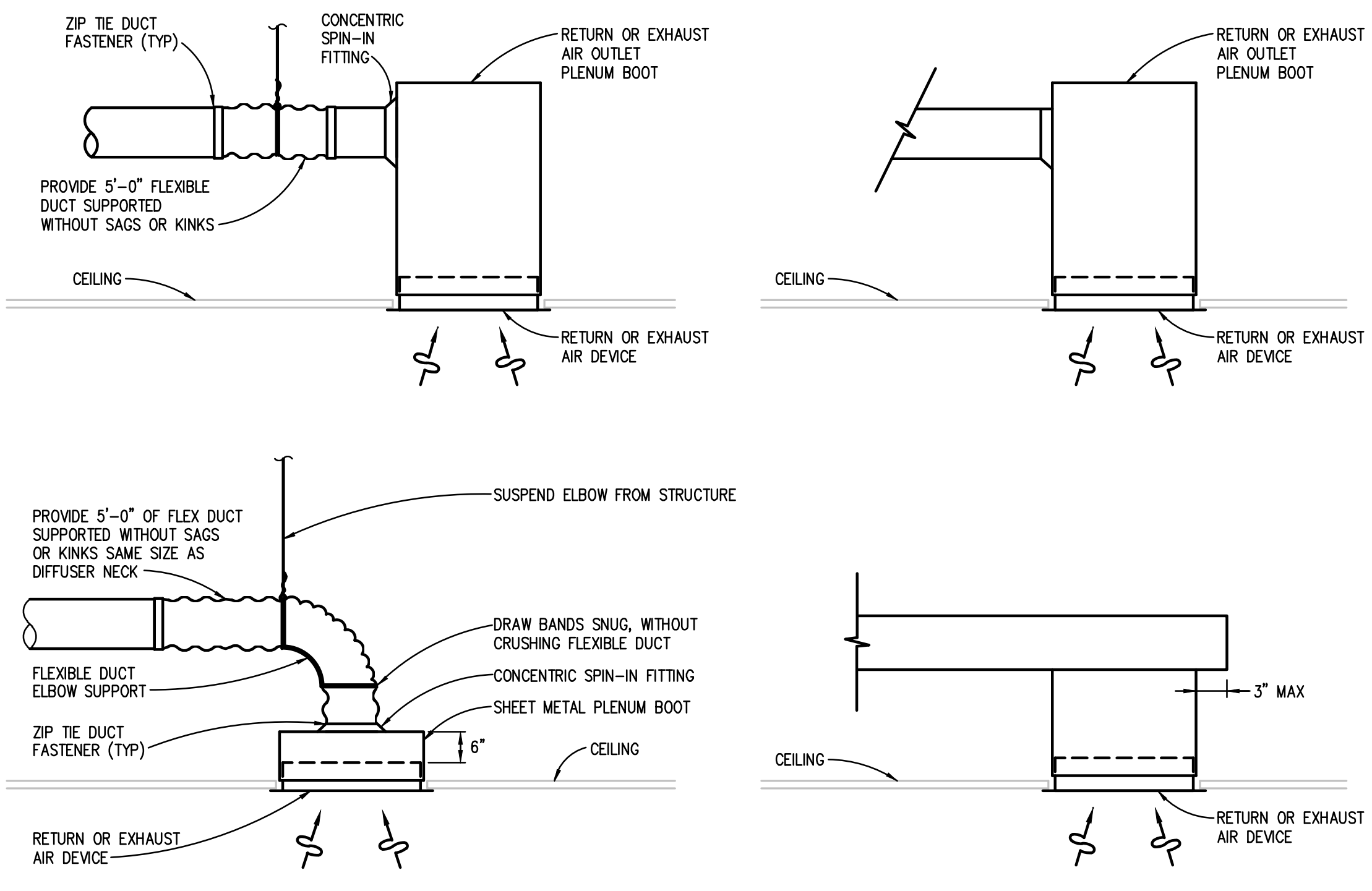
**TYPICAL SPRINKLER PIPING DETAIL**  
NO SCALE



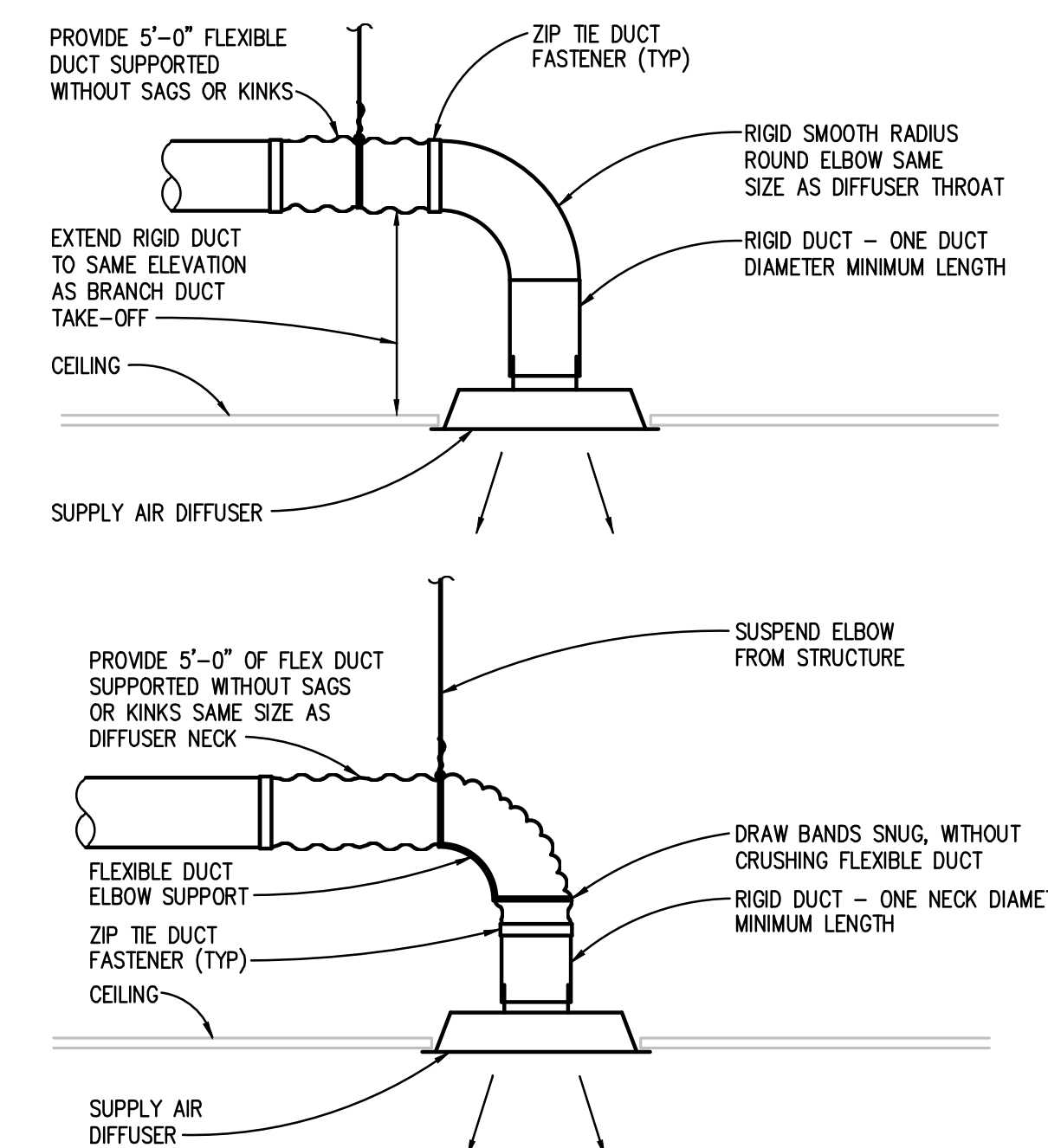
**TYPICAL BRANCH TAKE-OFF CONNECTION PIPING DETAIL**  
NO SCALE



**EXISTING FLOOR PIPE PENETRATION DETAIL**  
NO SCALE



**RETURN OR EXHAUST AIR DEVICE INSTALLATION DETAIL**  
NO SCALE  
NOTE: PAINT INTERIOR SURFACE OF PLENUM BOX FLAT BLACK.



**ROUND NECK SUPPLY AIR DIFFUSER DETAIL**  
NO SCALE

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**TEMPERATURE CONTROL - SYMBOLS LIST**

**SCHEMATIC SYMBOLS**

SYMBOL	DESCRIPTION
[AFC]	AIR FLOW CONTROLLER
[AQ]	AQUASTAT, STRAP ON BULB
[CO2]	CARBON DIOXIDE SENSOR - WALL MOUNTED
[CO2]	CARBON DIOXIDE SENSOR - DUCT MOUNTED
[CO]	CARBON MONOXIDE SENSOR - WALL MOUNTED
[CO]	CARBON MONOXIDE SENSOR - DUCT MOUNTED
[CS]	CURRENT SWITCH
[CT]	CURRENT TRANSMITTER
[D]	DAMPER - INLET VANES
[D]	DAMPER - OPPOSED BLADE
[D]	DAMPER - PARALLEL BLADE
[M]	DAMPER MOTOR
[M]	DAMPER MOTOR W/ POSITIVE POSITIONER
[DPT]	DIFFERENTIAL PRESSURE TRANSMITTER
[DPS]	DIFFERENTIAL PRESSURE SWITCH
[EP]	ELECTRIC-PNEUMATIC RELAY
[EPT]	ELECTRIC TO PNEUMATIC TRANSDUCER
[CM]	FIRE ALARM SYSTEM, ADDRESSABLE CONTROL MODULE
[IM]	FIRE ALARM SYSTEM, ADDRESSABLE INTERFACE MODULE
[FMS]	FLOW MEASURING STATION
[FM]	FLOW METER
[FS]	FLOW SWITCH
[FZ]	FREEZE/STAT
[F]	GAUGE - FLOW
[P]	GAUGE - PRESSURE
[T]	GAUGE - TEMPERATURE
[G]	GUARD FOR STAT OR SENSOR
[H]	HUMIDIFIER
[H]	HUMIDISTAT OR HUMIDITY SENSOR (AS DEFINED ON TC DRAWINGS)
[H]	HUMIDITY SENSOR, DUCT MOUNTED
[LVL]	LEVEL SWITCH OR TRANSMITTER
[LS]	LIMIT SWITCH
[L]	LINE - ELECTRIC
[L]	LINE - PNEUMATIC
[M]	MAIN CONTROL AIR SUPPLY
[MS]	MOTOR STARTER
[OS]	OCCUPANCY SENSOR
[P]	PILOT LIGHT OR BEACON R - RED LENS A - AMBER LENS B - BLUE LENS G - GREEN LENS
[PE]	PNEUMATIC-ELECTRIC SWITCH
[PS]	PRESSURE SWITCH
[PT]	PRESSURE TRANSMITTER
[R]	RELAY, ELECTRIC
[N]	SELECTOR SWITCH, (N=NUMBER OF POSITIONS)
[A]	SIGNAL - DDC/BAS, ANALOG INPUT
[AO]	SIGNAL - DDC/BAS, ANALOG OUTPUT
[D]	SIGNAL - DDC/BAS, DIGITAL INPUT
[DO]	SIGNAL - DDC/BAS, DIGITAL OUTPUT
[A]	SIGNAL - PACKAGED EQUIPMENT, ANALOG INPUT
[AO]	SIGNAL - PACKAGED EQUIPMENT, ANALOG OUTPUT
[D]	SIGNAL - PACKAGED EQUIPMENT, DIGITAL INPUT
[DO]	SIGNAL - PACKAGED EQUIPMENT, DIGITAL OUTPUT

**NOTES:**

- SOME SYMBOLS & ABBREVIATIONS SHOWN MAY NOT APPLY TO THIS PROJECT.
- REFER TO MECHANICAL STANDARDS ON DRAWING M0.1 FOR ADDITIONAL SYMBOLS & ABBREVIATIONS THAT MAY BE USED ON TEMPERATURE CONTROL DRAWINGS.

**SCHEMATIC SYMBOLS (CONT.)**

SYMBOL	DESCRIPTION
[DD]	SMOKE DETECTOR - DUCT MOUNTED
[SD]	SMOKE DETECTOR - SPACE MOUNTED
[S/S]	START/STOP RELAY
[SPT]	STATIC PRESSURE TRANSMITTER
[SP]	STATIC PRESSURE SENSOR OR PROBE
[SW]	SWITCH
[T]	TEMPERATURE SENSOR - RIGID ELEMENT IN WELL
[T]	TEMPERATURE SENSOR - STRAP ON BULB
[T]	TEMPERATURE SENSOR - DUCT MOUNTED AVG ELEMENT
[T]	TEMPERATURE SENSOR - DUCT MOUNTED RIGID ELEMENT
[T]	THERMOSTAT OR TEMPERATURE SENSOR (AS DEFINED ON TC DRAWINGS)
[T <sub>N</sub> ]	THERMOSTAT FOR NIGHT SETBACK
[XF]	TRANSFORMER
[2V]	VALVE - 2 WAY CONTROL VALVE
[3V]	VALVE - 3 WAY CONTROL VALVE
[2V/M]	VALVE - 2 WAY CONTROL W/ POSITIONER
[3V/M]	VALVE - 3 WAY CONTROL W/ POSITIONER
[VFC]	VARIABLE FREQUENCY CONTROLLER
[VS]	VELOCITY SENSOR
[VIB]	VIBRATION SWITCH
[V]	VOLTAGE SENSOR

**WIRING SYMBOLS**

SYMBOL	DESCRIPTION
[A]	AUDIBLE DEVICE (AS DEFINED ON TC DRAWINGS)
[M/S]	COIL - MOTOR STARTER CONTACTOR
[R]	COIL - RELAY
[TRP]	COIL - TIME DELAY RELAY
[VFC]	COIL - VARIABLE SPEED DRIVE CONTACTOR
[V]	COIL - EP OR SOLENOID VALVE
[I]	CONTACT - INSTANT OPERATING, NO
[I]	CONTACT - INSTANT OPERATING, NC
[T]	CONTACT - TIMED AFTER COIL IS ENERGIZED, NOTC
[T]	CONTACT - TIMED AFTER COIL IS ENERGIZED, NCTO
[T]	CONTACT - TIMED AFTER COIL IS DE-ENERGIZED, NOTO
[T]	CONTACT - TIMED AFTER COIL IS DE-ENERGIZED, NCTO
[G]	GROUND
[M]	MOTOR, SINGLE PHASE
[R]	PILOT LIGHT OR BEACON R - RED LENS A - AMBER LENS B - BLUE LENS G - GREEN LENS
[R]	PILOT LIGHT, WITH PUSH-TO-TEST
[I]	PUSH BUTTON - MOMENTARY CONTACT, NO
[I]	PUSH BUTTON - MOMENTARY CONTACT, NC
[I]	PUSH BUTTON - MOMENTARY CONTACT, NO & NC
[I]	PUSH BUTTON - MOMENTARY, NO (MUSHROOM HEAD)
[I]	PUSH BUTTON - MOMENTARY, NC (MUSHROOM HEAD)

**WIRING SYMBOLS (CONT.)**

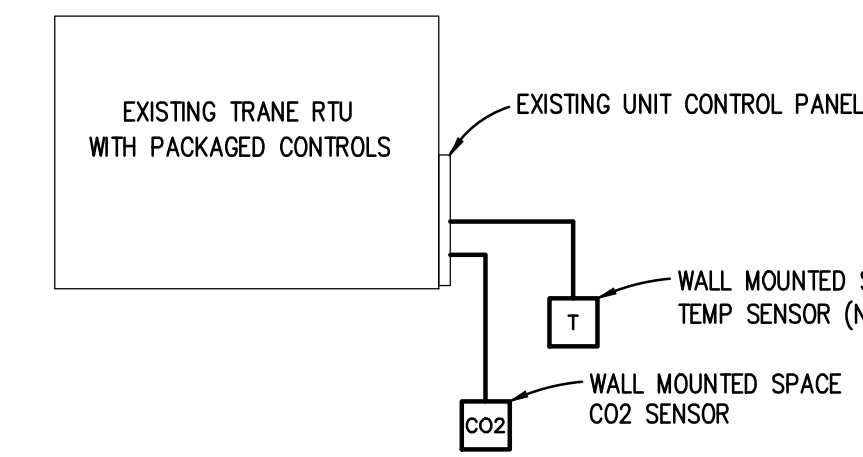
SYMBOL	DESCRIPTION
[1 2]	SWITCH - 2 POSITION SELECTOR
[H 0 A]	SWITCH - 3 POSITION SELECTOR HAND/OFF/AUTO
[I]	SWITCH - FLOW (AIR, WATER, ETC.), NO
[I]	SWITCH - FLOW (AIR, WATER, ETC.), NC
[I]	SWITCH - LIMIT, NO
[I]	SWITCH - LIMIT, NO, HELD CLOSED
[I]	SWITCH - LIMIT, NC
[I]	SWITCH - LIMIT, NC, HELD OPEN
[I]	SWITCH - LIQUID LEVEL, NO
[I]	SWITCH - LIQUID LEVEL, NC
[I]	SWITCH - MANUAL SPST, NO
[I]	SWITCH - MANUAL DPST, NO
[I]	SWITCH - MANUAL SPST, NC
[I]	SWITCH - MANUAL DPST, NC
[I]	SWITCH - MANUAL SPDT
[I]	SWITCH - MANUAL DPDT
[I]	SWITCH - PRESSURE & VACUUM, NO
[I]	SWITCH - PRESSURE & VACUUM, NC
[I]	SWITCH - TEMPERATURE ACTUATED, NO
[I]	SWITCH - TEMPERATURE ACTUATED, NC
[I]	THERMAL OVERLOAD, SINGLE PHASE
[I]	THERMAL OVERLOAD CONTACTS - 3 PHASE
[XF]	TRANSFORMER
[I]	WIRE TERMINATION AT DEVICE
[I]	WIRING NOT CONNECTED

**ABBREVIATIONS**

ABBREVIATION	DESCRIPTION
BAS	BUILDING AUTOMATION SYSTEM
DDC	DIRECT DIGITAL CONTROL
TC	TEMPERATURE CONTROLS
NO	NORMALLY OPEN
NC	NORMALLY CLOSED
NOTO	NORMALLY OPEN TIMED OPEN
NOTC	NORMALLY OPEN TIMED CLOSED
NCTO	NORMALLY CLOSED TIMED OPEN
NCTC	NORMALLY CLOSED TIMED CLOSED
SPST	SINGLE POLE SINGLE THROW
SPDT	SINGLE POLE DOUBLE THROW
DPST	DOUBLE POLE SINGLE THROW
DPDT	DOUBLE POLE DOUBLE THROW

**PNEUMATIC CONTROL SYMBOLS (ADDITIONAL)**

SYMBOL	DESCRIPTION
[LA]	LOAD ANALYZER
[LR]	LOW PRESSURE SELECTOR RELAY
[G]	MANUAL GRADUAL POSITION SWITCH
[PS]	PNEUMATIC SWITCH
[RR]	RATIO RELAY
[RC]	RECEIVER CONTROLLER
[X]	SWITCHED CONTROL AIR SUPPLY

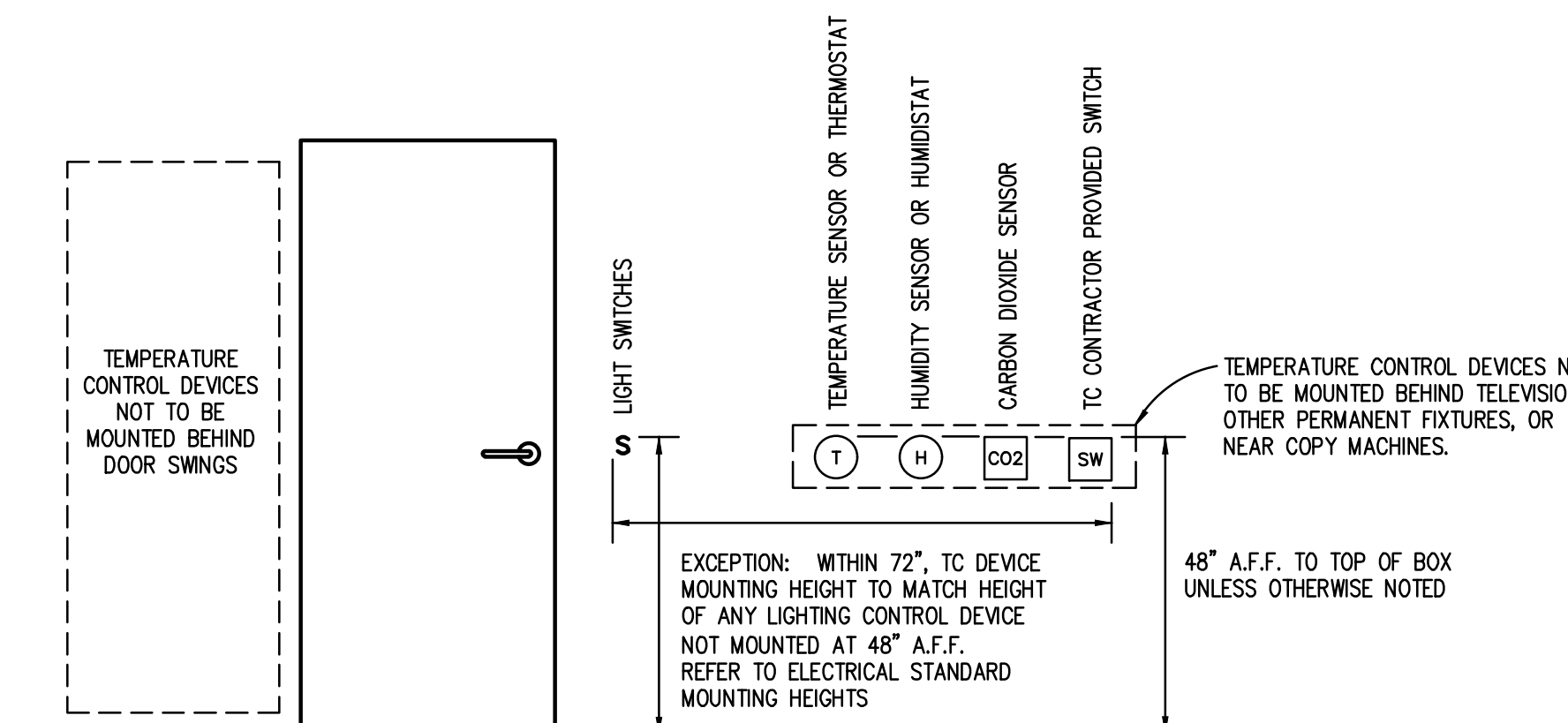


**EXISTING RTU MODIFICATION (WHERE INDICATED)**

REFER TO FLOOR PLANS FOR QUANTITY, LOCATION AND ZONE

**NOTES:**

- SPACE CO2 SENSOR FURNISHED AND INSTALLED BY TC CONTRACTOR.
- TEMPERATURE CONTROLS CONTRACTOR SHALL PROVIDE NEW SYSTEM CONTROL COMPONENTS AS INDICATED AND PROVIDE FIELD WIRING. COORDINATE EXACT FIELD WIRING AND TERMINATION REQUIREMENTS WITH EXISTING RTU MANUFACTURER.
- REFER TO FLOOR PLANS FOR SPACE TEMP DIGITAL WALL ADJUSTER LOCATION.
- SPACE CO2 SENSOR SHALL OVERRIDE UNIT OUTSIDE AIR CONTROL TO MAINTAIN CO2 LEVEL BELOW 800 PPM. TC CONTRACTOR SHALL REPROGRAM UNIT OUTSIDE AIR CONTROL TO ACCEPT DEMAND CONTROL VENTILATION OVERRIDE.
- TC CONTRACTOR SHALL PROVIDE NEW SPACE TEMPERATURE SENSORS THAT ARE COMPATIBLE WITH THE EXISTING CONTROL SYSTEM. NEW DEVICES SHALL HAVE THE SAME FUNCTIONALITY AS EXISTING SPACE TEMP CONTROL. REPROGRAM THE UNIT CONTROLS TO ACCEPT NEW SPACE TEMPERATURE SENSORS.



**TC DEVICE STANDARD MOUNTING HEIGHTS DETAIL**

NO SCALE

**TC GENERAL NOTES**

- THESE GENERAL NOTES SHALL BE APPLICABLE FOR ALL TEMPERATURE CONTROL (TC) DRAWINGS.
- "PROVIDE" IS DEFINED AS "FURNISH AND INSTALL".
- TEMPERATURE CONTROLS CONTRACTOR (TC CONTRACTOR) SHALL BE RESPONSIBLE TO COMPLY WITH ALL APPLICABLE CODES AND STANDARDS.
- FOR TEMPERATURE CONTROL DRAWINGS ONLY: ALL DETAILED INFORMATION IDENTIFIED WITH HEAVY LINE WEIGHT SHALL BE PROVIDED BY TC CONTRACTOR. ALL OTHER INFORMATION IDENTIFIED WITH LIGHT LINE WEIGHT SHALL BE PROVIDED BY OTHER TRADES.
- ALL CONTROL SCHEMATICS AND WIRING DIAGRAMS ARE FOR THE CLARIFICATION OF EQUIPMENT INTERLOCKING FUNCTIONS AND THE INTERFACE OF VARIOUS CONTRACTORS' WORK AND SHALL NOT BE MISTAKEN AS SHOP DRAWINGS FOR ACTUAL INSTALLATION.
- ALL TC PROVIDED COMPONENTS AND ALL TC CONTRACTOR INSTALLED WIRING SHALL BE LABELED PER SPECIFICATIONS.
- ALL WIRING AND SYSTEM CONTROL VOLTAGES SHALL BE IN ACCORDANCE WITH THE EQUIPMENT MANUFACTURER'S RECOMMENDATION AND THE ELECTRICAL SPECIFICATIONS.
- CONTROL INTERLOCK WIRING BETWEEN COMPONENTS SHALL BE INSTALLED WITHOUT INTERMEDIATE STOPS. WIRE SPLICING AT INTERMEDIATE TERMINAL STRIPS IS NOT ACCEPTABLE.
- ALL ELECTRICAL WIRING AND RACEWAY SYSTEMS SHALL COMPLY WITH ELECTRICAL SPECIFICATION REQUIREMENTS. WHERE RACEWAY IS REQUIRED, TWO SEPARATE ELECTRICAL RACEWAY SYSTEMS SHALL BE PROVIDED: ONE FOR 120V WIRING AND THE OTHER FOR 24V WIRING.
- TC CONTRACTOR SHALL BE RESPONSIBLE FOR ALL POWER SUPPLIES REQUIRED FOR TC SYSTEM UNLESS OTHERWISE NOTED. REFER TO ELECTRICAL PANEL SCHEDULES FOR SPARE CIRCUITS OR CIRCUITS DEDICATED TO TEMPERATURE CONTROLS. COORDINATE CIRCUIT USE WITH ELECTRICAL CONTRACTOR.
- TC CONTRACTOR SHALL VERIFY EXACT LOCATION OF ALL FIELD MOUNTED COMPONENTS.
- REFER TO TEMPERATURE CONTROLS STANDARD MOUNTING HEIGHTS DETAIL FOR ELEVATIONS OF WALL MOUNTED TEMPERATURE CONTROL DEVICES. PROVIDE WALL MOUNTED DEVICE GUARDS WHERE INDICATED ON TC DETAILS OR AT SPECIFIC LOCATIONS INDICATED ON MECHANICAL FLOOR PLANS.
- REMOTELY MOUNTED FIELD DEVICES SUCH AS RELAYS, CONTROL TRANSFORMERS, ETC., SHALL BE HOUSED IN AN ENCLOSURE PROVIDED BY THE TC CONTRACTOR.
- CONTROL TRANSFORMERS WHEN REQUIRED SHALL BE SIZED FOR 150% OF ACTUAL LOAD.
- TC CONTRACTOR SHALL FIELD MOUNT ALL REQUIRED "SHIPPED LOOSE" PACKAGED CONTROL COMPONENTS FURNISHED BY EQUIPMENT SUPPLIERS WHERE INDICATED. ALL REQUIRED 24V AND 120V FIELD WIRING SHALL BE PROVIDED BY TC CONTRACTOR UNLESS NOTED OTHERWISE. TC CONTRACTOR SHALL COORDINATE SPECIFIC SYSTEM WIRING REQUIREMENTS WITH PACKAGED EQUIPMENT SUPPLIERS.





FEEDER AND BRANCH CIRCUIT SIZING SCHEDULE - GENERAL PURPOSE. Table with columns for Overcurrent Device Rating (Amperes), Wire Size (AWG or KCMIL), Conduit Size, and Keyed Notes.

GENERAL NOTES:
1. CONTRACTOR TO SIZE FEEDERS AND BRANCH CIRCUITS BASED ON THIS SCHEDULE AND OVER CURRENT DEVICE SIZE, UNLESS NOTED OTHERWISE.
2. CONTRACTOR MAY COMBINE 20A CIRCUITS AS NOTED IN SPECIFICATION.
3. CONDUCTORS ARE BASED ON THHN/THWN UP TO AND INCLUDING #4/0. LARGER THAN #4/0 ARE BASED ON TYPE XHHW.
4. CONDUIT SIZES ARE VALID FOR EMT OR RGS. CONDUIT SIZES SHALL BE ADJUSTED AS REQUIRED FOR OTHER TYPES OF CONDUIT.
5. ELECTRICAL CONTRACTOR TO COORDINATE WITH MECHANICAL CONTRACTOR AND PROVIDE REQUIRED WIRE SIZES TO ACCOMMODATE MECHANICAL EQUIPMENT LUG SIZES.
6. SIZE OF DISCONNECT SWITCH LOCATED AT EQUIPMENT SHALL BE SIZED BASED UPON OVERCURRENT PROTECTION OF THAT DEVICE.
7. OBTAIN APPROVAL FROM ENGINEER PRIOR TO INSTALLING DIFFERENT SIZE/QUANTITY OF CONDUCTORS TO OBTAIN AN EQUIVALENT AMPACITY.
8. SPLICE FROM ALUMINUM TO COPPER PRIOR TO ENTERING EQUIPMENT LISTED FOR USE WITH COPPER CONDUCTORS ONLY OR USE COPPER CONDUCTORS FOR THE ENTIRE LENGTH OF FEEDER.

KEYED NOTES:
1. CONDUCTORS ARE BASED ON 90°C, 600V, INSULATED WIRE APPLIED AT 75°C FOR TERMINATION RATED 60/75°C OR 75°C. FOR TERMINATION RATED AT 60°C, USE CONDUCTORS AND CONDUIT SIZES INDICATED IN PARENTHESES.

POKE-THROUGH ASSEMBLY SCHEDULE. Table with columns for Type, Description, Manufacturer, Device Configuration, Bottom Housing, Flange/Cover Material & Color, Service Plate Type, Minimum Depth, Maximum Conduit, and Core Size Min/Max.

GENERAL NOTES:
1. PROVIDE 1 1/4" FC FROM EACH TELECOM FLOOR BOX (GANG) TO ACCESSIBLE LOCATION IN CEILING.
2. OTHER ACCEPTABLE MANUFACTURERS ARE STEEL CITY, OR HUBBELL-RAGO.
3. ALL PRODUCTS IN THIS SCHEDULE SHALL MEET AND EXCEED THE UL SCRUB WATER EXCLUSION REQUIREMENT.
4. COORDINATE ALL TELECOM AND A/V OUTLETS WITH COMMUNICATIONS AND A/V CONTRACTORS.
5. CORE MIN/MAX SIZES LISTED ARE FOR BARE CONCRETE OR TERRAZZO FLOORS.
ABBREVIATIONS:
BS = BRASS AL = ALUMINUM FR = FLIP LID/RECTANGULAR
D = DUPLEX RECEPTACLE BK = BLACK SL = SLIDES
T = 2 TELECOM OPENINGS BK = BLACK FC = FLIP COVER
OY = GRAY (CONCRETE) FF = FURNITURE FEED
BZ = BRONZE
NK = NICKEL

BRANCH CIRCUIT VOLTAGE DROP WIRING SCHEDULE FOR SINGLE PHASE CIRCUITS. Table with columns for Branch Ckt Rating (A), Wire Size (AWG), and Maximum Branch Circuit Length (in feet) for 120V, 208V, 240V, 277V, and 480V.

GENERAL NOTES:
1. THE ABOVE TABLE VALUES ARE BASED ON COPPER CONDUCTORS, IN STEEL CONDUIT, WITH A LOAD POWER FACTOR OF 0.85 PER NEC CHAPTER 9, TABLE 9.
2. PROVIDE BRANCH CIRCUIT CONDUCTORS AS INDICATED IN THE TABLE ABOVE FOR ALL LIGHTING AND RECEPTACLE BRANCH CIRCUITS, WHERE BRANCH CIRCUITS SERVE DEDICATED EQUIPMENT, THE CONTRACTOR MAY PERFORM VOLTAGE DROP CALCULATIONS BASED ON ACTUAL EQUIPMENT CONNECTED LOAD AND PROVIDE CONDUCTORS APPROPRIATELY SIZED TO LIMIT VOLTAGE DROP TO A MAXIMUM OF 3%.
3. CONDUCTOR SIZES ARE BASED ON MAXIMUM OF 9 CURRENT CARRYING CONDUCTORS IN A SINGLE CONDUIT.
4. LIMITS FOR CONDUCTOR LENGTHS SHOWN ARE BASED ON A MAXIMUM BRANCH CIRCUIT LOADING OF 64% OF THE BRANCH BREAKER RATING AND A MAXIMUM OF 3 PERCENT VOLTAGE DROP TO COMPLY WITH ASHRAE 90.1 AND THE NEC. FOR CIRCUITS LOADED GREATER THAN 64% OF BRANCH BREAKER RATING, THE CONTRACTOR SHALL PROVIDE CONDUCTORS APPROPRIATELY SIZED TO LIMIT VOLTAGE DROP TO 3%.

TELECOMMUNICATIONS OUTLET SCHEDULE. Table with columns for Tag, Description, and Remarks.

GENERAL NOTES:
1. REFER TO SPECIFICATIONS FOR TELECOMMUNICATION CABLE TYPE.
2. EMPTY BOX W/ CONDUIT FOR FUTURE TELECOM OUTLET.
3. TELECOM OUTLET. PROVIDE CABLE QUANTITIES PER SCHEDULE TAG ABOVE.
4. TELECOM OUTLET TO BE PROVIDED IN FLOOR SERVICE FITTING. PROVIDE CABLE QUANTITIES PER SCHEDULE TAG ABOVE.
5. TELECOM OUTLET TO BE PROVIDED IN POKE-THRU ASSEMBLY. PROVIDE CABLE QUANTITIES PER SCHEDULE TAG ABOVE.
6. TELECOM OUTLET TO BE PROVIDED FOR CAMERAS. PROVIDE CABLE QUANTITIES PER SCHEDULE TAG ABOVE.

MOTOR CIRCUIT SIZING SCHEDULE (480V, 3 PHASE). Table with columns for Motor HP, Switch/Fuse, Circuit Breaker, Starter Size/Type, and Motor Disconnect (Note 5).

GENERAL NOTES:
1. BASED ON MOTOR FULL LOAD AMPERES AS PROVIDED BY THE N.E.C.
2. BASED ON MOTOR RUNNING OVERLOAD PROTECTIONS PROVIDED BY THERMAL OVERLOAD RELAYS.
3. WHERE THE STARTER IS LOCATED REMOTE FROM THE MOTOR, PROVIDE DISCONNECT LOCATED AT THE MOTOR, SIZE AS INDICATED.

RACEWAY / CONDUCTOR / CABLE APPLICATION SCHEDULE. Large table with columns for Raceway, Conductor, Cable/Cord, and various application conditions like Concealed, Exposed, etc.

GENERAL NOTES:
1. TRANSITION FROM PVC/HDPE AND PROVIDE RIGID STEEL OR RTRC SWEEPS WHERE CONDUITS PENETRATE WALLS, CONCRETE SLABS, CONCRETE BASES, AND ASPHALT.
2. REFER TO SPECIFICATIONS FOR RESTRICTIONS ON MC/AC CABLE INSTALLATION.
3. EMT SHALL NOT BE USED ON THE EXTERIOR OF A BUILDING OR IN AREAS SUBJECT TO DAMAGE BELOW 10' AFF.
4. INSTALL SURFACE RACEWAYS ONLY WHERE INDICATED ON DRAWINGS.
KEYED NOTES:
1. NON-ARMORED CABLE SHALL BE INSTALLED IN RACEWAY. ARMORED CABLE SHALL BE INSTALLED IN TRAY OR FREE-AIR AS APPLICABLE.
2. CONDUIT AND BUILDING WIRE ALLOWED WHEN ENCASED IN MINIMUM 2" CONCRETE.
3. EMERGENCY FEEDERS IN OCCUPANCIES THAT ARE UNDER 700.10(D) SHALL HAVE A TWO HOUR RATING. RATING SHALL BE OBTAINED BY ROUTING CONDUIT AND BUILDING WIRE IN SPRINKLER SPACE.
4. IN A TWO HOUR SHAFT, OUTSIDE OF THE BUILDING, IN A LISTED TWO HOUR RATED RACEWAY, OR UNDER A MINIMUM OF 2" OF CONCRETE; OR BY USING A LISTED TWO-HOUR RATED CABLE ASSEMBLY.
5. SHALL BE INSTALLED PER MANUFACTURER'S INSTRUCTIONS BASED ON UL TESTING AND RATING.
6. FOR USE IN PATIENT CARE SPACES. SHALL NOT BE USED FOR LIFE SAFETY OR CRITICAL CIRCUITS EXCEPT WHERE PERMITTED BY NEC 517.

NOTE: SOME SYMBOLS AND ABBREVIATIONS SHOWN MAY NOT APPLY TO THIS PROJECT.

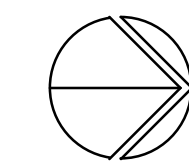


**ELECTRICAL DEMOLITION  
GENERAL NOTES:**

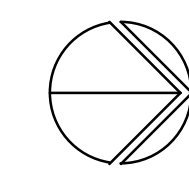
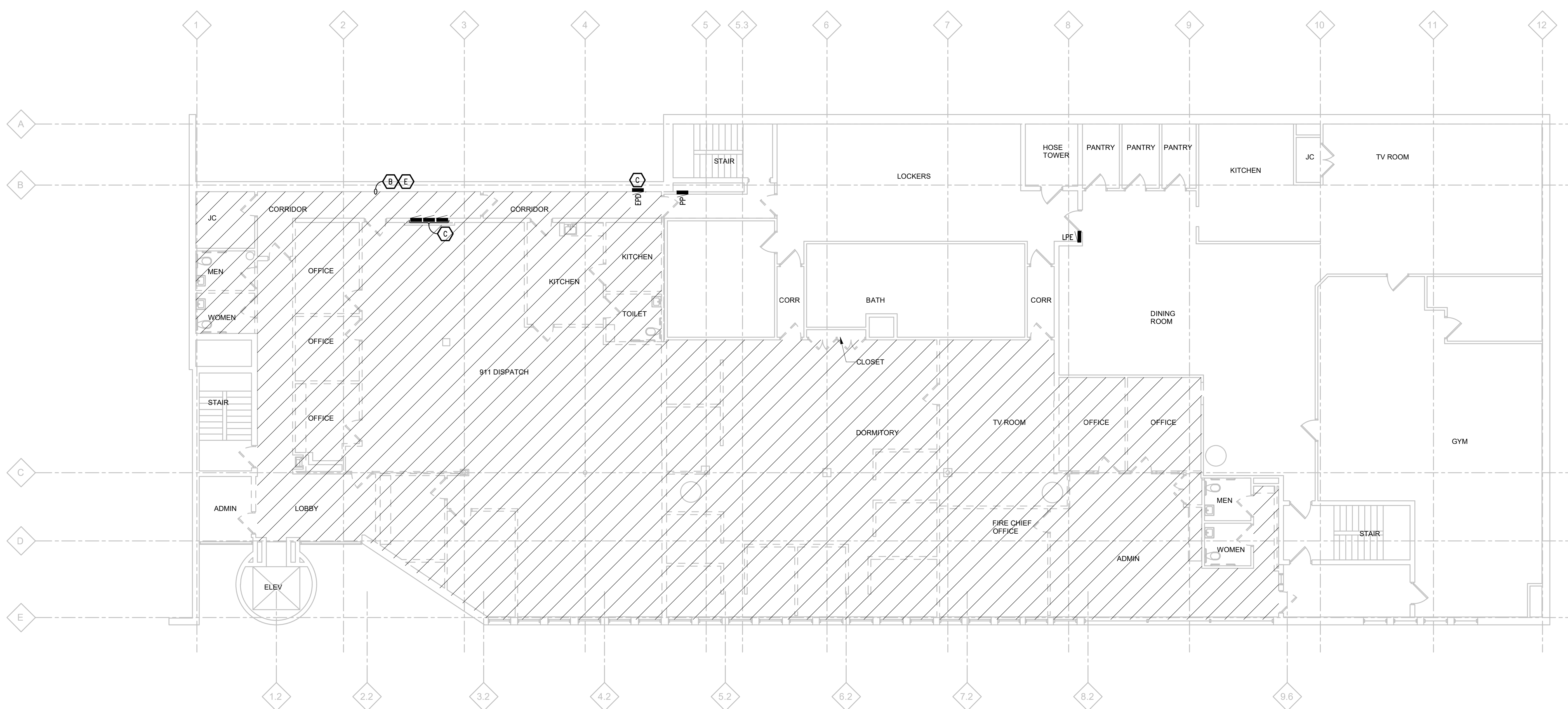
1. VISIT THE SITE PRIOR TO SUBMISSION OF BID TO EXAMINE THE EXISTING CONDITIONS AND THE EXTENT OF DEMOLITION WORK.
2. EXAMINE THE DRAWINGS OF OTHER TRADES AND BE FAMILIAR WITH THE DEMOLITION REQUIRED BY OTHER TRADES. PERFORM ALL INCIDENTAL ELECTRICAL DEMOLITION AND/OR RELOCATION REQUIRED TO FACILITATE THE DEMOLITION WORK OF OTHER TRADES, WHETHER OR NOT SPECIFICALLY INDICATED.
3. REMOVE EQUIPMENT OR MATERIALS AS INDICATED ON PLAN WITH CROSS HATCHING. DEMOLITION SHALL INCLUDE, BUT NOT BE LIMITED TO, THOSE COMPONENTS SHOWN.
4. COORDINATE WITH NEW WORK PLANS, ONE LINE DIAGRAMS AND RISER DIAGRAMS FOR EXTENT OF DEMOLITION WORK.
5. PROVIDE PROPER SUPPORT FOR EXISTING TO REMAIN CONDUITS AND BOXES WHERE EXISTING SUPPORT IS TO BE REMOVED. RE-ROUTE BRANCH CIRCUIT CONDUITS AND RELOCATE JUNCTION BOXES AS REQUIRED TO FACILITATE INSTALLATION OF NEW EQUIPMENT AND SYSTEMS IN CEILING SPACES.
6. REMOVE ALL CONDUIT AND WIRE BACK TO THE SOURCE OR NEAREST UPSTREAM DEVICE REMAINING IN SERVICE.
7. MAINTAIN ELECTRICAL SERVICE TO ALL LIGHTING FIXTURES, DEVICES AND EQUIPMENT THAT ARE TO REMAIN. EXTEND CONDUIT AND WIRE AS REQUIRED WHERE DEMOLITION WORK AFFECTS ELECTRICAL SERVICE TO DOWNSTREAM LOADS THAT ARE TO REMAIN.
8. DISPOSE OF ALL MATERIALS OFF SITE AND INCLUDE ALL COSTS FOR DISPOSAL IN BID. ALL MATERIALS SHALL BE DISPOSED OF IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL REGULATIONS, INCLUDING TOLP TESTING, PROPER DISPOSAL AND/OR RECYCLING OF FLUORESCENT LAMPS.
9. PROVIDE BLANK COVER PLATES WHERE SWITCHES AND DEVICES ARE REMOVED BUT EXISTING WALLS REMAIN INTACT.
10. RING OUT AND TAG ALL CIRCUITS AFFECTED BY THIS ALTERATION AT BOTH ENDS. MARK ALL UNUSED CIRCUIT BREAKERS "SPARE".
11. PROVIDE UPDATED TYPED-IN DIRECTORIES FOR ALL PANELS AFFECTED BY THIS ALTERATION.
12. VERIFY ALL UNDERGROUND AND IN SLAB UTILITY LOCATIONS PRIOR TO SAW-CUTTING OR PENETRATING ANY FLOOR SLAB.
13. COORDINATE ANY SHUT DOWN OF EXISTING SERVICES AND EQUIPMENT THAT ARE REMAINING IN USE WITH THE OWNER'S REPRESENTATIVE. WHERE EXISTING BUILDING SERVICE IS REQUIRED TO BE SHUT DOWN, INCLUDE ALL ASSOCIATED OVERTIME COSTS TO PERFORM THIS WORK DURING WEEKENDS AND EVENINGS INCLUDE ALL COSTS FOR PROVIDING TEMPORARY POWER WHERE SHUT DOWNS MUST OCCUR FOR PERIODS LONGER THAN THESE HOURS. COORDINATE ELECTRICAL SHUT DOWNS WITH THE OWNER 72 HOURS PRIOR TO SHUT DOWN.

**# DEMOLITION KEY NOTES:**

- A. REMOVE EXISTING LIGHTING FIXTURES, CONTROLS, AND BRANCH CIRCUITING BACK TO SOURCE OR NEXT REMAINING DEVICE.
- B. REMOVE EXISTING TELECOM BOXES, RECEPTACLES AND BRANCH CIRCUITING BACK TO SOURCE OR NEXT REMAINING DEVICE.
- C. EXISTING PANELBOARDS TO REMAIN.
- D. REMOVE EXISTING RED LIGHTS FROM NOTIFICATION SYSTEM. CIRCUIT/RELAY FOR THESE LIGHTS SHALL BE RE-USED FOR NEW R1 FIXTURES.
- E. REMOVE EXISTING SPEAKERS IN DORMITORY AREA FROM NOTIFICATION SYSTEM. MATCH SPEAKERS AND PROVIDE NEW FOR NEW WORK AS INDICATED AND RE-WORK WIRING AS NEEDED.



**SECOND FLOOR LIGHTING DEMOLITION PLAN**  
SCALE: 1/8" = 1' - 0"



**SECOND FLOOR POWER AND AUXILIARY SYSTEMS DEMOLITION PLAN**  
SCALE: 1/8" = 1' - 0"

THE FOLLOWING DIMENSION EQUALS ONE INCH WHEN PRINTED TO SCALE.

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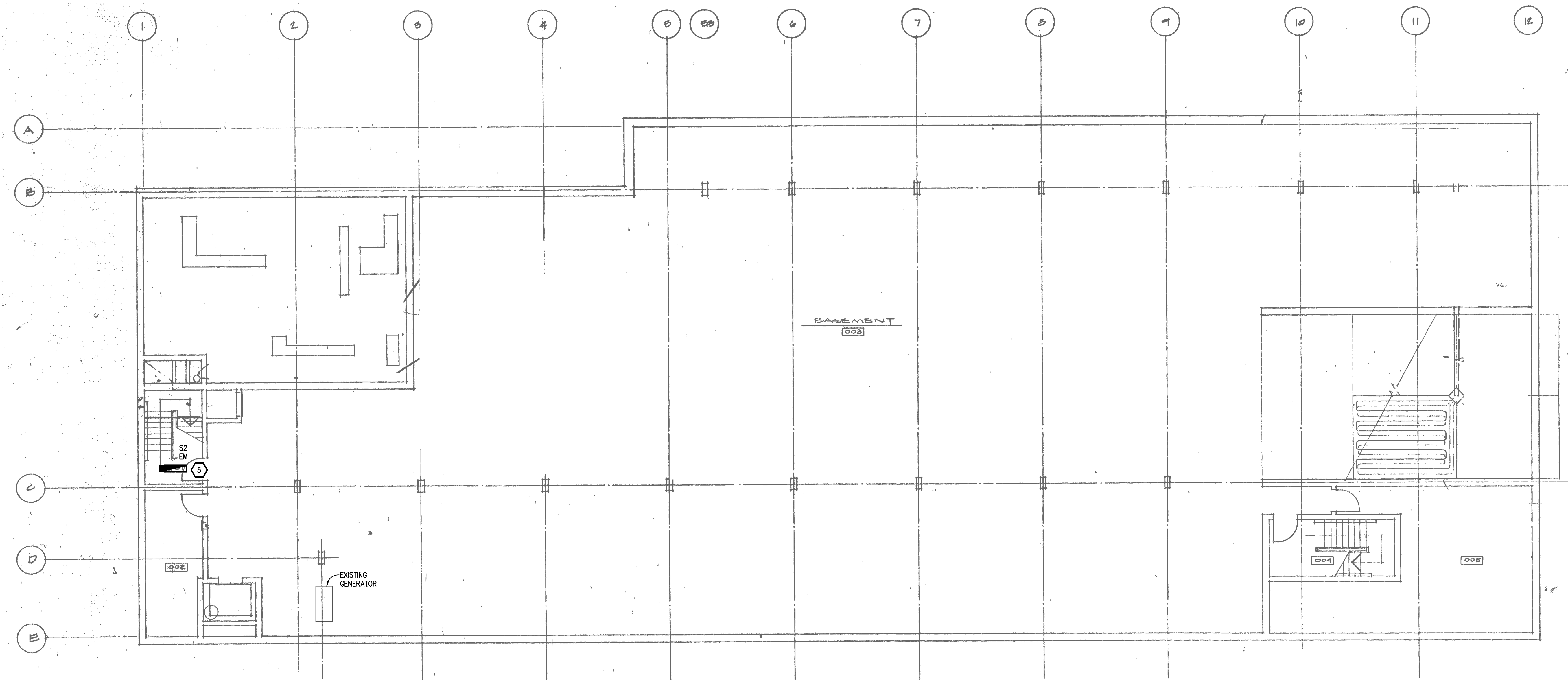


**ELECTRICAL GENERAL NOTES:**

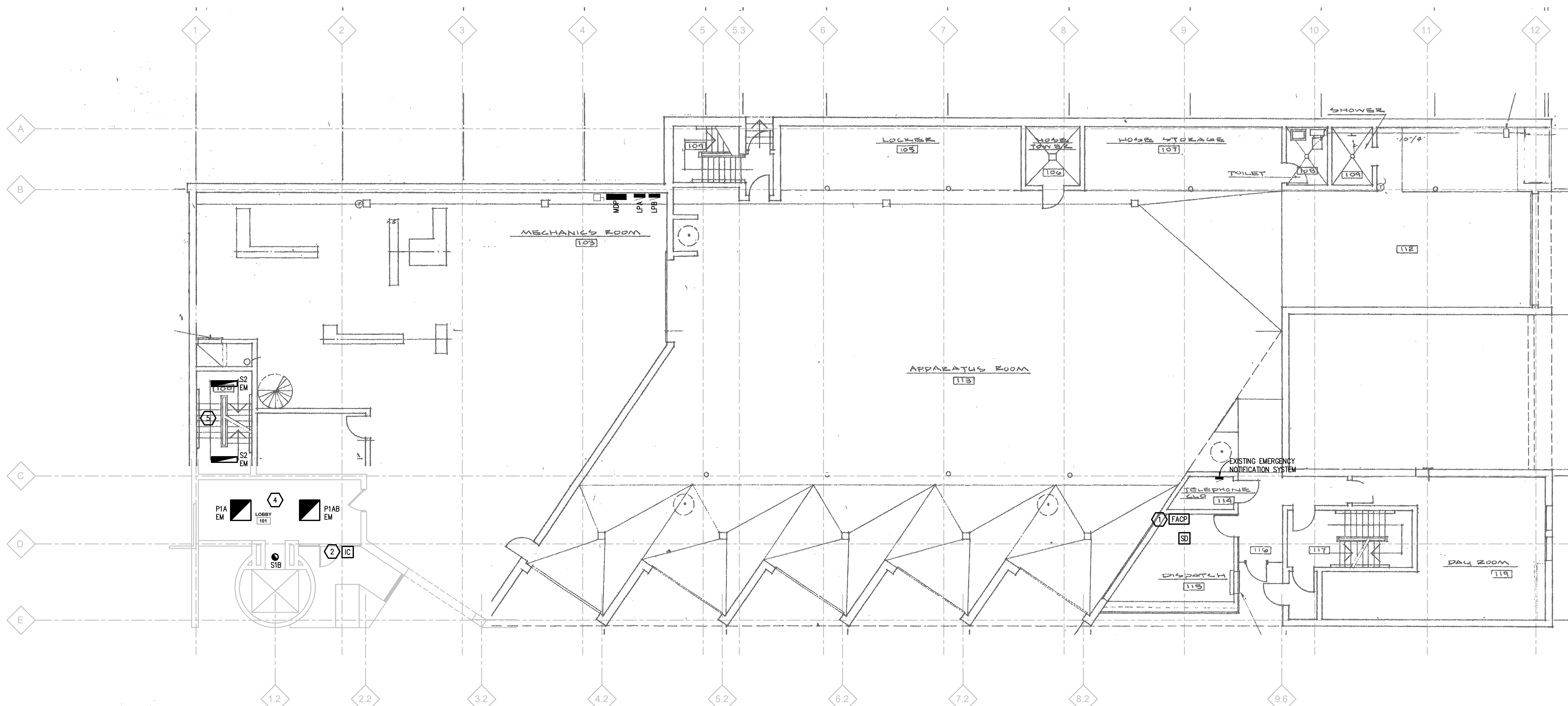
- THESE DRAWINGS REPRESENT THE GENERAL EXTENT AND ARRANGEMENT OF SYSTEMS. COORDINATE EXACT EQUIPMENT LOCATIONS, ELEVATIONS, AND FINAL CONNECTION REQUIREMENTS. PROVIDE EACH SYSTEM COMPLETE, INCLUDING ALL NECESSARY COMPONENTS, FITTINGS AND OFFSETS.
- INSTALL SYSTEMS SUCH THAT REQUIRED CLEARANCE AND SERVICE ACCESS SPACE IS PROVIDED AROUND ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AND AROUND ANY COMPONENTS WHICH REQUIRE SERVICE ACCESS.
- COORDINATE AND PROVIDE ACCESS DOORS WITHIN INACCESSIBLE CEILING, SHAFT, AND CHASE AREAS FOR ALL COMPONENTS WHICH REQUIRE SERVICE ACCESS. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING TYPES.
- PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL SYSTEMS.
- TRANSFORMER SECONDARY CONDUCTORS SHALL BE SIZED IN ACCORDANCE WITH TRANSFORMER CIRCUIT SIZING SCHEDULE SHOWN ON "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS OTHERWISE NOTED.
- MOTOR CIRCUIT PROTECTION SHALL BE SIZED IN ACCORDANCE WITH MOTOR CIRCUIT SIZING SCHEDULES SHOWN ON "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS OTHERWISE NOTED.
- COORDINATE THE MOUNTING HEIGHTS OF DEVICES WITH ARCHITECTURAL ELEVATIONS AND THE TRADES INSTALLING THE WORK.
- COORDINATE EXACT LOCATIONS OF ALL FLOOR SERVICE FITTINGS AND POKE-THROUGH ASSEMBLIES WITH FINAL FURNITURE LAYOUT DRAWINGS.
- REFER TO MECHANICAL SCHEDULE SHEETS FOR ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT. PROVIDE ALL CONNECTIONS, STARTERS, DISCONNECTS, ETC. AS REQUIRED BY SCHEDULES AND WHERE NOTED ELSEWHERE. VERIFY REQUIREMENTS OF ALL MECHANICAL EQUIPMENT WITH SHOP DRAWINGS SUBMITTALS. NOTIFY ENGINEER OF ANY CONFLICTS BETWEEN EQUIPMENT SUBMITTALS AND ELECTRICAL DRAWINGS. WHERE CIRCUIT SIZES ARE SHOWN ON THE ELECTRICAL DRAWINGS THAT DIFFER FROM WHAT IS INDICATED ON THE MECHANICAL SCHEDULES, PROVIDE THE CIRCUIT OF HIGHER AMPACITY.
- REFER TO TEMPERATURE CONTROLS SHEETS FOR REQUIRED FIRE ALARM CONTROL MODULES, DUCT SMOKE DETECTORS, AND MOTOR CONTROLLERS. PROVIDE ALL ACCESSORIES INDICATED.
- THE FIRE ALARM DEVICES SHOWN ON PLAN ARE A PARTIAL REPRESENTATION OF THE FIRE ALARM SYSTEM. PROVIDE THE DESIGN AND INSTALLATION OF A COMPLETE AND FUNCTIONAL FIRE ALARM SYSTEM IN ACCORDANCE WITH THE SPECIFICATIONS, DRAWINGS, AND ALL APPLICABLE CODES. THE FIRE ALARM VENDOR SHALL PROVIDE LAYOUT DRAWINGS INDICATING THE REQUIRED QUANTITIES AND LOCATIONS OF MANUAL PULL STATIONS, NOTIFICATION APPLIANCES, SMOKE AND HEAT DETECTORS, CONTROL MODULES, INTERFACE MODULES, MODULES FOR SPRINKLER FLOW AND TAMPER SWITCHES, ALL CONTROL PANELS, POWER SUPPLIES, AND ADDITIONAL DEVICES AND EQUIPMENT REQUIRED. COORDINATE LOCATIONS OF DEVICES WITH ARCHITECTURAL FINISHES AND REFLECTED CEILING PLANS, INCLUDING ADDITIONAL SMOKE AND HEAT DETECTORS REQUIRED FOR NON-SMOOTH CEILING APPLICATIONS. INCLUDE ALLOWANCES FOR ADJUSTMENT OF DEVICES BY THE ARCHITECT AT THE TIME OF SUBMITTAL TO COORDINATE WITH BUILDING FINISHES AND OTHER CEILING ELEMENTS.
- REFER TO LIGHTING CONTROL SCHEDULE FOR ROOM CONTROL AND EMERGENCY LIGHTING CIRCUIT CONTROL REQUIREMENTS. DESIGNATION FOR ROOM IS INDICATED AS A LETTERED OVAL SYMBOL.

**CONSTRUCTION KEY NOTES:**

- EXISTING FIRE ALARM PANEL TO BE REMOVED AND REPLACED WITH NEW PANEL. RE-USE EXISTING CIRCUIT.
- PROVIDE POWER AND PATHWAY FOR AI PHONE AT RECEPTION DESK AND 1ST FLOOR VESTIBULE. PROVIDE ALL INTERCONNECTION WIRING, BACK BOXES FOR AI PHONE SYSTEM PROVIDED BY OTHERS AND INSTALLED BY ELECTRICAL CONTRACTOR.
- PROVIDE 8" COMMERCIAL WHITE GRILL CEILING SPEAKER WITH CENTER FRONT VOLUME CONTROL. MATCH EXISTING. CONNECT SPEAKERS TO EXISTING EMERGENCY NOTIFICATION SYSTEM.
- CIRCUIT NEW LIGHTING TO EXISTING LIGHTING CIRCUIT AND TIE TO EXISTING LIGHTING CONTROLS.
- INSTALL TYPE S2-EM SURFACE-MOUNTED LUMINAIRES AT THE UNDERSIDE OF ALL LANDINGS (3) IN STAIRWELL, EXCEPT LOWEST BASEMENT LANDING. UPPER LAY-IN CEILING TO HAVE RECESSED LUMINAIRES AS SHOWN ON 2ND FLOOR LIGHTING PLAN.
- COORDINATE WITH FIRE PROTECTION SYSTEM DESIGN TO PROVIDE NEW FLOW AND TAMPER SWITCH AS REQUIRED FOR NEW BUNK ROOM SPRINKLER SYSTEM.
- CIRCUIT R1 DOWNLIGHTS TO THE EXISTING NOTIFICATION SYSTEM. LIGHTS SHALL TURN UPON ACTIVATION OF THE SYSTEM. RE-USE EXISTING RELAY AND CIRCUIT FOR NEW R1 DOWNLIGHTS.
- RELOCATE EXISTING POWER FOR RELOCATED ELECTRIC WATER HEATER. EXTEND FEEDS AS REQUIRED.

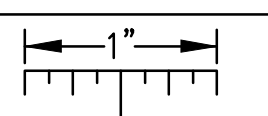


**BASEMENT ELECTRICAL NEW WORK PLAN**  
SCALE: 1/8" = 1' - 0"



**FIRST FLOOR ELECTRICAL NEW WORK PLAN**  
SCALE: 1/8" = 1' - 0"

THE FOLLOWING DIMENSION EQUALS ONE INCH WHEN PRINTED TO SCALE.



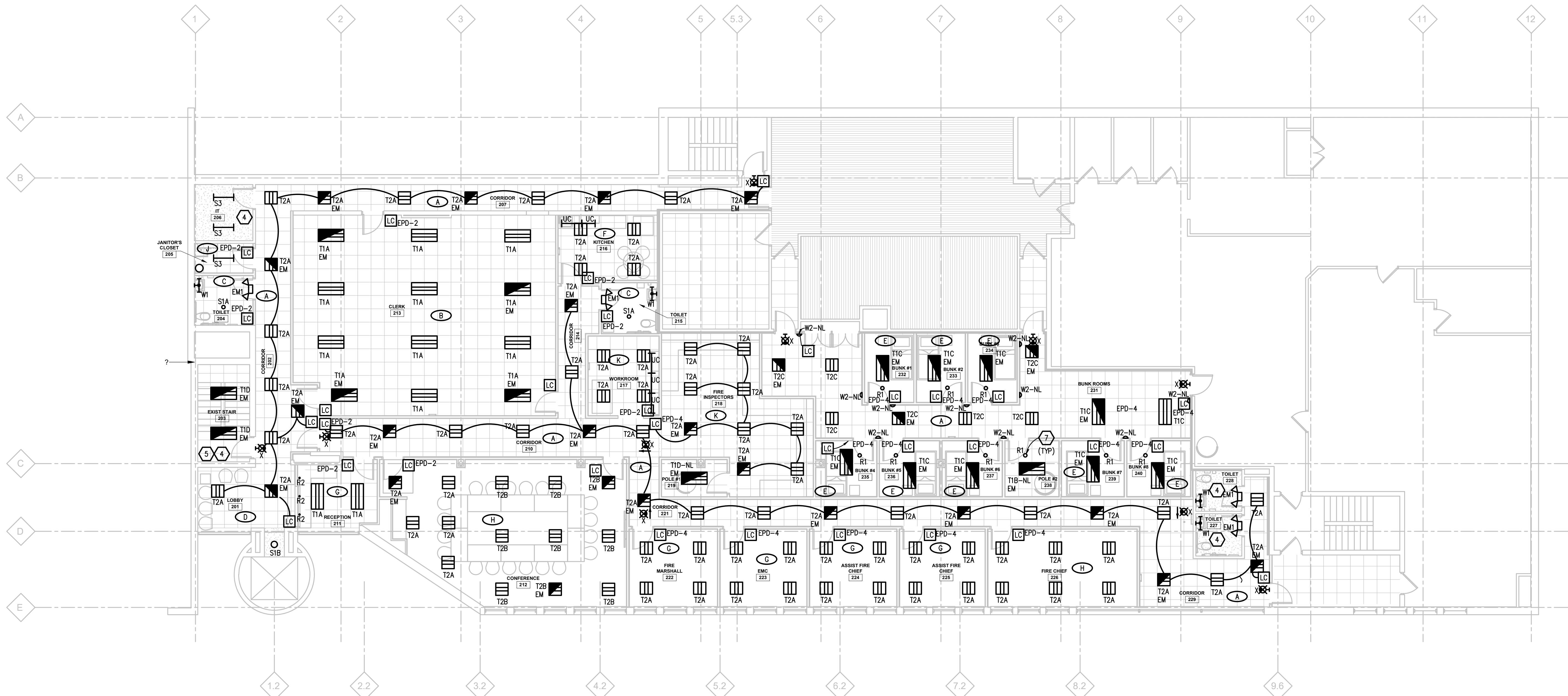


**ELECTRICAL GENERAL NOTES:**

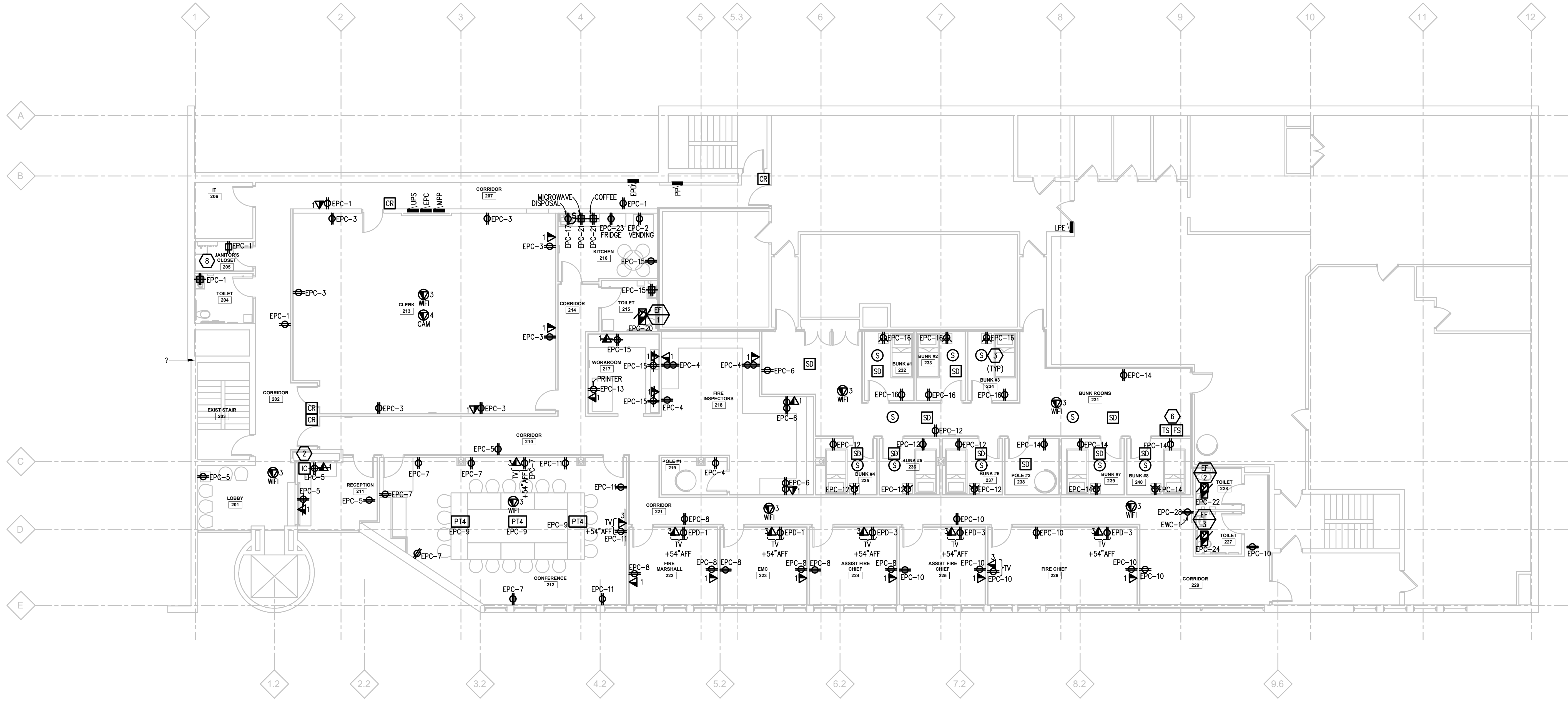
- THESE DRAWINGS REPRESENT THE GENERAL EXTENT AND ARRANGEMENT OF SYSTEMS. COORDINATE EXACT EQUIPMENT LOCATIONS, ELEVATIONS, AND FINAL CONNECTION REQUIREMENTS. PROVIDE EACH SYSTEM COMPLETE, INCLUDING ALL NECESSARY COMPONENTS, FITTINGS AND OFFSETS.
- INSTALL SYSTEMS SUCH THAT REQUIRED CLEARANCE AND SERVICE ACCESS SPACE IS PROVIDED AROUND ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AND AROUND ANY COMPONENTS WHICH REQUIRE SERVICE ACCESS.
- COORDINATE AND PROVIDE ACCESS DOORS WITHIN INACCESSIBLE CEILING, SHAFT, AND CHASE AREAS FOR ALL COMPONENTS WHICH REQUIRE SERVICE ACCESS. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING TYPES.
- PROVIDE SUPPLEMENTARY STEEL AS REQUIRED FOR THE PROPER SUPPORT OF ALL SYSTEMS.
- TRANSFORMER SECONDARY CONDUCTORS SHALL BE SIZED IN ACCORDANCE WITH TRANSFORMER CIRCUIT SIZING SCHEDULE SHOWN ON "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS OTHERWISE NOTED.
- MOTOR CIRCUIT PROTECTION SHALL BE SIZED IN ACCORDANCE WITH MOTOR CIRCUIT SIZING SCHEDULES SHOWN ON "ELECTRICAL STANDARD SCHEDULES DRAWING" UNLESS OTHERWISE NOTED.
- COORDINATE THE MOUNTING HEIGHTS OF DEVICES WITH ARCHITECTURAL ELEVATIONS AND THE TRADES INSTALLING THE WORK.
- COORDINATE EXACT LOCATIONS OF ALL FLOOR SERVICE FITTINGS AND POKE-THROUGH ASSEMBLIES WITH FINAL FURNITURE LAYOUT DRAWINGS.
- REFER TO MECHANICAL SCHEDULE SHEETS FOR ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT. PROVIDE ALL CONNECTIONS, STARTERS, DISCONNECTS, ETC. AS REQUIRED BY SCHEDULES AND WHERE NOTED ELSEWHERE. VERIFY REQUIREMENTS OF ALL MECHANICAL EQUIPMENT WITH SHOP DRAWINGS SUBMITTALS. NOTIFY ENGINEER OF ANY CONFLICTS BETWEEN EQUIPMENT SUBMITTALS AND ELECTRICAL DRAWINGS. WHERE CIRCUIT SIZES ARE SHOWN ON THE ELECTRICAL DRAWINGS THAT DIFFER FROM WHAT IS INDICATED ON THE MECHANICAL SCHEDULES, PROVIDE THE CIRCUIT OF HIGHER AMPACITY.
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- CIRCUIT R1 DOWNLIGHTS TO THE EXISTING NOTIFICATION SYSTEM. LIGHTS SHALL TURN ON UPON ACTIVATION OF THE SYSTEM. RE-USE EXISTING RELAY AND CIRCUIT FOR NEW R1 DOWNLIGHTS.
- RELOCATE EXISTING POWER FOR RELOCATED ELECTRIC WATER HEATER. EXTEND FEEDS AS REQUIRED.



**SECOND FLOOR LIGHTING PLAN**  
SCALE: 1/8" = 1' - 0"



**SECOND FLOOR POWER AND AUXILIARY SYSTEMS PLAN**  
SCALE: 1/8" = 1' - 0"

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THE FOLLOWING DIMENSION EQUALS ONE INCH WHEN PRINTED TO SCALE.



