GROSSMONT UNION HIGH SCHOOL DISTRICT

Mount Miguel High School

BUILDING 300S

MODERNIZATION

PREPARED FOR:

GROSSMONT UNION HIGH SCHOOL DISTRICT
P.O. BOX 1043
LA MESA, CA 91944

PREPARED BY:

HARLEY ELLIS DEVEREAUX
350 Camino de La Reina, Suite 510
SAN DIEGO, CA 92108

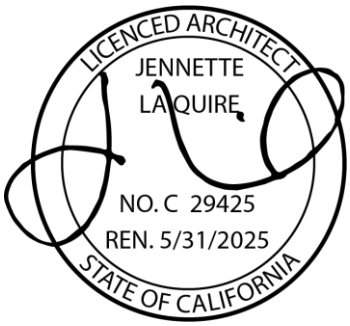
Project No. 2023-GU001-010

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SECTION 00 01 07

CERTIFICATIONS AND SEALS

ARCHITECT
I hereby certify that the Project Drawings and the Project Manual were prepared by me or under my direct supervision and that I am a duly registered Architect under the laws of the State of California.



IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 04-123438 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 11/05/2024

STRUCTURAL ENGINEER
I hereby certify that the Project Drawings and the Project Manual were prepared by me or under my direct supervision and that I am a duly registered Engineer under the laws of the State of California.



MECHANICAL / PLUMBING ENGINEER

I hereby certify that the Project Drawings and the Project Manual were prepared by me or under my direct supervision and that I am a duly registered Engineer under the laws of the State of California.



ELECTRICAL ENGINEER

I hereby certify that the Project Drawings and the Project Manual were prepared by me or under my direct supervision and that I am a duly registered Engineer under the laws of the State of California



END OF SECTION

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END OF SECTION 00 01 10

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Project:
Alteration of Building 1000 and 1400 along with adjacent site improvements. Building 1000 to receive full structural rehabilitation and new HVAC system. Building consisting of classrooms, science lab, and restrooms. Building 1400 to be divided into two classrooms and new HVAC system. Neither building to alter its existing envelope.
Type V-B wood construction. E Occupancy.
.

B. Description of Work:

Totaling approximately 26,000 square feet of patch crack, slurry and seal asphalt pacing on the access road to the scope of work. New fenced yard serving Building 1000 and a small parking lot and miscellaneous sitework, as indicate in the Contract Documents prepared by Harley Ellis Devereaux (HED).

1.02 PERFORMANCE REQUIREMENTS

A. All work shall conform to 2022, Title 24, California Building Code (CBC).

B. Changes to the approved Drawings and Specifications shall be made by addenda or a construction change document (CCD) approved by the Division of the State Architect, Office of Regulation Services, as required by Section 4-233, Part 1, Title 24, California Building Code.

1.03 WORK UNDER OTHER CONTRACTS

A. No work is planned or scheduled to be performed by the Owner's own forces.

1.04 WORK SEQUENCE

A. Work is to be conducted in a single phase based on a single lump-sum contract. All work shall be completed as stipulated in the Notice to Proceed. The contract closeout procedure as specified in Section 01 77 00 - Closeout Procedures shall be completed within this period. Normal inclement weather for the various seasons of the year shall not be grounds for extensions of contract time, and the Contractor shall take this into account when formulating his Construction Schedule. By submitting a Bid and entering into this Contract, Contractor certifies that he has adequate resources and is fully capable of completing the Work within the allotted time.

1.05 CONTRACTOR USE OF PREMISES

A. During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project.

B. Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy and use by the public.

1. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.

C. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

D. Use of the Existing Buildings: Maintain the existing buildings in a weather-tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

1.06 OCCUPANCY

A. At each phase of completion, the Owner will occupy the Project in the manner outlined in Section 01 77 00 - Closeout Procedures, and as set forth in the General Conditions. Refer to General Conditions of the contract, Article ____ (Occupancy) and Article ___ (Completion) for occupancy and completion conditions.

Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building, prior to Substantial Completion provided that such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. A Certificate of Substantial Completion will be executed for each specific portion of the Work to be occupied prior to Owner occupancy.

2. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.

3. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION
(Not Applicable)

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Administrative and procedural requirements for Alternates.

B. Perform work required for complete execution of each accepted alternate designated in the Owner-Contractor Agreement. Amount of alternate prices shall include cost of modifications made necessary including overhead and profit.

C. Work for alternates shall comply with applicable provisions of the contract documents, except as otherwise specified herein.

D. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each alternate. Indicate whether alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to alternates.

E. Schedule: Specification Sections referenced in the list of alternates contain requirements for materials and methods necessary to achieve the Work described under each alternate.

1. Include as part of each alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the alternate.

1.02 COORDINATION

A. Coordinate pertinent related work and modify surrounding work as required to complete the project under each accepted alternate designated in the Owner-Contractor Agreement.

1.03 DEDUCTIVE ALTERNATES:

A. Refer to BID FORM for alternates.

B. All BID FORM ALTERNATES shall be bid, or the bidder may be deemed a "non-responsive" bidder.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

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SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: General requirements for the proposal of substitutions.

1.02 MATERIAL

A. Equipment, materials, and articles incorporated into the work shall be new and suitable for the purposes intended.

B. Reference to equipment, material, article, or patented process by trade name or catalog number shall not be construed as limiting competition.

1. In cases where the Specifications designate a material, product, thing, or service by specific proprietary brand or trade name, and there is only one brand or trade name listed, the item involved is:

a. Used as a standard of quality which must be satisfied without compromise, or

b. The only brand or trade name known to the Owner and Architect.

2. Wherever in the Contract Documents a material, article, or process is indicated or specified by trade, patent, proprietary name, or name of manufacturer, such indication shall be deemed to be followed by the words, **"or equivalent, as accepted in writing by the Architect".**

a. Contractor shall submit a substitution request for Architect’s written acceptance.

3. If the phrase "NO SUBSTITUTIONS" is used, the product is required to be used since it is a unique product application.

C. The naming of more than one manufacturer in a Section does not imply that all products of named manufacturers are acceptable for use on the Project. Where more than one proprietary name is specified, provide materials or equipment of any one of the manufacturers specified, only if full compliance with other portions of the Specifications can be provided.

D. Construction shall be in compliance with the cited standards for the materials specified.

1.03 SUBSTITUTIONS

A. Should the Contractor wish to substitute an item purported to be equal to the one specified, then the Contractor shall, no later than 35 days after Award of Contract, furnish to the Architect the name of the manufacturer, model number, color options and other pertinent data and information respecting the "or equivalent" item which has been proposed in the bid and which the Contractor contemplates incorporating in the work. If the "or equivalent" item is not found by the Architect to be, in fact, equivalent or better, then the item specified in the Contract Documents shall be furnished.
When colors have been indicated prior to Bid, Contractor shall be required to provide a custom color to match. See Section 01 33 00, Submittal Procedures.

B. When required by the Contract Documents, or when directed by the Owner, furnish full information concerning the material or article proposed for incorporation into the work. Testing of a proposed substitute material to assure compliance with the Specifications may be required by the Owner at the Contractor's expense. When so directed, submit samples for acceptance. Equipment, material, and articles installed or used without required acceptance shall be at the risk of subsequent rejection, and replacement at Contractor's cost.

C. Substitutions shall comply with, or exceed, requirements of dimension, function, structure, durability, and appearance without exception. Use of accepted substitutions shall in no way relieve the Contractor from responsibility for compliance with the Contract Documents after installation. It shall be incumbent upon the Contractor using accepted substitutions to assume extra costs caused by the use of such substitutions where they affect other work.

D. Do not substitute materials, equipment, or methods unless such substitution has been reviewed and approved by the Architect. **Substitutions shall be submitted to the Division of the State Architect for approval prior to acceptance by Architect.**

E. "Or Equivalent":

1. Where the phrase "or equivalent", "or approved equivalent", or "or equivalent as approved by the Architect" occurs in the Contract Documents, do not assume that materials, equipment, or methods will be accepted as equal unless the item has been specifically accepted, in writing, for the Work by the Architect **and by the Division of the State Architect, Office of Regulation Services for items which "affect health, safety or welfare."**

F. Failure to place orders for specified equipment or material sufficiently in advance of the scheduled installation date will not be considered a valid reason upon which the Contractor may base his request for substitutions or for deviations from the Drawings and Specifications.

G. In the event the Contractor requests changes or revisions requiring drawings or services of the Architect or the Architect’s consultants, to facilitate installation or erection of any portion of the work, the Contractor shall accept the responsibility to hire and pay for the Architect's or Consultant's services. A standard hourly rate, as agreed upon, shall be paid by the Contractor whether the change is accepted or rejected. In the event the change is approved, this fee shall be deducted, and paid, from the Contract Sum.

H. Redesigning by the Contractor: Redesigning shall be by an Engineer licensed, in the State of California, to perform such work. In the event approval is required from authorities having jurisdiction, such approval shall be obtained by the Contractor at the Contractor’s expense before submitting the revised design or substitution to the Architect.

I. Revision after Approval: When a submittal has been reviewed by the Architect, resubmittal for substitution of materials or equipment will not be considered unless accompanied by an explanation acceptable to the Architect as to the reason substitution is considered necessary. Changes in Plans and Specifications, which effect safety, health or welfare, shall be made by Addenda or Construction Change Document approved by the Division of the State Architect.

1.04 SUBSTITUTION REQUEST FORM:

A. Submittal of the requested information shall be accompanied by the attached Substitution Request Form. Submit six copies of each request to the Architect. Architect will distribute as appropriate.

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION
(Not Applicable)

END OF SECTION

ATTACHMENT: Substitution Request Form

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SUBSTITUTION REQUEST FORM

Re: _____
Project Name

_____
Project Manual Section Number

_____
Item

To: _____
Architect

From: _____
Contractor

Reviewed for timeliness and completeness by General Contractor:

We hereby submit for your consideration the following product comparisons of the specified item and the proposed substitution:

A. Comparison	Specified Item	Substitution
1. Product Name/Model	_____	_____
2. Manufacturer	_____	_____
Address	_____	
Address	_____	
Phone Number	_____	
3. Product Cost	_____	
Installation/Labor Cost	_____	
4. Delivery Time	_____	
Installation Time	_____	
5. Product Characteristics	_____	
6. Dimensions	_____	
Effects	_____	
7. Guarantee/Warranty	_____	
8. **ICC No.**	_____	

9. UL Rating _____

B. Substantiating Data:

Attach manufacturer's literature for both specified item and substitution.

C. Samples: Provide samples for both specified item and substitution, if applicable.

D. Similar Projects for Reference:

1. _____ _____
Name Date

_____
Address

_____
Address

_____
Contact

_____
Telephone

2. _____ _____
Name Date

_____
Address

_____
Address

_____
Contact

_____
Telephone

E. Maintenance Service/Parts/Supplier:

_____
Name

_____
Address

_____
Address

_____
Telephone

F. What effect does this substitution have on applicable code requirements?

_____

_____

_____

_____

G. Change Data:

Attach complete information for changes to be made to Drawings and Project Manual.

* * * * * * * * * * * * * * *

* Certification of equal performance and assumption of liability for equal performance.

* The Contractor shall agree to pay for costs involved in changing the building design; including engineering, drafting and detail cost caused by the proposed substitution.

Submitted by:

_____ _____

Signature Name

Title _____

_____ _____

Firm Name Date

_____ _____

Address Address

_____ _____

City State Zip Telephone

Remarks:

_____

_____

_____

Signature must be by persons having authority to legally bind his firm to the above terms. Failure to provide legally binding signature will result in retraction of approval.

Product substitution of _____

for _____

Specifications Section _____
(number) (name)

For Use by Owner's Representative:

□ Accepted □ Not Accepted

Owner's Consultant:

By: _____

Date: _____

□ Accepted □ Not Accepted

School District:

By: _____

Date: _____

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Administrative and procedural requirements governing the Contractor's Applications for Payment.

B. Related Work:

1. The Construction Progress Schedule is included in Section 01 32 16 and shall be coordinated with the work of this Section.

2. PROJECT RECORD DOCUMENTS: All requirements for record documents, Specification Section 01 78 39, shall be completed to the Owner's satisfaction prior to Owner's processing of each month's Application for Payment.

1.02 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of the Network Analysis Schedule.

B. Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than 7 days before the date scheduled for submittal of the initial Application for Payment. Include with initial submission a projected monthly payment request schedule for total cost of project, for Owner's cash flow planning.

C. Acceptance of the Schedule of Values by the Architect and the District is required prior to approval and payment of the first application for payment.

D. Format and Content: The Project Manual Table of Contents may be used as a general guide to format the Schedule of Values; specific item numbers may be sequentially numerical.

1. The Schedule of Values shall be a detailed breakdown of the price to provide and install each item of work and material on the project.

2. Each line item on the Schedule of Values shall be presented to allow the Architect to easily find that item of work within the construction during his review of the construction operations and evaluate whether that line item is 100% complete or not.

3. Each line item of the Schedule of Values shall be given a value by the Contractor that, in the opinion of the Contractor, best represents the value of that work, and if required to present evidence of his opinion, the Contractor will be able to substantiate the value by the use of supplier, subcontractor written quotations, labor wages/rates, hourly estimates and/or by industry recognized cost estimating references.

4. Each line item of the Schedule of Values shall be in such detail and coordinated with other line items of work and with the contractor's Construction Schedule, that

when making application for payment each month, each line item depicts a portion of work that can be completed within one month's pay period, reviewed by the Inspector and the Architect; if that line item is 100% complete, recommended to the Owner for payment. If, in the opinion of the Architect, the line item is not 100% complete, the line item will not be recommended for payment.

5. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed. Each sheet of the Schedule of Values shall be titled and numbered sequentially.

   a. Line Item Number
   b. Description of Item.
   c. Quantity.
   d. Unit of Measure.
   e. Unit Price.
   f. Value of Line Item.
   g. Line Item Value Request this month.
   h. Line Item Value previously completed.
   i. At the bottom of each sheet, the Total Amount of Columns f, g, and shall be tabulated and carried forward on each page and the TOTAL AMOUNT presented at the end.

E. Round amounts off to the nearest whole Dollar; the total shall equal the Contract Sum.

F. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.03 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.

1. The initial Application for Payment, the Application for Payment at the time of Substantial Completion, and the final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is the 15th day of each month. The period of construction Work covered by each Application for Payment is the period ending 15 days prior to the date for each progress payment and starting the day following the end of the preceding period.

C. Payment Application Forms: Use AIA Document G702 and the form of Schedule of Values accepted by the Architect and approved by the District.

D. Application Preparation: Complete each entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

1. Entries shall match data on the Network Analysis Schedule. Use updated schedules if revisions have been made.

2. Include amounts of Owner-approved Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit three (3) executed copies of each Application for Payment to the Architect by means of ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.

1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.

F. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics lien from entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, and related to the Work covered by the payment.

1. Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period covered by the Application.

2. Submit final Application for Payment with or precede by final waivers from entity involved with performance of Work covered by the application who could lawfully be entitled to a lien.

G. Initial Application for Payment: Administrative actions and submittals that must precede submittal of the first Application for Payment include the following:

1. List of subcontractors.

2. Schedule of Values.

3. Contractor's Construction Schedule.

4. Schedule of unit prices, if applicable.

5. Submittal Schedule.

6. Copies of permits as may be required to start the Work (encroachment permits, etc., may be obtained as necessary for sequence of construction).

7. Copies of authorizations and licenses from governing authorities for performance of the Work.

8. Initial progress report.

9. Report of pre-construction meeting

10. Certificates of insurance and insurance policies.

11. Performance and payment bonds.

Note: Each preceding item shall be submitted to the Architect, accepted by the Architect and approved by the Owner prior to the certification and approval of the first payment to the Contractor.

H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. Administrative actions and submittals that shall proceed or coincide with this application include:

1. Occupancy permits and similar approvals.
2. Warranties (guarantees) and maintenance agreements.
3. Test/adjust/balance records.
4. Maintenance instructions.
5. Meter readings.
6. Start-up performance reports.
7. Change-over information related to Owner's occupancy, use, operation and maintenance.
8. Final cleaning.
9. Application for reduction of retainage, and consent of surety.
10. Advice on shifting insurance coverages.
11. Final progress photographs.
12. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion. Each work item value shall be listed and the total amount deducted from amounts owed over and above the retention.

I. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:

1. Completion of Project closeout requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Written assurance that unsettled claims will be settled.
4. Written assurance that Work not complete and accepted will be completed without undue delay.
5. Transmittal of required Project construction records to Owner.
6. Certified property survey.
7. Proof that taxes fees and similar obligations have been paid.
8. Removal of temporary facilities and services.
9. Removal of surplus materials, rubbish and similar elements.
10. Change of door locks to Owner's access.

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION
(Not Applicable)

END OF SECTION

Attachments: Application and Certification for Payment – Form G702
Continuation Sheet – Form G702

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SECTION 01 31 13

PROJECT COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Administrative and supervisory requirements required to ensure orderly progress and timely completion of the Work.

B. Related Work Described Elsewhere:

1. Additional requirements for coordination are included on Contract Drawings and other Sections of the Specifications. It is intended that all work provided under this Contract shall be complete except where otherwise specified or shown. Any drawing, document, or section, by itself, is not a complete description of the work. Cross references to related work, where given, are provided as a convenience and shall not limit the applicability of other requirements specified or shown unless specifically stated.

1.02 QUALITY ASSURANCE

A. Familiarity with Contract Documents:

1. Contractor and all Subcontractors shall conduct a study necessary to become completely familiar with all requirements. Applicable requirements indicated or described in the Contract Documents, and the publications referred to, are a part of the Work required as though repeated in each such Section.

2. In the event discrepancies or conflicts are encountered, notify the Architect immediately. Where there is discrepancy between different parts of the contract documents, including referenced codes and standards, the documents requiring the higher quality, the greater quantity, or the more difficult work shall govern, unless determined otherwise by the Architect.

3. Promptly distribute required information to entities concerned and ensure the needed actions are taken.

B. Reporting: Unless otherwise noted by the Contractor in his transmittals, all of the Contractor's data transmittals to the Architect for the Architect's review will be construed as stipulating that the Contractor has thoroughly and completely reviewed and coordinated the data prior to transmittal.

C. Interfacing: It shall be solely the responsibility of the Contractor to make sure that each Subcontractor completes in a timely manner the assigned work and that all interfaces are prepared, connected, and function as required.

1.03 REQUEST FOR INFORMATION

A. The General Contractor shall plan, schedule, coordinate and sequence Work so Requests for Information (RFI), if necessary, may be submitted to the Architect in a timely manner so as not to delay progress of Work. Submission of and responses to RFI(s) with copies to Owner, shall be transmitted via email or owner approved web application.

B. Telephone conversations requesting information shall be confirmed in writing for prompt reply of all RFIs. Contractor shall coordinate the timing of email and telephone conversations to be made with the Architect's office between the hours of 8:00 a.m. and noon, Monday through Friday.

C. RFI will be unanswered until Contractor submits a "Construction Schedule". "Construction Schedule" shall be based on Specification Section arrangement, and establish starting and ending dates for Work in each section. "Construction Schedule" shall be updated monthly and delivered to Architect and Owner at "Request for Payment".

If "Construction Schedule" is not received by Architect and Owner by that date, Architect's response to pending RFI(s) will be delayed by the same number of days as the days the "Construction Schedule" is late.

D. No damages for delay due to RFI response beyond allotted time will be allowed, unless Contractor can show that RFI was not foreseeable with proper planning, scheduling, coordination, and sequencing and the Architect's late response delayed timely purchase or delivery of equipment or material, or limited construction personnel from proceeding with their task(s), within previously listed "Construction Schedule" activity period(s).

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION

3.01 PLANNING THE WORK

A. By thorough advance planning of activities, coordinate the following in addition to other coordination activities required:

1. Materials, services, and equipment purchasing.
2. Shipping.
3. Receipt and storage at the site.
4. Installation, including interface with related items.
5. Inspection and testing, to the extent required under the Contract.
6. Assistance in initial start-up and operational tests.
7. Completion of the Work, including removal and disposal of Contractor's surplus material and equipment, and final cleaning of structures and sites.

3.02 COORDINATION

A. Coordinate construction activities included under various Sections of these Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative

procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work.

3.03 GENERAL INSTALLATION PROVISIONS

A. Coordination methods used by the Contractor are at the Contractor's option, except that the Architect may disapprove Work completed by the Contractor or data submitted by the Contractor when, in the Architect's judgment, coordination has been inadequate to ensure the specified quality.

B. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

END OF SECTION

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SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.01 SUMMARY

A. ***The Contractor shall develop and maintain the Construction Schedule for the Work per Special Conditions Article A. TIME OF PERFORMANCE. The purpose of the Construction Schedule shall be to:***

1. ***Assure adequate planning, scheduling, and reporting during execution of the construction and related activities so they may be prosecuted in an orderly and timely manner, within the Contract Time and in accordance with the Milestones stipulated by the Contract;***
2. ***Assure coordination of the work of the Contractor and the various subcontractors and suppliers at all tiers:***
3. ***Assist in the preparation, evaluation and processing of the Contractor's monthly progress payments;***
4. ***Assist in monitoring the progress of the work and evaluating proposed changes to the Contract and the Construction Schedule; and,***
5. ***Assist in detecting problems for the purpose of taking corrective action and to provide a mechanism or tool for determining and monitoring such corrective actions.***

B. ***The work under this Contract shall be planned, scheduled, executed and reported using the Critical Path Method (hereinafter referred to as CPM). The Contractor shall use scheduling software compatible with Primavera Project Planner (P6) scheduling software.***

1.02 DEFINITIONS

A. Day: As used throughout the Contract, the work "day" means "calendar day" unless otherwise indicated.

B. Adverse weather that is normal for the area and the season shall be taken into account in the Construction Schedule ***and as required per special conditions Article "A", Time of Performance.***

1.03 QUALITY ASSURANCE

A. Qualifications of Scheduling Personnel: Employ a project scheduler thoroughly trained and experienced in ***critical path scheduling on projects of similar size and scope for the duration of the Contract.***

B. Reliance Upon Accepted Schedule:

1. The construction schedule, as accepted by the Architect, shall be an integral part of the contract and will establish interim Contract completion dates for various activities.

2. Should any activity fail to be completed within ***10*** days after the stipulated

schedule date, the Owner shall have the right to order the Contractor to expedite completion of the activity by whatever means the Owner deems appropriate and necessary, without additional compensation to the Contractor, and as set forth in the General Conditions of the Contract.

3. Should any activity be ***20*** or more days behind schedule, the Owner shall have the right to perform the activity or have the activity performed by whatever method the Owner may deem appropriate, and as set forth in the General Conditions of the Contract.

4. Costs incurred by the Owner in connection with expediting construction shall be deducted from the Contract amount.

5. Failure by the Owner to exercise the option to either order the Contractor to expedite an activity or to expedite the activity by other means, will not be considered a precedent for any other activities nor a waiver of the Owner's rights to exercise his rights on subsequent occasions.

1.04 SUBMITTALS

A. Submittal Procedure: Refer to Section 01 33 00 – Submittal Procedures and to Section 01 25 00 – Substitution Procedures.

B. Preliminary Analysis: Within 10 days after receipt of notice to proceed, submit one reproducible copy of a preliminary Construction Schedule.

C. Construction Schedule: Within 30 days after receipt of notice to proceed, submit one reproducible copy of the initial construction schedule.

D. Periodic Reports: On the first working day of each month following submittal of the initial construction schedule, submit one reproducible copy of the updated Construction Schedule.

PART 2 - PRODUCTS

2.01 CONSTRUCTION ANALYSIS

A. Graphically show the order and interdependence of activities necessary to complete the Work, and the sequence in which each activity is to be accomplished, as planned by the Contractor and his project field superintendent in coordination with all subcontractors whose work is shown on the diagram. Show all activities on the diagram. Each activity shall indicate work item breakdown noting duration and responsibility for each item, including, but not necessarily limited to:

1. Project mobilization.

2. Submittal and review of shop drawings and samples.

3. Procurement of equipment and critical materials.

4. Fabrication of special material and equipment. Installation and testing of each by item and by system.

5. Final Cleanup.

6. Final inspection and testing.

7. Activities by the Architect that affect progress, required dates for completion, or both, for each part of the work.

PART 3 - EXECUTION

3.01 PRELIMINARY ANALYSIS

A. Prepare a Preliminary Construction Schedule:

1. Show all activities of the Contractor under this Contract for the period between receipt of notice to proceed and submittal of initial construction schedule.

2. Show the Contractor's general approach to remainder of the Work.

3. Show cost of all activities scheduled for performance before submittal and review of the Construction Schedule.

3.02 INITIAL CONSTRUCTION SCHEDULE

A. Update the Preliminary Construction Analysis for use as the initial Construction Schedule:

1. Clearly indicate the critical path and slack where it occurs.

2. Meet with the ***Construction Manager*** and review contents of proposed Construction Schedule.

3. Make all revisions required by the ***Construction Manager.***

3.03 DETAILED CONSTRUCTION SCHEDULE:

A. Within twenty-one (21) calendar days of the date of Notice to Proceed. Contractor shall submit to the Construction Manager a detailed Construction CPM Schedule for the Contractor's construction work scope.

B. The detailed Construction Schedule shall conform with the requirements outlined in this Specification Section.

C. The Construction Schedule will be reviewed in accordance with the following:

1. Within 10 calendar days after receipt by the Construction Manager of the detailed Construction Schedule, the Construction Manager will notify the Contractor of any objections the District or its representatives may have in regard to the detailed Construction Schedule.

2. If the Contractor's proposed activities, logic, or durations, are questioned, the Contractor shall, within 7 calendar days after receipt of the Construction Manager's request, provide a satisfactory revision to, or adequate justification for, these activities, logic, or durations, to the satisfaction of the District.

3. In the event the Contractor fails to define any element of work, activity or logic and the District review does not detect this omission or error, such omission or error, when discovered by the Contractor or Construction

Manager, shall be corrected by the Contractor at the next monthly Schedule Update (discussed hereinafter) and shall not affect the Contract Time.

4. Acceptance of Contractor's Construction Schedule

a. Acceptance of the Contractor's Detailed Construction Schedule will be a condition precedent to the making of any progress payments under the Contract.

b. Acceptance of the Contractor's Construction Schedule does not relieve the Contractor of any of Contractor's responsibility whatsoever for the accuracy or feasibility of the Construction Schedule, or of the Contractor's ability to meet the Contract completion date(s) or milestone dates, nor does such acceptance acknowledge or admit the reasonableness of the activities, logic, or durations, included in the Contractor's Construction Schedule

3.04 SCHEDULE UPDATING

A. The term "updated schedule" means dates have been changed without change to the logic sequence by inserting status information reflecting actual progress.

B. Schedule updating:

1. On a monthly basis, the Contractor shall meet with the Construction Manager for the purpose of reviewing the updated Construction Progress Schedule. The updating process will be performed by the Contractor making an assessment of actual progress of each activity. Information to be recorded consists of activity actual start and finish dates, and activities' percent complete.

2. The update information will be provided by the Contractor and submitted to the Construction Manager. This updated actual progress data will be used by the Construction Manager as the basis for processing the Contractor's monthly Application for Payment.

3. Upon finalization of the computerized schedule update, the Contractor shall submit the required schedule reports as detailed in the "Required Reports" section of this Specification

4. In addition to these monthly updates, interim updates may be required by the Construction Manager. Contractors will be expected to contribute update data to the Construction Manager as required to complete these interim updates.

3.05 SCHEDULE REVISIONS

A. The term "revised schedule" means logic and planned activity durations have been changed from the Schedule of Record, or its latest previous revision.

B. If, as a result of the monthly Schedule Update, it appears the Construction Schedule no longer represents the anticipated actual performance and progress of the work, the Construction Manager will require the Contractor to submit a revision to the Construction Schedule. Such revisions to the Schedule shall not alter any of the Milestone or completion dates.

C. The Contractor may also request revisions to the Construction Schedule in the

event the Contractor's planning for the work is revised. If the Contractor desires to make changes in the Construction Schedule to reflect revisions in the method of operating and scheduling of the work, the Contractor shall notify the Construction Manager in writing, stating the reason for the proposed revision as well as proposed changes. All reasonable requests by the Contractor for revisions will be accepted by the Construction Manager, provided there is no impact to achieving the milestones or completion dates.

D. If revision to the Construction Schedule is contemplated, the Contractor shall advise the Construction Manager in writing at least 14 calendar days prior to the next Schedule Update meeting, describing the revision and setting forth the reasons thereof. The Contractor shall submit copies of the proposed changes along with a written narrative of the proposed changes. If accepted by the Construction Manager, those revisions may be incorporated into the current Construction Schedule.

E. The Construction Manager may suggest revisions to the Construction Schedule. The Contractor shall respond in writing within 14 calendar days, either agreeing with the Construction Manager's proposed revision, or setting forth justification why it cannot be accomplished. If the Contractor's justification for not accomplishing the revision is reasonable, such revision will not be incorporated into the Construction Schedule. If the Contractor's justification is not accepted, the Construction Manager-directed revisions shall be incorporated into the Construction Schedule. Should the Contractor's not respond in writing within 14 calendar days, the Construction Manager-suggested revisions will be deemed to be acceptable, and such revisions will be incorporated into the Construction Schedule

3.06 REQUIRED REPORTS

A. On a monthly basis as specified above, submit updated Construction ***Progress*** Schedule:

1. Indicate "actual" progress in percent completion for each activity.

2. Provide written narrative summary of revisions causing delay in the program. Explain corrective actions taken or proposed.

3. Progress Payments to Prime Contractor (per general conditions section 9.3) shall be contingent on submittal of updated construction progress schedule as required here-in.

B. Revise accepted construction schedule only when revisions are reviewed and approved in advance by the ***Construction Manager.***

END OF SECTION

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SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined by manufacturer's name and catalog number, reference to recognized industry and government standards, or description of required attributes and performance.

2. To help ensure that the specified products are furnished and installed in accordance with design intent, submit design product and data in advance for review by the Architect. Review by the Architect and the design consultants in no way relieves the contractor or subcontractor or supplier from providing the products or construction as described in the Contract Documents.

3. Make submittals required by the Contract Documents. Revise and resubmit when requested to establish compliance with the specified requirements.

B. Related Work Described Elsewhere: Additional requirements for submittals are described in other Sections of these Specifications and the General Conditions.

1.02 QUALITY ASSURANCE

A. Coordination of Submittals: Prior to each submittal, review and coordinate each item being submitted and verify that each item and the submittal conform with the requirements of the Contract Documents. **By affixing the Contractor's signature to each submittal, certify that this coordination has been performed.**

B. Certificates of Compliance:

1. Certify that materials used in the Work comply with specified provisions thereof. Certification shall not be construed as relieving the Contractor from furnishing satisfactory materials if, after tests are performed on selected samples, the material is found not to meet specified requirements.

2. Show on each certification the name and location of the Work, name and address of Contractor, quantity and date or dates of shipment or delivery to which the certificate applies, and name of the manufacturing or fabricating company. Certification shall be in the form of letter or company-standard forms containing required data. Certificates shall be signed by an officer of the manufacturing or fabricating company.

3. In addition to the above information, laboratory test reports submitted shall show the date or dates of testing, the specified requirements of which testing was performed, and results of the test or tests.

1.03 SUBMITTALS

A. Contractor shall submit all shop drawings, samples, requests for substitutions, mix designs, and other items, in accordance with this Section. Submit schedule per Section 01 32 16, Construction Progress Schedule, indicating timing of all required submittals.

B. Prior to submittal of the Contractor's first application for payment, submit a schedule of all submittals required by the Contract Documents.

C. Submittals shall be submitted per the following time schedule for the following specific items. Failure to submit by these dates will be considered sufficient grounds to delay Architect's certification of Contractor's Application for Payment until these items are received in proper order.

1. Within **15 calendar days** after Award of Contract:

a. **All Requests for Substitutions:** After this date, no further requests for substitution will be considered, and Contractor shall be obligated to provide the specified products - **NO EXCEPTIONS.**

2. Within **20 calendar days** after Notice to Proceed:

a. Concrete mix design, steel connectors to be embedded in concrete foundations and slabs, materials for underground site plumbing, sewer, storm drainage, and underground site electrical.

3. Within **30 calendar days** after Notice to Proceed:

a. Hollow metal, door hardware, fire alarm system, fire sprinkler system, glu-lam beams and other structural lumber, structural steel, miscellaneous structural connectors, mechanical, plumbing and electrical materials, and equipment and fixtures.

b. All materials requiring a color selection by the Owner and Architect.

c. All casework.

4. Within **45 calendar days** prior to installation:

a. All other items not specifically mentioned in 1, 2 and 3 above.

D. Provide required submittals for the following products to interface with other portions of the Work. Submit data to verify compliance only.

1. For products specified only by reference standard, select product meeting that standard, by manufacturer.

2. For products specified by naming several products or manufacturers, select one of the products or manufacturers named.

3. For products specified by naming one or more products or manufacturers and stating "or other approved', or "or approved equivalent", or other such wording on drawings or within specifications sections, submit a request for substitutions for product or manufacturer which is not specifically named, but only after submitting bid on specified products and systems.

PART 2 - PRODUCTS

2.01 SHOP DRAWINGS AND COORDINATION DRAWINGS

A. Scale and Measurements: Make shop drawings to a scale sufficiently large to shown pertinent aspects of the item and its method of connection to the Work.

B. Type of Prints Required: When contractor desires a reproducible shop drawing, submit shop drawings in the black and white paper and PDF format.

C. Reproduction of Reviewed Shop Drawings: Printing and distribution of reviewed shop drawings for the Architect's use will be by the Architect.

D. Review comments of the Architect will be shown on the sepia transparency when it is returned to the Contractor. The Contractor shall make and distribute copies required for his purposes.

2.02 MANUFACTURERS' LITERATURE

A. General: Where submitted literature from manufacturers includes data not pertinent to the submittal, indicate which portion of the contents is being submitted for review. Submittals not clearly marked will be returned without review.

B. Number of Copies Required: Nine (9) total, three (3) for Contractor plus six (6) copies to be retained by the Architect. The Architect will distribute stamped copies to the Consultant, D.S.A., the Inspector, and two (2) to the Owner.

C. The Contractor shall make and distribute copies required for his purposes.

2.03 SAMPLES

A. Accuracy of Samples: Precise article proposed to be furnished shall be labeled with a submittal number, and project name.

B. Number of Samples Required: Submit quantity required to be returned plus one each retained by the Architect, the Inspector, D.S.A., and the Owner, unless otherwise noted.

C. Reuse of Samples: In situations accepted by the Architect, the Architect's retained sample may be used in the construction as one of the installed items.

D. Size of Samples: Samples shall be 6" x 6", or manufactured width by 12 inches, unless otherwise required by the pertinent Specification section.

2.04 COLORS AND PATTERNS

A. When the precise color and pattern is not specifically described in the Contract Documents, and whenever a choice of color or pattern is available in a specified product, submit accurate color and pattern charts to the Architect for review and selection. Submit data to verify compliance only. If the color is specifically described in the Contract, submit only that color for verification and approval.

PART 3 - EXECUTION

3.01 IDENTIFICATION OF SUBMITTALS

A. General: Consecutively number submittals within the respective specification section. Accompany each submittal with transmittal cover letters attached to the end of this Section. Fill out each transmittal cover letter completely, number sequentially, include specification section, name of supplier or installer, and contact person and telephone number.

B. Internal Identification: On the first page of each copy of each submittal, and elsewhere as required for positive identification, indicate the submittal number.

C. Resubmittals: When material is resubmitted, transmit under a new letter of transmittal and with same submittal number plus a "alphabetic" suffix indicating its a re-submittal, e.g. 05500-1A, 05500-1B.

D. Submittal Log: Maintain submittal log for the duration of the Contract. Show current status of submittals, with columns showing "approved", "approved as corrected", etc, to match Architect's categories. Make the submittal log available for the Architect's review upon request. Log shall be available and will be reviewed at each project meeting.

3.02 COORDINATION OF SUBMITTALS

A. The Contractor's Project Engineer shall be responsible to coordinate and review all submittals prior to forwarding to Architect. All submittals shall be stamped with Contractor's stamp, signed and dated, stating:

1. Contractor has reviewed submittal for compliance with requirements of the Contract Documents.

2. Contractor has reviewed submittal for proper interfacing with other trades.

B. General: Prior to making submittals, coordinate materials including, but not necessarily limited to:

1. Determine and verify interface conditions, catalog numbers, and similar data,

2. Coordinate with other trades as required,

3. Clearly indicate deviations from requirements of the Contract Documents. Deviations which are <u>not</u> clearly called out as a deviation and which subsequently become a part of an approved submittal can under no circumstances be considered legitimate grounds for an additive change order.

C. Grouping of Submittals: Make submittals in groups containing associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected as not complying and the Contractor shall be strictly liable for occasioned delays.

D. Color selections for materials in the same space or same elevation shall be submitted at one time. "Piece meal" submission of the color samples or charts is unacceptable and will be returned awaiting a "complete" submission.

3.03 TIMING OF SUBMITTALS

A. General: Make submittals far enough in advance of dates scheduled for installation to provide time required for reviews; for possible revisions and resubmittals; and for placing orders and securing delivery, and as otherwise required by Part 1.03 of this Section.

B. Architect's Review Time: In scheduling, allow at least 20 calendar days for review by the Architect following his receipt of the submittal or as otherwise may be required under each Specification section. Allow an additional 10 days for reviews involving Architect's consultants or as otherwise may be required under each Specification section.

C. Delays: Delays caused by tardiness in making submittals or resubmittals will not be an acceptable basis for extension of the Contract completion time.

3.04 ARCHITECT'S REVIEW

A. General: Corrections or comments made on Shop Drawings during his review shall not relieve the Contractor from compliance with requirements of the Drawings and Specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of other trades, and performing his work in a safe and satisfactory manner.

1. Authority to Proceed: The notations "Furnish as Submitted" or "Furnish as Corrected" authorize the Contractor to proceed with fabrication, purchase, or both or the items so noted, subject to the revisions, if any, required by the Architect's review comments.

2. Revisions: The notation "Revise and Resubmit" or "Submit Specified Item" means make revisions required by the Architect and resubmit. If the Contractor considers required revision to be a change, he shall so notify the Architect as provided for under "Changes" or "Changes in the Work" in the General Conditions. Show each drawing revision by number, date, and subject in a revision block on the drawing. Make only those revisions directed by or accepted by the Architect.

3. Rejection: The notation "Rejected" means the submission does not meet requirements of project contract documents. Make new submission meeting project contract documents.

END OF SECTION

Attachment: Contractor’s Form - Shop Drawings / Submittal Transmittal Letter
Cover Sheet referenced herewith.

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SECTION 01 42 19

REFERENCE STANDARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Throughout the Contract Documents, reference is made to codes and standards which establish qualities and types of workmanship and materials, and methods for testing and reporting on the pertinent characteristics.

B. Provide materials and workmanship which meet or exceed the specifically named code or standard.

C. Deliver to the Architect required proof that the materials or workmanship, or both, meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested by the Architect and will generally be required to be copies of a certified report of tests conducted by a testing agency acceptable for that purpose to the Architect.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Specific naming of codes or standards occurs on the Drawings and in other Sections of these Specifications. Comply with laws, ordinances, and regulations of authorities having jurisdiction. Proof of compliance with laws, ordinances, and regulations shall be by the signed approval of the respective authorities having jurisdiction. Costs relative thereto shall be borne by the Contractor.

1.03 QUALITY ASSURANCE

A. Familiarity with Pertinent Codes and Standards: Verify the requirements of the specifically named codes and standards as well as requirements mandated by law, ordinance and authority. Verify that the items procured and installed in this Work meet or exceed the specified requirements.

B. Rejection of Noncomplying Items: The Architect reserves the right to reject items incorporated into the Work which fail to meet such minimum requirements.

1.04 APPLICABLE CODES

A. Work of the project shall conform to the following list of the **2022, Title 24, California Code of Regulations (CCR),** a List of Codes, copies of which shall be maintained at the job site by the Contractor throughout the duration of the work.

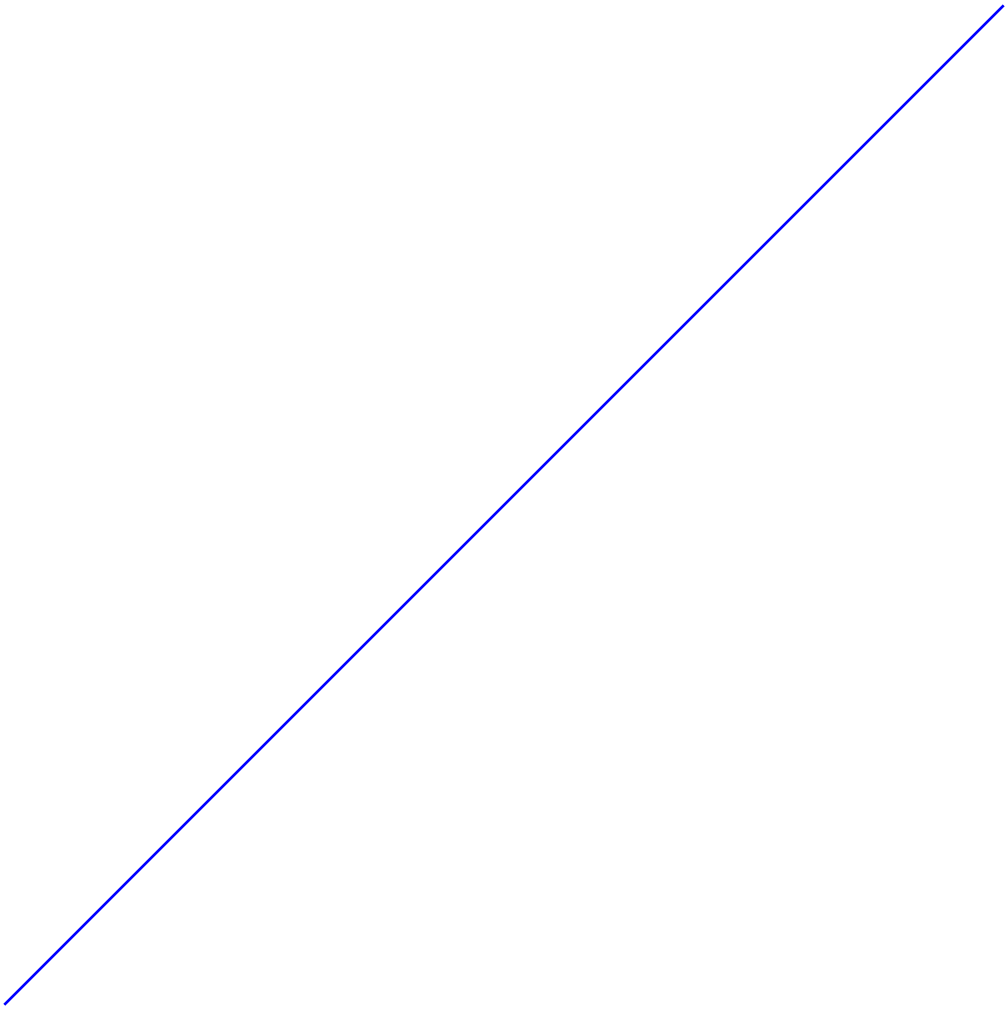
B. **Applicable Codes as of January 1, 2023**:

1. **2022 California Administrative Code** (CAC), Part 1, Title 24 CCR
2. **2022 California Building Code** (CBC), Part 2, Title 24 CCR
3. **2022 California Electrical Code** (CEC), Part 3, Title 24 CCR
4. **2022 California Mechanical Code** (CMC), Part 4, Title 24 CCR
5. **2022 California Plumbing Code** (CPC), Part 5, Title 24 CCR
6. **2022 California Energy Code**, Part 6, Title 24 CCR
7. **2022 California Fire Code** (CFC), Part 9, Title 24 CCR

8. **2022 California Existing Building Code** (CEBC), Part 10, Title 24 CCR
9. **2022 California Green Building Standards Code** (CALGreen), Part 11, Title 24 CCR
10. **2022 California Referenced Standards Code**, Part 12, Title 24 CCR
11. **Title 19 CCR**, Public Safety, State Fire Marshal Regulations

C. **Applicable Standards**:
For a list of applicable standards, including California amendments to the NFPA Standards, refer to CBC Chapter 35 and CFC Chapter 80.

D. **Applicable Standards**:



For a complete list of applicable NFPA standards refer to 2022 CBC (SFM) Chapter 35 and California Fire Code Chapter 80.

See California Building Code Chapter 35 for State of California amendments to the NFPA

Standards.

1.05 REFERENCE STANDARDS

A. Standards referenced in the Specifications are usually referred to by the abbreviation of the organization's name and the designation of the document (e.g., ASTM A36). Documents in common use may be referred to by their own designation (e.g., the California Electrical Code is published by the National Fire Protection Association as NFPA-70 but is referred to as CEC, and is part of a series of documents or standards referred to as the California Fire Code). References are to the latest issue of the publication available on the date stipulated for the receipt of bids.

STANDARDS ORGANIZATIONS

AA	Aluminum Association
AAMA	American Architectural Manufacturer's Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AGA	American Gas Association
AISC	American Institute of Steel Construction
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association, Inc.
ANSI	American National Standards Institute, Inc.
APA	APA-The Engineered Wood Association
ARI	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Protection Association
AWPB	American Wood Preservers' Bureau
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
CBC	California Building Code, 2022
CDA	Copper Development Association

CEC	California Electrical Code
CEQA	California Environmental Quality Act
CGA	Compressed Gas Association
CISPI	Cast Iron Soil Pipe Institute
CMC	California Mechanical Code - See IAPMO
CPC	California Plumbing Code - See IAPMO
CPSC	Consumer Product Safety Commission
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard of U.S. Dept. of Commerce
CTIOA	Ceramic Tile Institute of America (former CTI)
CSMA	Chemical Specialties Manufacturing Association
FGMA	Flat Glass Marketing Association
FM	Factory Mutual Global (former FMS)
FS	Federal Specification
GA	Gypsum Association
HI	Hydraulic Institute
HRI	Hydraulics Research Institute
IAPMO	International Association of Plumbing and Mechanical Officials
ICC	International Code Council (former ICBO)
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society of North America
MIL-STD	Military Specifications (former MIL)
ML/SFA	Metal Lath/Steel Framing Association
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
NAAMM	National Association of Architectural Metal Manufacturers
NIST	National Institute of Standards and Technology (former NBS)
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturers Association

N FLUID PA	National Fluid Power Association
NFPA	National Fire Protection Association
NRCA	National Roofing Contractors Association
NSF	National Sanitation Foundation
NWWDA	National Wood Window and Door Association
PS	Voluntary Product Standard (of NIST former NBS)
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SDI	Steel Deck Institute
SJI	Steel Joist Institute
SSPC	The Society for Protective Coatings (former SSPC)
TCNA	Tile Council of North America, Inc. (former TCA)
TSIB	Technical Services Information Bureau (former WLPDIA)
UL	Underwriters Laboratories, Inc.
WI	Woodwork Institute (former WIC)
TITLE	Title 24, California Code of Regulations, Part 1, 2, 3, 4, 5, 6, 8, & 9
TITLE	Title 19, California Code of Regulations

1.06 REFERENCE COPIES

A. A minimum of one copy of Codes, Regulations, and Standards referenced in the drawings or the specifications, or applicable to the work, shall be furnished to the Owner's Representative at least (2) two weeks prior to the commencement of work affected by such codes, regulations or standards.

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION
(Not Applicable)

END OF SECTION

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SECTION 01 45 23

TESTING AND INSPECTING SERVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Cooperate with the Owner's selected testing agency, the Owner's assigned Inspector, and others responsible for testing and inspecting the Work, and assist the Owner by coordinating such testing and inspecting services as specified in this Section and/or elsewhere in the Contract Documents.

B. Related Work Specified Elsewhere:

1. Requirements for testing may be required in other Sections of these Specifications.

2. Where no testing requirements are specified or required by reference standards or authorities having jurisdiction, the Owner may require such testing to be performed under current pertinent standards for testing. Payment for such testing will be made as described herein.

C. Work Not Included:

1. The Owner will select a pre-qualified independent testing laboratory and Inspector as approved by the Division of the State Architect (DSA), Department of General Services, Architect and Structural Engineer.

2. The Owner will pay for initial services of the testing laboratory as further described hereinafter.

1.02 QUALITY ASSURANCE

A. The Owner will select an independent testing laboratory to conduct the tests. Selection of the material required to be tested shall be by the laboratory or the Owner's representative and not by the Contractor.

B. Qualifications of Testing Laboratory: The testing laboratory, approved by DSA, shall be qualified to the Owner's acceptance in accordance with ASTM E329. The testing laboratory shall be qualified by the Division of the State Architect.

C. Codes and Standards: Testing, when required, will be in accordance with pertinent codes and regulations and with selected standards of the American Society for Testing and Materials and other organizations or agencies which publish recognized codes, standards, or tests. Refer to Article 3.04 - Required Testing of this Section.

1.03 TEST REPORT DISTRIBUTION

A. Promptly process and distribute required copies of test reports and related instructions to ensure necessary retesting and/or replacement of materials with the least possible delay in progress of the Work.

B. One copy of Test Reports shall be forwarded to the Division of the State Architect by the testing agency. Such reports shall include tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations as required shall also be reported. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of Title 24 and with the approved specifications. Test reports shall show the specified design strength. They shall also state definitely whether or not the material or materials tested comply with requirements.

C. Each Testing Agency shall submit to the Division of the State Architect a verified report in duplicate covering tests which are required to be made by that agency during the progress of the project. Such report shall be furnished each time that work on the project is suspended, including tests up to that time, and at the completion of the project.

1.04 PAYMENT FOR TESTING SERVICES

A. Initial Services: The Owner will pay for initial testing and inspection except as specifically modified herein- after or as specified otherwise in technical sections, provided the results of inspection indicate compliance with the Contract Documents.

B. Retesting: When initial tests or inspection indicate noncompliance with the Contract Documents, subsequent retesting or reinspection occasioned by the noncompliance shall be performed by the same testing laboratory or Inspector and the costs thereof will be deducted by the Owner from the Contract Sum. Retesting and reinspection will continue until test or inspection results indicate compliance.

C. Code Compliance Testing: Inspections and tests required by codes or ordinances, or by authorities having jurisdiction and made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Owner, but backcharged to the Contractor in case of retesting due to non-compliance.

D. Specified Inspections and Tests: Tests and inspections specified in the Specifications, directly or by reference, shall be coordinated by the Contractor at his expense and paid for by the Owner. Corrections of noncompliance and test failures shall be paid for by the Owner, but shall be backcharged to the Contractor. Reinspection and retesting shall be in accordance with paragraph 1.04-B.

E. Contractor's Convenience Testing: Inspecting or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of and at the expense of the Contractor.

1.05 INSPECTION BY THE OWNER

A. The Owner and his representatives will have access, for the purpose of inspection, to parts of the work and to the shops wherein the work is in preparation, and the Contractor shall maintain proper facilities and provide safe access for such inspection.

B. The Owner shall have the right to reject materials and workmanship which are defective, and to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the Owner. If the Contractor does not correct such rejected work within a reasonable time, fixed by written notice, the Owner may correct rejected work and charge the expense to the Contractor.

C. Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire work to make an examination of work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish necessary facilities, labor and materials. If such work is found to be defective in respect due to fault of the Contractor or his subcontractor, he shall defray expenses of such examinations and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the contract, the additional cost of labor and material necessarily involved in the examination and replacement will be allowed the Contractor.

1.06 OWNER'S INSPECTOR

A. An Inspector employed by the Owner, approved by DSA in accordance with the requirements of the State of California Administrative Code, Title 24, Part 1, and qualified in accordance with Division of the State Architect will be assigned to the work. Reference DSA IR A-7 and IR A-8 for project Inspector certification and approval and duties and performance rating by DSA. The inspector duties are specifically defined in Title 24, Part 1, Section 4-219, reprinted herein:

" 4-219 Duties of the Project Inspector

(a) General. The project inspector shall act under the direction of the architect or registered engineer and under the supervision of the enforcement agency.

(b) Duties. The general duties of the project inspector in fulfilling project inspection responsibilities are as follows:

1. Continuous inspection requirement. The project inspector must have actual personal knowledge obtained by personal and continuous inspection of the work of construction in all stages of its progress that the requirements of the approved plans and specifications are being executed.

Continuous inspection means complete inspection of every part of the work. Work, such as concrete work or masonry work which can be inspected only as it is placed, shall require the constant presence of the project inspector. Other types of work which can be completely inspected after the work is installed may be carried on while the project inspector is not present. In any case, the project inspector must personally inspect every part of the work. In no case shall the inspector have or assume any duties that will prevent him or her from providing continuous inspection.

The project inspector may obtain personal knowledge of the work of construction, either on-site or off-site, from the inspections performed by special inspectors or approved assistant inspectors and from the reporting of others on testing and inspection of materials and workmanship for compliance with the plans, specifications, and applicable standards. The exercise of reasonable diligence to obtain the facts shall be required.

2. Relations with the architect or engineer. The project inspector shall work under the general direction of the architect or registered engineer. Any uncertainties in the inspector's comprehension of the plans and specifications shall be reported promptly to the architect or registered engineer for his/her interpretation and instructions. In no case shall the instructions of the architect or registered engineer be construed to cause

work to be done which is not in conformity with the DSA approved plans, specifications and documents authorizing changes.

3. Job file. The project inspector shall keep a file of approved plans and specifications (including all approved documents authorizing changes) on the job at all times.

4. Construction procedure records. The project inspector shall keep a record of certain construction procedures including, but not limited to the following:

A. Concrete pouring operations. The records show the time and date of placing concrete and the time and date of removal of forms in each portion of the structure.

B. Welding operations. The record shall include identification marks of welders, lists of defective welds, manner of correction of defects, etc.

C. Penetration under the last ten (10) blows for each pile when piles are driven for foundations. All such records of construction procedures shall be kept on the job until the completion of the work. These records shall be made a part of the permanent records of the owner.

5. Deviations. The project inspector shall notify the contractor, in writing, of any deviations from the approved plans and specifications which are not immediately corrected by the contractor when brought to the contractor's attention. Copies of such notice shall be forwarded immediately to the architect or registered engineer and to the enforcement agency.

Failure on the part of the project inspector to notify the contractor of deviations from the approved plans and specifications shall in no way relieve the contractor of any responsibility to complete the work covered by his or her contract in accordance with the approved plans and specifications and all laws and regulations.

6. Verified reports. The project inspector shall submit to the enforcement agency verified reports as required in Section 4-214.

(c) Violations. Failure, refusal or neglect on the part of the project inspector to notify the contractor of any work which does not comply with the requirements of the approved plans and specifications, or failure, refusal or neglect to report immediately, in writing any such violation to the architect or registered engineer, to the owner and to the enforcement agency shall constitute a violation of the Act and shall be cause for the enforcement agency to take action, which may result in withdrawal of the inspector's approval.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16017 and 16021. "

B. The work of construction in stages of progress shall be subject to the personal continuous observation of the Inspector as continuous observation is defined by Title 24. He shall have free access to all parts of the work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from obligation to fulfill this Contract.

1.07 OWNER'S OTHER PERSONNEL

A. From time to time, other personnel in the employ of the Owner may inspect the Work when the Work is in progress but shall have no authority to direct the Contractor or request changes in the Work except as may be provided elsewhere in the Contract Documents.

1.08 REPRESENTATIVE OF THE DIVISION OF THE STATE ARCHITECT

A. Architect shall have access to the site in accordance with Title 24.

B. Field Engineers and Inspectors from DSA. Structural Safety Section, Fire & Life Safety Review and Access Compliance shall have access to the site in accordance with Title 24.

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION

3.01 COOPERATION WITH TESTING LABORATORY AND INSPECTORS

A. Inspectors and representatives of the testing laboratory shall have access to the work. Provide facilities for such access in order that the testing, inspection, and the obtaining of samples may be done properly.

B. Contractor shall deliver material specimens to the Owner's testing lab, which must by terms of the Contract be tested prior to inclusion in the Project, at least 45 days prior to scheduled delivery to the job site.

C. Material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the job.

3.02 TAKING SPECIMENS

A. Field specimens and samples for testing, unless otherwise provided in these Contract Documents, shall be selected and taken by the Testing Laboratory or Inspector and not the Contractor. Sampling equipment and personnel will be provided by the testing laboratory. Deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory. Soil samples for approval of import fill shall be delivered to the Testing Laboratory by the Contractor, as directed by the Testing Laboratory.

3.03 SCHEDULES FOR TESTING

A. Establishing Schedule:

1. By advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.

2. Provide required time within the Construction Schedule.

B. Revising Schedule: When changes of construction schedule are necessary during construction, coordinate such changes of schedule with the testing laboratory as required.

C. Adherence to Schedule: When the testing laboratory is ready to test according to the determined schedules, but is prevented from testing or taking specimens due to incompleteness of the work, extra charges for testing attributable to the delay may be back-charged to the Contractor and will be deducted by the Owner from the Contract Sum.

3.04 REQUIRED TESTING

Tests and inspections for the following items will be required in accordance with referenced Sections/Chapters of California Building Code, Title 24, Part 2:

A. FOUNDATIONS

Sitework, Demolition & Construction (Chapters **17A** and **18A**)

1.	Earth Fill Compaction	1803A, 1705A.6
2.	Excavation and Fills	1910A.1

B. CONCRETE (Chapters **179A** and **19A**):

1. MATERIALS:

a.	Portland Cement Test	1910A.1
b.	Concrete Aggregates	1903A.5
c.	Reinforcing Bars	1903A.8
d.	Batch Plant Inspection	1705A.3.3

2. CONCRETE QUALITY:

a.	Proportions of Concrete	1904A
b.	Strength Test of Concrete	1905A.1.15
c.	Concrete Curing	1903A

3. CONCRETE INSPECTION:

a.	Job Site Inspection	1705A.3.5, 1705A.3.6
b.	Batch Plant or Weighmaster Inspection	1705A.3.3
c.	Reinforcing Bar Welding Inspection	1705A.3.1
d.	Clean Rough Construction Joints	1903A
e.	Waiver of Batch Plant Inspection	1705A.3.3.1

C. MASONRY (Chapters **17A, 19A** and **21A**):

1. MATERIALS:

a.	Masonry Units	2103A.1
b.	Portland Cement	2103A
c.	Mortar & Grout Aggregates	2103A.2 & 2103A.3
d.	Reinforcing Bars	2103A.4

2. MASONRY QUALITY:

a.	Portland Cement Tests	1905A.1.15
b.	Mortar & Grout Tests	2105A.3
c.	Masonry Core Tests	2105A.4
d.	Masonry Prism Tests	2105A.5
e.	Reinforcing Bar Tests	1910A.2
f.	Masonry Unit Tests	2105A.6

3. MASONRY INSPECTION:

a.	Reinforced Masonry (continuous by DSA approved Special Inspector)	1705A.4
b.	Reinforcing Bar Welding Inspection	1705A.3.1

D. STRUCTURAL STEEL (Chapter **17A** and **22A**):

1. MATERIALS:

a.	Structural Steel, Cold Formed Steel	2203A, 2205A, and 2211A
b.	Material Identification	2202A.1

2. TESTS AND INSPECTION OF STRUCTURAL STEEL:

a.	Tests of Structural Steel	2202A.1
b.	Welding inspection (by AWS-CWI approved by DSA)	1705A.2.5
c.	Shop fabrication inspection	1704A.2.5
d.	Tests of high strength bolts, nuts, washers	1705A.2.1
e.	Tests of end-welded studs	2213A.2
f.	Automatic end-welded stud shear connector Inspection	1705A.2.1
g.	High Strength Bolt Inspection	1705A.2.1
h.	Tension test for drilled-in anchor or chemical type anchors	1910A.5
i.	Non-destructive weld testing	1705A.2.1
j.	(Special Inspection)	1705A

E. WOOD (Chapter **23**):

1. MATERIALS:

a.	Lumber and Plywood Grading Standard	2303
b.	Glued-Laminated Members	2303.1.3, 1705A.5.4

2. WOOD INSPECTION:

a.	Glued-Laminated Fabrication (by DSA approved Project Inspector)	1705A.5.4
b.	Timber Connections	1705A.5.6
c.	Manufactured Trusses	1705A.5.5

F. EXPANSION BOLTS OR EPOXY-TYPE ANCHORS IN CONCRETE (Hard Rock)

Refer to Structural notes S-001, and CBC 1910A.5

1.	Tension Testing	Per S-001
2.	Failure/Quality Assurance	Per S-001

END OF SECTION

Attachment: **DSA form**: **103** Structural Tests & Inspections

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Construction facilities and temporary controls including:

1. Temporary utilities such as heat, water, electricity, and telephone.
2. Field offices and storage areas, including offices for Architect and Inspector.
3. Sanitary facilities for construction personnel.
4. Enclosures such as tarpaulins, barricades, and canopies.
5. Provision of fire safety and fire fighting facilities.

B. Related Work Specified Elsewhere:

1. Installation and connections to existing utility lines are described in the Sections of these Specifications relative to permanent connections required.

1.02 QUALITY ASSURANCE

A. Conform with the following criteria of the California Fire Code, Chapter 33 – Fire Safety During Construction, And Demolition:

1. Section 3301.1 SCOPE
2. Section 3302 DEFINITIONS
3. Section 3303 TEMPORARY HEATING EQUIPMENT
4. Section 3304 PRECAUTIONS AGAINST FIRE
5. Section 3305 FLAMMABLE AND COMBUSTIBLE LIQUIDS
6. Section 3306 FLAMMABLE GASES
7. Section 3307 EXPLOSIVE MATERIALS
8. Section 3308 OWNER'S RESPONSIBILITY FOR FIRE PROTECTION
9. Section 3309 FIRE REPORTING
10. Section 3310 ACCESS FOR FIRE FIGHTING
11. Section 3311 MEANS OF EGRESS
12. Section 3312 WATER SUPPLY FOR FIRE PROTECTION

14. Section 3314 AUTOMATIC SPRINKLER SYSTEM
15. Section 3315 PORTABLE FIRE EXTINGUISHERS

16. Section 3316 MOTORIZED CONSTRUCTION EQUIPMENT

17. Section 3317 SAFEGUARDING ROOFING OPERATIONS

END OF CHAPTER 33

1.03 PROJECT CONDITIONS

A. Make required connections to existing utility systems with minimum disruption to services.

B. When disruption of the existing service is required, do not proceed without the Owner's and Architect's review and, when required, provide alternate temporary service.

C. Environmental Requirements: Provide and maintain heat, fuel, materials, and services necessary to protect work and materials against injury from extreme heat, cold, dry winds, dust, or dampness as follows:

1. During the placing, setting and curing of concrete and cement work, provide sufficient heat to ensure the heating of spaces involved do not fall to less than 50 degrees Fahrenheit.

2. Suspend operations on work when subject to damage by climatic conditions, flooding, or because of insufficient curing or drying of surfaces or materials.

3. Take necessary action to protect site and Work from wind, flood, and storm damage.

PART 2 - PRODUCTS

2.01 GENERAL

A. Construction facilities shall be subject to the Architect's review and approval.

2.02 UTILITIES

A. Water:

1. Provide necessary temporary water lines and water supply and, upon completion of the work, remove temporary facilities.

2. Furnish water needed for construction. Comply with the regulations of local water authority including transport of reclaimed water for construction.

B. Electricity:

1. Provide necessary temporary wiring and, upon completion of the work, remove temporary facilities.

2. Provide area distribution boxes so located that the individual trades may use 100 feet maximum length extension cords to obtain adequate power and artificial lighting at points where required for the work, for inspection and for safety.

3. Furnish electricity needed for construction.

C. Heating: Provide and maintain heat needed for proper conduct of operations included in the work.

D. Telephone: Make necessary arrangements and pay costs for operation and installation of separate telephone service at locations approved by the District's Inspector.

E. Utilities for Testing: Normal quantities required to make final tests of installed permanent systems shall be furnished at no cost to the Owner.

F. Temporary facilities in the public right-of-way are subject to approval. Obtain and pay for any permits required.

2.03 SIGNAGE

A. Bid Package No. 1, shall provide a 4' x 8' self-supporting temporary sign per the Drawing at the end of this Section. Supporting posts to be wood 4 x 4's embedded minimum four feet into tamped (compacted) soil to discourage easy removal. Verify text with Architect and Owner prior to fabrication. Sign shall remain the property of the School District at the completion of the Work. Remove sign and deliver to the District to location directed by the Owner when the temporary office facilities are removed.

B. Location of signs shall be as directed by the Architect.

PART 3 - EXECUTION

3.01 MAINTENANCE AND REMOVAL

A. Maintain facilities and temporary controls as long as needed for the safe and proper completion of the work.

B. Remove such construction facilities and temporary controls as rapidly as progress of the work will permit, or as directed by the Architect.

END OF SECTION

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SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Site clearing as specified herein.

B. Related Sections:

1. Section 01 50 00, Temporary Facilities and Controls
2. Section 31 20 00, Earth Moving

C. Principal items of Work included herein:

1. Protection of trees to keep the foliage canopy and branching structure clear from contact by equipment, materials and activities.

2. To preserve roots and soil conditions in an intact and non-compacted state.

3. To identify the Tree Protection Zone (TPZ) in which no soil disturbance is permitted and activities are restricted.

1.01 REFERENCES

A. Demolition shall be as per 2022 California Fire Code, Title 24, Part 9.

1.02 PROJECT SITE CONDITIONS

A. The Contractor shall be responsible to furnish and maintain all temporary barricades, warning lights, and other types of protection protect the trees noted on the plans to remain.

B. The Contractor shall be responsible to protect adjacent properties, roads, right of ways, utilities and other improvements above or below ground from damage in performing the work.

C. Comply with applicable sections of the storm water pollution prevention plan, including but not limited to, erosion control, soil, waste and maintenance areas.

D. Salvaged Materials – Contractor shall recycle or compost all tree trimmings. Contractor shall provide certification for all salvaged materials. Certifications may take the form of receipts from recycling facilities, manufacturers, or any other legitimate form of certification.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.01 EXECUTION

A. Establish the Tree Protection Zone (TPZ), which is defined as a radius of 10 times greater than

the diameter of the tree's trunk or ten feet, whichever is greater by enclosed temporary fencing. Fence shall be a minimum of 6' high.

B. Provide tree protection as follows:

1. Trees in an open area – enclose the entire area under the canopy or TPZ, which ever is greater throughout the life of the construction project.

2. Trees in a planting strip - only the planting strip and yard side of the TPZ shall be enclosed with the required chain like protective fencing.

3. Trees in a tree well or sidewalk planter pit – wrap trees with 2-inches of orange plastic fence from the ground to the first branch and overlay with 2X thick wooden slats bound securely (ensure slats do not dig into bark). Avoid damage to any branches.

C. Provide a plastic 10-inch by 12-inch sign securely affixed to the fence at a minimum of 20-foot intervals clearly stating "Warning – Tree Protection Zone".

D. Duration – Tree fencing and signage shall be erected before demolition, grading or construction begins and remain in place until final inspection of the project except for work specifically allowed in the TPZ. Work or disturbance in the TPZ required approval by the Project Manager and Landscape Architect.

E. No Storage of materials, top soil, vehicles or equipment shall be permitted within the TPZ.

F. The ground under the tree canopy shall not be altered, unless specifically noted on the plans.

G. Trees to be retained shall be irrigated, aerated and maintained as necessary to ensure survival.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: General requirements for delivery, storage, and handling of materials and equipment applicable to the product sections of this specification and necessary for the construction of the Project.

B. Related Sections:

1. Section 01 25 00 – Substitution Procedures

2. Section 01 33 00 – Submittal Procedures

1.02 GENERAL

A. Material and Equipment Incorporated into the Work:

1. Conform to applicable specification and standards.

2. Comply with size, make, type, and quality specified.

B. Manufactured and Fabricated Products:

1. Design, fabricate and assemble in accordance with the best engineering and shop practices.

2. Manufacture like parts of duplicate units to standard sizes and gages for interchangeability.

3. Two or more items of the same kind shall be identical, by the same manufacturer.

C. Reused Materials: Where the contract documents indicate that existing materials may be reused, such materials shall be cleaned and reincorporated in the work.

1. Materials to be reused shall be approved for reuse by the Inspector.

D. Supplementary materials not specifically described in each Section, but required for a complete and proper installation of the Work, shall be new, first quality of their respective kinds, and subject to review and acceptance by the District.

1.03 DELIVERY

A. Arrange deliveries of products in accordance with construction schedules and in ample time to facilitate inspection prior to installation. Notify the Inspector of Record, in writing, when items are delivered to the site, so he may inspect and verify quality and quantities delivered are as intended.

B. Coordinate deliveries to avoid conflict with work and conditions at site, taking into consideration:

1. Work of the Contractors, or Owner.

2. Limitations of storage space.

3. Availability of equipment and personnel for handling products.

4. Owner's use of premises.

C. Deliver products in undamaged condition in original containers or packaging, and with identifying labels intact and legible.

D. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of parts, and to facilitate assembly.

E. Immediately on delivery, inspect shipment to ensure:

1. Product complies with requirements of Contract Documents and reviewed submittals.

2. Quantities are correct.

3. Containers and packages are intact and labels are legible.

4. Products are undamaged and properly protected.

F. The District reserves the right to observe delivered materials, to review the accompanying bills of lading, and to reject the following:

1. Materials not identifiable as accepted products of the accepted manufacturer.

2. Materials exhibiting shelf-lives in excess of those stipulated by the manufacturer.

3. Materials not bearing the appropriate label of Underwriters Laboratories (UL), where applicable.

4. Materials in opened or excessively damaged containers.

5. Materials exhibiting evidence of moisture, organic matter, or other adulterants.

G. In the event of damage or rejection by the District for stipulated cause, immediately make repairs and replacements necessary to the acceptance of the Architect and at no additional cost to the Owner.

1.04 STORAGE

A. Payment will not be made by the Owner for materials stored off-site, until such time as the materials are incorporated into the Work.

B. Store products immediately on delivery, store in accordance with manufacturer's instructions and as further required by the Owner's Storm Water Pollution Prevention Plan, and protect until installed in the Work.

C. Store products subject to damage by elements in weather tight enclosures.

1. Maintain temperatures within limits recommended by manufacturer's instructions.

2. Provide humidity control for sensitive products, as required by manufacturer.

3. Store unpacked products in a manner accessible for inspection.

D. Exterior Storage:

1. Provide substantial platforms, blocking, or skids to support fabricated products above ground and prevent soiling or staining.

a. Cover products subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
b. Comply with requirements of Owner's, Storm Water Pollution Prevention Plan.

2. Store loose granular materials on solid paved surfaces, or provide plywood platforms to prevent mixing with foreign matter.

a. Provide surface drainage to prevent flow or ponding of rainwater.
b. Prevent mixing of refuse or chemically injurious materials or liquids.
c. Comply with requirements of Owner's Storm Water Prevention Plan.

1.05 MAINTENANCE OF STORAGE

A. Maintain periodic system of inspection of stored products on scheduled basis to assure that:

1. State of storage facilities is adequate to provide required conditions.

2. Required environmental conditions are maintained on a continuing basis.

3. Surfaces of products exposed to elements are not adversely affected.

B. Mechanical and electrical equipment which requires servicing during long term storage shall have complete manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.

1.06 PROTECTION AFTER INSTALLATION

A. Provide protection of installed products to prevent damage from subsequent operations. Remove protection materials when no longer needed, prior to completion of work.

B. Control traffic to prevent damage to equipment and surfaces.

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION
(Not Applicable)

END OF SECTION

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SECTION 01 71 23

FIELD ENGINEERING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: General requirements for field engineering necessary to provide horizontal and vertical control, including:

1. Survey work required in execution of the project.

2. Civil Engineering and Land Surveying services specified or required to execute contractors construction methods.

3. Coordination with testing laboratory or agency and Soils Engineer.

4. Contractor furnished assistance.

5. Verification of conditions.

6. Reporting procedures.

B. Requirements not in this section:

1. Specific test procedures performed in accordance with Section 01 45 23 - Testing and Inspecting Services.

1.02 QUALIFICATIONS OF ENGINEER OR SURVEYOR

A. Qualifications: Registered Civil Engineer qualified to perform land surveying or licensed Land Surveyor acceptable to Contractor and Owner. Contractor shall furnish to the Owner prior to start of work the name and license or registration number issued by the State of California, Board of Registration for Professional Engineers and Land Surveyors. Contractor shall provide notice to the Owner during the course of construction should the identification of the individual responsible for this work change from time to time, and shall obtain approval of the Owner for the replacement.

B. All field engineering services furnished during the course of this project shall be under the direct supervision and control of the named individual Civil Engineer or Land Surveyor.

1.03 FIELD ENGINEERING REQUIREMENTS

A. Survey Reference Points:

1. Existing basic horizontal and vertical control points for the project are those designated on the drawings. If there are not 3 specific bench marks (BM) or temporary bench marks (TBM) shown, contractor shall identify a minimum of 3 possible TBM’s and verify horizontal and vertical location of all three hubs. All work on the plans shall be tied together and verified prior to beginning any field work.

2. Locate and protect control points prior to starting site work, and preserve permanent reference points during construction. Identify and protect survey

monuments on the site discovered during construction, which are not referenced on the project drawings. Tie out such monuments and notify Architect prior to allowing them to be disturbed.

3. Replace any permanent boundary markers disturbed during construction with new permanent monuments and file the required Record of Survey or Corner Record in accordance with applicable State and County laws, at no additional cost to the Owner.

1.04 PROJECT SURVEY REQUIREMENTS

A. Establish a minimum of three permanent horizontal and vertical control points on the site, remote from the "Building Pad Area" and referenced to data established by the survey control points. Three points shall be tied together and the survey shall be closed to second order surveying standards.

1. Site Improvements:

a. Provide stakes for grading, fill and topsoil placement.

b. Locate utility lines, including, but not limited to, storm drains, sewers, water mains, gas, electric and telephone lines. Provide adequate horizontal control to locate the lines and provide vertical control in proportion to the slope of the line as required for accurate construction.

2. Provide curb stakes and elevations as required to construct paving and on and off-site concrete work.

a. Calculate and layout subgrade elevations and intermediate controls as required to provide smooth transitions between the spot elevations indicated on the plans.

b. From time to time, verify layouts of work by the same methods.

1.05 RECORDS

A. Maintain a complete, accurate log of control and survey work as it progresses.

1.06 SUBMITTALS

A. Submit name and address of Licensed Surveyor or Civil Engineer to Architect, including changes as they may occur from time to time.

B. On request of the Architect, submit documentation to verify accuracy of the field engineering work.

C. Project Record (As-Built) Drawings:

1. At the project completion, deliver to Architect, final "as-built" Record Drawings of the Work, prepared on reproducible transparencies. Clearly indicate differences between original drawings and completed work within specified tolerances.

2. Show as-built locations by coordinates of utilities on-site with top of pipe elevations at major grade and alignment changes.

3. Completed as-built transparencies shall be signed and certified as correct by the

licensed Surveyor or Civil Engineer.

4. Furnish any required Engineering Survey information for all utility easements for any required document recording.

5. Submit certification of subgrade completion and building location on the building pads showing the actual elevation of the completed constructed subgrade, to the nearest hundredth of a foot 0.01 foot.

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION
(Not Applicable)

END OF SECTION

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SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Administrative and procedural requirements for cutting and patching.

B. Related Work Specified Elsewhere:

1. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the work.

2. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 21 through Division 28, Sections for other requirements and limitations applicable to cutting and patching plumbing, mechanical and electrical installations.

1.02 SUBMITTALS

A. Before commencing alteration or demolition work, submit for review by the Architect and approval of the Owner, a Schedule showing the commencement, the order and the completion dates for the various parts of this work. Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.

3. List products to be used and firms or entities that will perform Work.

4. Indicate dates when cutting and patching is to be performed.

B. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted. Before starting work relating to existing utilities (electrical, sewer, water, heat, gas, fire lines, etc.) that will temporarily discontinue or disrupt service to the existing building, notify the Architect and the Owner 72 hours in advance and obtain the Owner's approval in writing before proceeding with this phase of the work.

C. 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. All cutting of structural elements subject to acceptance of the Structural Engineer and approval of the Division of the State Architect prior to execution.

D. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory. Subject to approval by the Division of the State Architect.

E. All cutting and patching of existing hard scape or landscaping for installation or modification, shall be reinstalled in kind. When new utilities are shown or utility modifications are shown on the plans and specific cutting and patching notes are not shown, the contractor shall assume that the existing hardscape shall be saw cut, material removed and disposed, trenches prepared in accordance with local water district or county regulations, and all existing hardscape shall be returned to existing condition or better.

1.03 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut or notch any structural elements unless specifically detailed on the Drawings.

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.

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'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. If possible, retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:

Processed concrete finishes
Stonework and stone masonry
Ornamental metal
Matched-veneer woodwork
Preformed metal panels
Window wall system
Stucco and ornamental plaster
Acoustical ceilings
Terrazzo
Finished wood flooring
Carpeting
Aggregate wall coating
Wall covering
Swimming pool finishes
HVAC enclosures, cabinets or covers

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use materials that are identical to existing materials. Materials and workmanship employed in the alterations, unless otherwise shown or specified, shall conform to that of the original work, or to new construction as specified elsewhere in these specifications. 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. Use materials whose installed performance will equal or surpass that of existing materials.

B. It is intended that interior finish materials, or existing surfaces to be removed, be re-used insofar as reasonable in areas necessary to match existing surfaces. Care in removal and stockpiling shall be exercised to ensure re-use.

PART 3 - EXECUTION

3.01 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

B. Before proceeding, meet at the site with entities involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Make such explorations and probes as are necessary to ascertain required protective measures before proceeding with demolition and removal. Give particular attention to shoring and bracing requirements so as to prevent damage to existing construction.

C. Provide, erect, and maintain catch platforms, lights barriers, weather protection, warning signs and other items as required for proper protection of the public, occupants of the building, workmen engaged in demolition operations, and adjacent construction.

D. Provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.

E. Provide and maintain temporary protection of the existing structure designated to remain where demolition, removal and new work is being done, connections made, materials handled, or equipment moved.

F. Take necessary precautions to prevent dust and dirt from rising by wetting demolished masonry, concrete, plaster and similar debris. Protect unaltered portions of the existing building affected by the operations under this Section by dustproof partitions and other adequate means.

G. Provide adequate fire protection in accordance with local Fire Departments, and with Section 01 50 00.

H. Do not close or obstruct walkways, passageways or stairways. Do not store or place materials in passageways, stairs, or other means of egress. Conduct operations with minimum traffic interference.

I. Be responsible for damage to the existing structure or contents by reason of the insufficiency of protection provided.

J. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

1. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

2. Take precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's 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.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill. Provide pilot holes at corners and do not overcut.

4. Comply with requirements of applicable Sections of Division 2 where cutting and patching requires excavating and backfilling.

5. 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.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specific tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

2. 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.

3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.

a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.

4. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

D. Perform demolition, removal and alteration work with due care, including shoring, bracing, etc. Be responsible for damage which may be caused by such work to part or parts of existing structures or items designated for re-use. Perform patching, restoration and new work in accordance with applicable technical sections of the Specifications.

E. Materials and/or items designated to become the property of the Owner shall be as shown. Remove such items with care, under the supervision of the trade responsible for reinstallation; protect and store until required. Replace material and/or item damaged in its removal with approved similar and equal new material.

F. Materials and/or items demolished and not designated to become the property of the Owner or to be reinstalled shall become the property of the Contractor and shall be removed from the Owner's property. Storage or sale of removed items on site will not be permitted.

G. Execute the work in a careful and orderly manner, with the least possible disturbance to the public and to the occupants of the building.

H. Where alterations occur, or new and old work join, cut, remove, patch, repair or refinish the adjacent surfaces or so much thereof as is required by the involved conditions, and leave in as a good a condition as existed prior to the commencing of the work. The alteration work shall be performed by the various respective trades which normally perform the particular items of work.
New detail for asphalt and concrete

I. Finish new and adjacent existing surfaces as specified for new work. Clean existing surfaces of dirt, grease, loose paint, etc. before refinishing.

J. Where existing equipment and fixtures are indicated to be re-used, repair such equipment and fixtures and refinish to put in perfect working order. Refinish as directed.

K. Cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the respective finishes.

L. Confine cutting of existing roof areas designated to remain to the limits required for the proper installation of the new work. Cut and fold back existing built-up roofing. Cut and remove insulation, etc. Provide temporary weathertight protection as required until new roofing and flashings are applied.

3.04 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION

SECTION 01 74 00

CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Cleaning throughout the construction period, and final project cleaning after acceptance tour "**Punch List**" has been completed.

B. Related Work Described Elsewhere: In addition to standards specified herein, comply with requirements for cleaning as described in other sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.

B. Codes and Standards: In addition to the requirements specified herein, comply with pertinent requirements of authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.02 COMPATIBILITY

A. Use cleaning materials and equipment which are compatible with the surfaces being cleaned, as recommended by the manufacturer of the material to be cleaned.

B. Do not power wash concrete/masonry surfaces.

PART 3 - EXECUTION

3.01 PROGRESS CLEANING

A. General:

1. Retain stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.

2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this work. Debris shall be removed from the site and disposed of in a lawful manner. Disposal receipts or dump tickets shall be furnished to Architect upon request.

3. At least twice each month, and more often if necessary, remove scrap, debris, and waste material from the job site.

4. Provide adequate storage for items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove items to the place designated for their storage. Combustible waste shall be removed from the site. Flammable waste shall be kept in sealed metal containers until removed from the site.

2. Weekly, and more often if necessary, inspect, arrangements of materials stored on the site; restack, tidy, or otherwise service arrangements to meet the requirements specified above.

3. Maintain the site in a neat and orderly condition.

C. Structures:

1. Weekly, and more often if necessary, inspect the structures and pick up scrap, debris, and waste material. Remove items to the place designated for their storage.

2. Weekly, and more often if necessary, sweep interior spaces clean.

a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a handheld broom, i.e., "broom-clean".

3. As required preparatory to installation of succeeding materials, clean the structures of pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the required cleanliness.

4. Following the installation of finish floor materials, clean the finish floor daily and more often if necessary, and while work is being performed in the space in which finish materials have been installed.

a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material which, in the opinion of the Architect, may be injurious to the finish floor material, i.e., "vacuum clean".

3.02 FINAL CLEANING

A. Definition: Except as otherwise specifically provided, "clean", for the purpose of the Article, shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials, i.e., "scrub and polish clean".

B. General: Prior to completion of the work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste, conduct final progress cleaning as described above.

C. Site: Unless otherwise specifically directed by the Architect, water and broom clean paved areas on the site and public paved areas directly adjacent to the site. Remove resultant debris.

D. Structures:

1. Exterior: In areas affected by the work under this contract, visually inspect exterior surfaces and remove traces of soil, waste material, smudges, and other foreign matter. Remove traces of splashed material from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure.

   In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the Owner.

2. Interior: In areas affected by the work under this contract, visually inspect interior surfaces and remove traces of soil waste material, smudges, and other foreign matter. Remove traces of splashed materials from adjacent surfaces. Remove paint drippings, spots, stains, and dirt from finished surfaces. Use only the cleaning materials and equipment instructed by the manufacturer of the surface material.

3. Glass: Clean glass inside and outside.

4. Polished surfaces: On surfaces requiring the routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished. Glossy surfaces shall be cleaned and shined as intended by the manufacturer.

E. Timing: Schedule final cleaning after the **Final Punch List** has been completed by the Architect to enable the Owner to accept a completely clean project.

3.03 CLEANING DURING OWNER'S OCCUPANCY

A. Should the Owner occupy the work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning of the occupied spaces shall be determined by the Architect in accordance with the General Conditions of the Contract.

END OF SECTION

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SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Operations and submittals required to establish Substantial Completions, Project Acceptance, and filing of Notice of Completion.

B. Contract Completion Date is the day established by the Agreement, the Special Conditions, and the Notice to Proceed as the calendar date by which all Work must be completed in accordance with the Contract Documents. Once established, the Contract Completion Date can only be altered by Change Order. If Work is not complete in accordance with the Contract Documents by the Contract Completion Date, Contractor is obligated to pay liquidated damages to the Owner. In accordance with the terms of the Contract.

C. Substantial Completion: The Date of Substantial Completion is the date on which the Architect certifies to the Owner that construction is sufficiently complete, in accordance with the Contract Documents, that the District may occupy the Project for the use intended, and all agencies and authorities have provided written acceptance of the portions of the Work over which they have jurisdiction.

D. Project Acceptance: The District will accept completion of the Contract after the entire Work shall have been completed to the satisfaction of the District and after issuance of the Certificate of Substantial Completion. The Work may only be accepted as complete by formal action of the Governing Board of the School District. Acceptance of the Project by the Governing Board establishes the formal and official Completion Date for the Project, to be compared against the Contract Completion Date. Project Acceptance must occur prior to Contract Completion Date to preclude assessment of liquidated damages.

E. Notice of Completion: The date of record for the Notice of Completion shall be the date stamped on the Notice by the County Recorder at the time the County Recorder registers the Notice (note: this is normally not the same date as the date the Owner actually files the Notice of Completion with the Recorder office).

1.02 CLOSEOUT SCHEDULE AND PROCEDURE

A. Requirements Preparatory to Project Acceptance:

1. Contractor shall deliver certifications to Architect that no new materials containing asbestos have been included in the work.

2. Temporary facilities shall be removed from site as specified in Section 01 50 00, Temporary Facilities and Controls.

3. Entire site shall be thoroughly cleaned of all construction debris.

4. Record drawings shall be completed, signed by Contractor and Inspector and submitted to Architect as specified in Section 01 78 39 – Project Record Documents.

5. Guarantees and warranties shall be submitted to Architect as specified in General conditions and Section 01 78 30 – Warranties.

6. Contractor's Final Verified Report (Form DSA-6) and other Reports and Affidavits required by the Division of State Architect shall be submitted.

7. Operating and maintenance data shall be submitted and instruction sessions completed as outlined in Section 01 78 23 – Operating and Maintenance Data and as required in CBC 2022 Section 110.3.10.2.

8. Contractor to provide a copy of cleaning and maintenance recommendations for countertops to the underneath side of furniture, in addition to requirements listed above and outlined in Section 01 78 23 – Operating and Maintenance Data.

B. Project Acceptance Requirements, Division of the State Architect:

1. Upon completion of construction of the project, the following reports are required to be submitted before the Division of the State Architect will issue a letter to certificate of compliance of the work:

    a. A copy of the Notice of Completion filed by the School District.

    b. Final Verified Report Form DSA 6 A/E certifying all work is 100% complete from the Architect, Structural Engineer, Mechanical Engineer and the Electrical Engineer.

    c. Contractor’s Documents and Field Reports:

        1) Final Verified Report Form DSA 6, certifying all work is 100% complete, from the Contractors (or Contractors), the Inspector of Record, and Special Inspector(s).

        2) Verified Reports of Testing and Inspection as specified on the approved drawings an specifications (i.e., Final Laboratory Report, Welding, Glued-laminated Timber, etc.).

        3) Weighmaster’s Certificates (if required by approved drawings and specifications).

        4) If responsibility was changed in any area during construction, the change must be supported by appropriate documentation and termination reports filed by the individuals originally charged with responsibility.

C. Procedure for Project Acceptance:

1. Contractor shall complete all Work as required by the Contract Documents, to the best standards of the industry and the trades involved. It shall be the Contractor's responsibility to provide a new, complete, properly operating, professionally finished, detailed, cleaned, high-quality project. There shall be no loose, untrue, or ill-fitting materials, unsightly gaps, voids, or holes, misalignments, mis-adjustments, shoddy workmanship, or damaged, missing, inoperable, or incomplete work. Work shall be free of smudges, spots, stains, dirt, nicks, tears, cracks, scratches, paint runs, flaws, overspray, and all other unsightly blemishes.

2. Completion lists and correction lists for items described in the paragraph above, as opposed to short lists of a few minor corrective items that may have inadvertently been missed by the Contractor, shall be the responsibility of the Contractor, and not the Architect, Inspector, or District. By entering into this Contract, Contractor agrees that quality control is the responsibility of the Contractor. "Punch" list generated by the Architect is under no circumstances to be considered a vehicle to compel subcontractors to complete contract work.

3. Contractor shall prepare a comprehensive and complete list of corrective items for himself and his subcontractors and shall verify that these items have been corrected prior to notifying the Architect of completion. Copies of the Contractor's list(s) shall be made available to the Architect and Inspector upon request.

4. Contractor shall notify the Architect *in writing* when Contractor, with concurrence of Inspector, feels the project is one-hundred percent complete and is ready to leave the Project. Architect shall then commence the construction review and prepare a "Punch List", or list of minor corrective items to be issued to Contractor. For convenience, reviews may be phased for various portions of the work, as each distinct portion becomes one hundred percent (100%) complete.

5. Architect will arrange for Engineering Consultants to make their construction reviews, to be completed before Architect will make his construction review. Contractor and his principal superintendent, authorized to act in behalf of the Contractor, as well as principal subcontractors that the Architect may request to be present, shall accompany the Architect/Engineers during the construction reviews.

6. Excessive amounts of corrective ("punch list") items, as judged by the Architect, shall be grounds to terminate the construction review until such time as the Contractor is deemed sufficiently complete to start the review once again. As a rule of thumb, more than four minor items per typical room will be considered excessive.

7. If Owner elects to occupy the Project after the Contract Completion Date, but before the Contractor has completed the Work, Architect must make a comprehensive construction review prior to Owner's occupancy. Contractor shall reimburse Architect and Engineers for their time in conducting such review, and for the time of their clerical staffs in preparing the review documents, at the Architect's/Engineer's standard hourly rates for extra services. Contractor will be billed at the time of Contractor's Application for Payment. Payments to the Architect not received within 30 days will be deducted from subsequent Contractor's Applications for Payment in accordance with the General Conditions.

8. After completion of "Punch List" work, Contractor shall notify Architect in writing to perform an acceptance tour. Notice shall be issued at least seven (7) days in advance of the time the acceptance tour is to be performed.

9. Contractor and his principal superintendent, authorized to act on behalf of Contractor, as well as principal subcontractors that Architect may request to be present, shall accompany Architect and Inspector on acceptance tour.

a. If work has been completed in accordance with Contract Documents, and no further corrective measures are required, Architect will issue a Certificate of Substantial Completion, and recommend that Owner accept Project and file Notice of Completion.

b. If work is judged to be substantially completed in accordance with Contract Documents, and only a few corrective measures are required, Architect will issue a Certificate of Substantial Completion, (Article 64 of the General Conditions), and recommend that Owner conditionally accept Project and file Notice of Completion. Owner may conditionally accept project and withhold amount for completion per Article 64 of the General Conditions, Contractor shall issue a written notice of intent to complete the corrective measures by a specific named date agreed to by District.

c. If work has not been substantially completed in accordance with Contract Documents, and several or many corrective measures are still required, Architect will recommend that Owner not accept project and not file Notice of Completion. Instead, based on information gathered from acceptance tour, Contractor will be required to complete corrective measures and then call for another project acceptance tour following procedure outlined above. Contractor will compensate Architect and Inspector for additional acceptance tour and deduct amount paid from final payment to Contractor.

10. After Substantial Completion, Contractor shall issue an Application for Payment in accordance with Specification Section 01 29 00, Part 1.03, H. All administrative actions and submittals, including conditions, outlined therein outlined must be complete prior to Owner's release of payment, **and MUST BE COMPLETED PRIOR TO AGENDIZING FOR PROJECT ACCEPTANCE BY THE OWNER'S GOVERNING BOARD.**

11. Upon Contractor completing all administrative actions and submittals, and meeting all conditions, Owner will agendize acceptance of the Work for the next official meeting of the Governing Board. Official action by the Governing Board shall constitute Project Acceptance. Upon acceptance, Contractor shall immediately remove trailers and other remaining temporary facilities.

12. District shall file Notice of Completion with the County Recorder as soon as practicable following Project Acceptance. The date of record for the Notice of Completion shall be the date stamped on the Notice by the Recorder at the time the County Recorder registers the Notice.

13. The date stamped on the Notice of Completion by the County Recorder shall be the date for commencement of all warranties and guarantees, and the date the Owner becomes responsible for security, maintenance, heating and cooling, utilities, damage to the work (unless done by Contractor's forces working on corrective items), and insurance.

Contractor shall remain responsible for these items prior to this date.
The Owner will inform the Contractor by letter immediately after receiving confirmation in writing from the Recorder's office of registration of the Notice of Completion. Contractor is hereby notified that the process of registering, stamping, and receipt of confirmation from the County has been known to take as much as four weeks from the time of filing.

14. Upon acceptance of Project by Owner, Contractor shall submit his request for final payment in accordance with Specification Section 01 29 00 – Payment Procedures, Part 1.03, I. Payment of retention will not be made by Owner until 35 days after Notice of Completion has been registered by the County Recorder.

In addition, retention payment will not be made until Contractor has filed the required Form DSA 6 with Division of the State Architect, with copy to the Architect.

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION
(Not Applicable)

END OF SECTION

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SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY:

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 1 Specifications Sections, apply to this section, and including all Technical Specifications Sections, and the Operating and Maintenance Requirements of Division 21 through Division 28.

B. Section Includes:

1. Compilation of product data and related information appropriate for Owner's maintenance and operation of products and equipment furnished under the Contract per CBC 2022 Section 110.3.10.2.

2. Instruction of Owner's personnel in the maintenance of products and in the operation of equipment and systems.

1.02 SUBMITTAL PROCEDURES

A. Preliminary: Submit one copy of proposed manuals to Architect at least 15 days prior to final inspection or acceptance.

B. Final: Following the indoctrination and instruction of the Owner's operating and maintenance personnel, review proposed revisions to the manual with the Architect.

1. Submit three copies of accepted data in final form 10 days after final inspection. Approval of submittal is a pre-requisite at Substantial Completion prior to Owner's agendizing project for acceptance by the Governing Board.

PART 2 - PRODUCTS

2.01 FORMAT

A. Size: Minimum 4 inch, three-ring binders for 8-1/2" x 11" punched pages, completely clear plastic covered for insertion of labels on spines and covers.

B. Provide identifying tabbed pages. Classify by Division and by Section. All tabbing shall be in numerical order.

C. Drawings:

1. Provide reinforced punched binder tab. Bind drawings with text.
2. Fan fold larger drawings to size of text pages, for easy foldout.

D. Cover: Identify each volume with typed or printed label, List:

1. Title of Project
2. Identity of separate structures as applicable.
3. Identity of general subject matter covered in the manual.

E. Spine: Identify each volume with typed or printed label stating OPERATING AND MAINTENANCE INSTRUCTIONS, GUARANTEES AND SERVICE CONTRACTS and the following information:

1. Title of Project.
2. Divisions and Sections included within volume.
3. Volume number (i.e. "1 of 4")

F. For each item A to E above, also provide in PDF format, saved in flash drive(s), with clearly marked Project Name and content.

PART 3 - EXECUTION

3.01 CONTENT OF MANUAL

A. Table of Contents:

1. List of each product indexed to the content of the volume.

2. List with each product the name, address, and the telephone number of:

a. Subcontractor and installer.
b. Maintenance contractor, as appropriate.
c. Local sources of supply for parts and replacement.

B. Product Data: Annotate each sheet to clearly identify the data applicable to the installation. Delete references to inapplicable information.

C. Drawings:

1. Supplement product data with Drawings as necessary to illustrate the following:

a. Relationship of component parts of equipment and systems.
b. Control and flow diagrams.

2. Do not include Project Record Drawings as maintenance drawings.

D. Instructions: Provide written text, as required to supplement product data for the particular installation.

E. Warranties, Guaranties, Bonds, and Service Contracts: Include a copy of each warranty, guaranty, bond, and service contract issued.

1. Provide information sheet for Owner's personnel describing the following:

a. Proper procedures in the event of failure or emergencies.

b. Circumstances under which the validity of warranties, guaranties, or bonds might be compromised.

3.02 MANUAL FOR MATERIALS AND FINISHES

A. Instructions for Care and Maintenance: Include Manufacturer's data as follows:

1. Recommendations for types of cleaning agents and methods.

2. Cautions against cleaning agents and methods which are detrimental to the product:

3. Recommended schedule for cleaning and maintenance.

B. Energy Conservation Features:

1. Provide a list of energy conservation features, materials, components, and mechanical devices installed in the building.

3.03 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Content, for each unit of mechanical equipment and system, as appropriate:

1. Description of unit and component parts:

a. Function, normal operating characteristics, and limiting conditions.
b. Performance curves, engineering data, and tests.
c. Complete nomenclature and commercial number of replaceable parts.

2. Operating Procedures:

a. Start-up, break-in, routine, and normal operating instructions.
b. Regulation, control, stopping, shut-down, and emergency instructions.
c. Summer and winter operating instructions.

3. Maintenance Procedures:

a. Routine operations.
b. Guide to "trouble-shooting".
c. Disassembly, repair, and reassembly.
d. Alignment, adjusting, and checking.

4. Servicing and lubrication schedule including list of lubricants required.

5. Manufacturers’ printed operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.

7. Original manufacture's parts list, illustrations, assembly drawings, and diagrams required for maintenance, including:

a. Predicted life of parts subject to wear.
b. Items recommended to be stocked as spare parts.

8. Control diagrams by manufacturer of controls as installed in project.

9. Coordination drawings and color coded piping diagrams.

10. Charts of valve tag numbers, with the location and function of each valve.

B. Content, for each electric and electronic system as appropriate.

1. Description of system and component parts:

a. Function, normal operating characteristics, and limiting conditions.
b. Performance curves, engineering data, and tests.
c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories of panelboards:

a. Electrical service.
b. Controls.
c. Communications.

3. As-installed color coded wiring diagrams.

4. Operating procedures:

a. Routine and normal operating instructions.
b. Sequences required.
c. Special operating instructions.

5. Maintenance procedures:

a. Routine operations.
b. Guide to "trouble-shooting."
c. Disassembly, repair and reassembly.
d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

3.04 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment, and systems installed in project.

1. Provide services of factory trained instructors from the manufacturer of each major item of equipment or system.

2. Provide for each instruction session or "in-service", a DVD Camcorder operator and **DVD Camcorder** to record the session. DVD recordings shall be clearly labeled as to project, subject, and date. Submit DVDs in triplicate.

B. Operating and maintenance manual shall constitute the basis of instruction.

1. Review contents of manual with personnel in full detail to explain all aspects of operation and maintenance.

2. Review instructions on how to efficiently use state required energy conservation features, materials, components, and mechanical devices.

END OF SECTION

SECTION 01 78 30

WARRANTIES, GUARANTEES, AND BONDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: General requirements for written warranties, guaranties, and bonds required by the Contract Documents.

B. Referenced Sections:

1. Section 01 77 00 – Closeout Procedures: Submittal of Final Verified Reports and Notice of Completion, as a condition of project acceptance and payment.

2. Section 01 78 39 – Project Record Documents as a condition of project acceptance and payment.

3. Section 01 78 23 – Operation and Maintenance Data: Incorporation of warranties, guaranties, and bonds into instruction manuals.

C. **Approval of the warranties, guaranties, and bonds by the Owner is a prerequisite to payment at Substantial Completion and agendizing for acceptance by the Governing Board of the Owner.**

1.02 TIME PERIOD

A. Deliver manufacturers' warranties, guaranties, and bonds required by Contract Documents, with Owner named as beneficiary. Where manufacturers' warranty or guaranty extends for a longer time period than the Contractor's warranty and guaranty, deliver manufacturer's warranties or guaranties in same manner.

1.03 WARRANTY/GUARANTY FORM

A. Submit written warranties and guaranties, except manufacturer's standard printed warranties and guaranties, on the Contractor's, subcontractors', material suppliers', or manufacturers' own letterhead, addressed to Owner, in the form attached to this Section.

B. Submit warranties and guaranties in duplicate, and in the form indicated, signed by cognizant entities, and by Contractor in every case, with modifications as approved by Owner to suit the conditions pertaining to the warranty or guaranty.

1.04 SUBMITTALS

A. Collect and assemble written warranties and guaranties into bound booklet form, and PDF format, and deliver bound books and Flash Drives to Architect for delivery to Owner for final review and approval.

1. See Sections 01 77 00 and 01 78 23 for additional submittal requirements.

ATTACHMENT: Warranty/Guaranty Form

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WARRANTY/GUARANTY FORM

FOR _____ WORK

We, the undersigned, do hereby warranty and guaranty that the parts of the work described above which we have furnished or installed for:

(PROJECT NAME)

are in accordance with the Contract Documents and that all said work as installed will fulfill or exceed all the Warranty and Guaranty requirements. We agree to repair or replace work installed by us, together with any other work which is displaced or damaged by so doing, that proves to be defective in workmanship, material, or operation within a period of _____ ( ) year(s) from the date Notice of Completion is registered with the San Diego County Recorder, ordinary wear and tear and unusual neglect or abuse excepted.

In the event of our failure to comply with the above-mentioned conditions within a reasonable time period determined by the Owner, after notification in writing, we, the undersigned, all collectively and separately, hereby authorize the Owner to have said defective work repaired and/or replaced and made good, and agree to pay to the Owner upon demand all moneys that the Owner may expend in making good said defective work, including all collection cost and reasonable attorney fees.

Date: _____ _____

(Subcontractor, Sub-subcontractor, Manufacturer or Supplier)

By:_____

Title: _____

State License No: _____

Local Representative: For maintenance, repair, or replacement service, contact:

Name: _____

Address: _____

Phone Number _____

END OF SECTION

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SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for Record Documents.

B. Throughout progress of the work of the contract, maintain an accurate record of changes in the Contract Documents, as described below.

C. Upon completion of the work of this Contract, transfer the recorded changes to a set of Record Documents, as described herewith.

1.02 QUALITY ASSURANCE

A. General: Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as accepted in advance by the Architect.

B. Accuracy of Records: Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of drawings and other documents where such entry is required to properly show the change. Accuracy of records shall be such that future searches for items shown in the Contract Documents may reasonably rely on information obtained from the accepted Record Documents.

C. Timing of Entries: Make entries within 24 hours after receipt of information.

1.03 PAYMENT WITHHELD

A. The Architect reserves the right to withhold certification of payment requests for failure on the part of the Contractor to maintain Record Drawings in conformance with this Section.

1.04 SUBMITTALS

A. General: The Architect's review of the current status of Record Documents will be a prerequisite to the Architect's review of requests for progress payment and request for final payment under the contract.

B. Progress Submittals: Prior to submitting each request for progress payment, secure the Architect’s review of the Record Documents as currently maintained.

C. Final Submittal: Prior to submitting request for final payment, submit the final Record Documents to the Architect and secure his acceptance.

1.05 PRODUCT HANDLING

A. Maintain the job set of Record Documents protected from deterioration and from loss and damage until completion of the work and transfer of the recorded data to the final Record Documents.

B. In the event of loss of recorded data, use means necessary to again secure the data to

the Architect's acceptance; such means shall include, if necessary in the opinion of the Architect, removal and replacement of concealing materials and, in such case, replacements shall be to the standards originally specified in the Contract Documents.

PART 2 - PRODUCTS

2.01 RECORD DOCUMENTS

A. Job Set: Secure from the Owner, at no charge to the Contractor, one complete set of Documents comprising the Contract.

B. Contractor shall provide the architect a pdf copy of all as-builts after the project is completed. As-builts shall include all posted CCDs and RFIs and any other documents issued during construction. As-builts shall be maintained during construction on a daily basis. Any adjustments in location of any item on the plans shall be accurately recorded on the as-built plans.

C. Before commencing backfilling of utilities or any other underground pipes, ducts, conduits, or structures, take photographs showing relationship of below ground utilities to structure(s) or other physical reference point. Provide thumb-drive or CD containing numbered prints of photos, categorized by locations and indicating utilities shown. Provide a photo(s) of all connections, crossings, stubs, or other critical points. If the Contractor neglects to take such photographs, Contractor shall uncover, at the Contractor's expense, the area(s) so neglected in order to provide the requisite photos.

Provide a hard copy and pdf copy composite Utility Site Plan with the number of each photograph placed on the plan at the location the photo was taken from, and a mark indicating which way the camera was pointed. All numbers and marks shall be in ink, and shall be clear, legible, and neatly done. Photo files and photo plan shall be considered part of the Record Documents.

PART 3 - EXECUTION

3.01 MAINTENANCE OF JOB SET

A. Identification: Upon receipt of the job set, identify each of the documents with a title "RECORD DOCUMENTS-JOB SET".

B. Preservation:

1. Considering the contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set for the review of the Architect.

2. Use the job set for no purpose other than entry of new data and for review by the Architect, until start of transfer of data to final Record Documents.

3. Maintain the job set at the site of work as that site is designated by the Architect.

C. Making Entries on Drawings: Using an erasable colored pencil (not ink nor indelible pencil), clearly describe the change by note and by graphic line, as required. Date entries. Call attention to the entry by a "cloud" around the area or areas affected. In the

event of overlapping changes, different colors may be used for each of the changes. In the event of superseding changes to any area of the drawing, erase only that portion of the preceding change that is affected by the subsequent change before entering the subsequent change.

D. Making Entries on Other Documents:

1. Where changes are caused by directives issued by the Architect, clearly indicate the change by note in ink, colored pencil, or rubber stamp, and reference Division of the State Architect approved addenda and change orders.

2. Where changes are caused by Contractor originated proposals reviewed by the Architect, including inadvertent errors by the Contractor which have been accepted by the Architect, clearly indicate the change by note in erasable colored pencil.

3. Make entries in the pertinent documents as reviewed by the Architect.

4. Reference specifications section 01 77 00, Closeout Procedures, 1.02 (Closeout Schedule and Procedure) paragraph 4. Project Acceptance Requirements, Division of the State Architect for list of documents required at closeout.

E. Conversion of Schematic Layouts:

1. In most cases on the Drawings, arrangement of conduits and circuits, piping, ducts, and other similar items, is shown schematically and is not intended to portray precise physical layout. Final physical arrangement shall be as determined by the Contractor, subject to the Architect's review. However, design of future modifications of the facility may require accurate information as to the final physical arrangement of items and location of utilities which are shown only schematically on the Drawings.

2. Show on the job set of record Drawings, by dimension accurate to within 1 inch, the centerline of each run of items such as are described in the preceding paragraph above. Clearly identify the item by accurate note such as "cast-iron drain", "galvanized water pipe", etc. Show, by symbol or note, the vertical location of the item ("under slab", "in ceiling plenum", "exposed", etc.). Make identification sufficiently descriptive that it may be related reliably to the Specifications.

3. The Architect may waive the requirements for conversion of schematic layouts where, in the Architect's judgment, such conversion serves no beneficial purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the Architect.

4. Timing of Entries: Be alert to changes in the work from how it is shown in the Contract Documents: Promptly, and in no case later than 24 hours after the change has occurred and been made known to the Contractor, make the entry or entries required.

F. Accuracy of Entries: Use means necessary, including proper instruments or tools for measurement, to determine actual locations of the installed items.

3.02 FINAL RECORD DOCUMENTS

A. General: The purpose of the final Record Documents is to provide factual information regarding the work, both concealed and visible, which will enable future modification of design to proceed without lengthy and expensive site measurement, investigation, and examination.

B. Review of Recorded Data Prior to Transfer: Following receipt of the pdf as-builts described here-in-above, and prior to start of transfer of recorded data thereto, secure a review by the Architect of recorded data. Make required revisions.

C. Transfer of Data to Drawings: Carefully transfer change data shown on the job set of Record Drawings to corresponding sepias, coordinating the changes as required, and clearly indicating at each affected detail and other drawing the full description of changes made during construction and the actual location of items described above. Call attention to each entry by drawing a cloud around the area or areas affected. Make change entries on the as-builts neatly, consistently, and in ink or crisp black pencil.

D. Transfer of Data to Other Documents: If the documents other than drawings have been kept clean successfully during progress of the work, and if entries have been sufficiently orderly thereon and reviewed by the Architect, the job set of those documents (other than drawings) will be accepted by the Architect as the final portion of the record documents. If any such document is not so accepted by the Architect, secure a new copy of that document from the Architect at the Architect's usual charge for reproduction carefully transfer the change data to the new copy and obtain the acceptance of the Architect.

E. Review and Approval: Submit the completed total set of Record Documents in both hard copy and in pdf format to the Architect as described above. Participate in review meeting or meetings as required by the Architect, make required changes in the Record Documents, and promptly deliver the final Record Documents to the Architect.

3.03 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor shall have no responsibility for recording changes in the work subsequent to acceptance of the work by the Owner, except for changes resulting from replacements, repairs, and alterations made by the Contractor as a part of his guarantee. No changes will be allowed without approval of the Division of the State Architect.

END OF SECTION

SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

Owner's Project Requirements (OPR) and Basis of Design (BoD) documentation are included by reference. These documents are for information only and will be furnished upon request.

1.02 SUMMARY

Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

Related Sections:

Division 1 Section "Operations and Maintenance Data" for requirements for documentation for operation and maintenance of commissioned systems and equipment.

1.03 DEFINITIONS

BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

CxA: Commissioning Authority.

Design Intent Documents (DID): Shared meaning element with OPR; may be used interchangeably.

OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. Address HVAC, lighting, indoor environment, energy efficiency, site, water use and other factors affecting the environmental responsiveness of the facility.

Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.04 COMMISSIONING TEAM

Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning

process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

Members Appointed by Owner:

CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.

The CxA, as an independent third party, may not be a member of the design team for the project.

Representatives of the facility user and operation and maintenance personnel.

Architect and engineering design professionals.

1.05 OWNER'S RESPONSIBILITIES

Provide the OPR documentation, prepared by the Commissioning Team and approved by Owner, to the CxA and Contractor for information and use.

Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.06 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.

2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.

3. Attend commissioning team meetings.

4. Integrate and coordinate commissioning process activities with construction schedule.

5. Review and accept construction checklists provided by the CxA.

6. Complete paper construction checklists as Work is completed.

a. Provide completed checklists to the Commissioning Authority not less than weekly.

7. Review and accept commissioning process test procedures provided by the Commissioning Authority.

8. Complete commissioning process test procedures.

1.02 CxA'S RESPONSIBILITIES

A. Administrative: Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Commissioning Meetings: Convene, attend and direct commissioning team meetings. At the discretion of the Architect, these meetings may be combined with the job progress meetings. Commissioning meetings shall be scheduled weekly.

D. Construction Checklists: Provide Project-specific construction checklists and commissioning process test procedures.

E. Issues Log: Prepare and maintain the Issues Log.

F. Check List Log: Prepare and maintain completed construction checklist log.

G. Independent Verification: Witness systems, assemblies, equipment, and component startup.

H. Quality Control: Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

I. Final Commissioning Report: Compile test data, inspection reports, and certificates; include them in either the systems manual or the commissioning process report. List each commissioned system and assembly, and include the following items, as a minimum:

1. CxA's statement of the system's or assembly's compliance with the OPR.

2. Description of the OPR.

3. Description of the project specifications.

4. Verification of installation (construction checklist disposition).

5. Functional performance testing and forms.

6. Operations and maintenance data evaluation.

7. Training program evaluation.

8. Value of the commissioning process.

9. Outstanding issues.

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION
(Not Applicable)

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Project site and building demolition work to prepare for addition of new improvements, as indicated on the Drawings and specified herein. General and Special Conditions and Division 1 specification sections apply to this section.

B. Related Sections:

1. Section 01 73 29, Cutting and Patching
2. Section 01 50 00, Temporary Facilities and Controls
3. Section 01 77 00, Closeout Procedures
4. Section 31 20 00, Earth Moving

1.02 DEFINITIONS

A. “Remove”: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner’s property.

B. “Removed and Salvaged”: Items to remain the Owner’s property shall be removed, cleaned, and packed or crated to protect against damage.

1. Identify contents of containers and deliver to Owner’s designated storage area.

C. “Existing to Remain” Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original locations.

D. “Remove and Reinstall”: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

E. Salvaged Materials (not wanted by Owner): Items which the Owner does not want and is of salvable value to Contractor may be removed from structure as work progresses. Owner and CBC 2022 require a minimum of 50% (by weight) of all non-hazardous construction materials be recycled, composted and/or salvaged. Salvage shall conform to the following:

1. Contractor shall submit salvage plan showing how all materials are to be sorted, salvaged and recycled. Plan must include all final destinations for each type of material.

2. Salvaged items must be transported from site as they are removed, unless materials are to be reused on site.

3. Storage or sale of removed items on site will not be permitted, unless materials are to be reused on site.

4. Contractor shall provide certification for all salvaged materials. Certifications may take the form of receipts from recycling facilities, manufacturers, or any other legitimate form of certification. Certification types shall be outlined in salvage plan and approved by

Owner.

1.03 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition by the Contractor(s) in a legal disposal area appropriate to the materials being disposed.

1.04 SUBMITTALS

A. Submit each item in this Article according to the Conditions of the Contract and Specifications Section 01 33 00, unless otherwise indicated.

B. Proposed Dust Control Measures.

C. Proposed Noise Control Measures.

D. Schedule of demolition activities indicating the following:

1. Detailed sequence of demolition, salvage, and removal work, with starting and ending dates for each activity.

2. Dates for shutoff, capping, and continuation of utility services.

E. Salvage Plan - Inventory of items to be removed and salvaged. Salvage plan shall show how all materials are to be sorted, salvaged and recycled. Plan must include all final destinations for each type of material.

F. Inventory of items to be removed and salvaged and deliver to Owner's designated storage area.

G. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and improvements that might be misconstrued as damage caused by demolition operations.

H. Record drawings at project closeout according to specifications section 01 77 00 - Closeout Procedures shall identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed demolition work similar to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Predemolition Conference: Conduct conference at Project site with Owner, Architect and Construction Manager.

1.06 PROJECT CONDITIONS

A. Building, where partial wall will be demolished, will be vacated and its use discontinued before start of the Work.

B. Conditions, existing at time of inspection for bidding purpose, will be maintained by Owner as far

as practical.

C. Hazardous Materials: If applicable, a Hazardous Materials Study was performed on site and a specification for removal of said materials is incorporated into the project documents.

1.07 SCHEDULING

A. Arrange demolition and salvage schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicted to determine extent of demolition required.

C. Inventory and record the conditions of items to be removed and reinstalled and items to be removed and salvaged.

D. Survey condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.

E. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.

3.02 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner, and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.

B. Provide not less than 72 hours notice to Owner if shutdown of service is required during changeover.

D. Utility Requirements: Refer to Division 33 sections for shutting-off, disconnecting, removing, and sealing or capping utility services. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.03 PREPARATION

A. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate

routes around closed or obstructed traffic ways if required by governing regulations.

B. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways.

2. Protect existing site improvements, appurtenances, and landscaping to remain.

C. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to remain.

1. Strengthen or add new supports when required during progress of demolition.

3.04 EXPLOSIVES

A. The use of explosives will not be permitted.

3.05 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

1. Do not create hazardous or objectionable conditions, such as flooding, and pollution, when using water.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

C. Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before start of demolition.

3.06 DEMOLITION

A. Demolish partial building wall, concrete and/or asphalt paving, interior finishes, fixtures and accessories, as required to prepare for new construction, and remove from the site.

B. Locate demolition equipment throughout the building and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

C. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.

D. Fill below-grade areas and voids resulting from demolition of building elements and pavements and soil materials according to requirements specified in Section 31 20 00 – Earth Moving and/or geotechnical report.

E. Promptly repair damages to adjacent facilities caused by demolition operations.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning demolished materials is not allowed.

C. Transport demolished materials off Owner's property and legally dispose of these materials.

END OF SECTION

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SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Completion of subgrade preparation, formwork, ties, shoring, bracing, anchorage and blockouts as indicated on the Drawings and specified herein.

B. Related Sections:
1. Concrete Reinforcing; refer to Section 03 20 00.
2. Cast-in-Place Concrete; refer to Section 03 30 00.

1.02 REFERENCED STANDARDS

A. Refer to Section 01 42 19 for information concerning availability and use of references.

ACI 117-90 - Tolerances for Concrete Construction & Materials

ACI 347R-94 - Formwork for Concrete

ANSI/AHA A135.4 - Basic Hardboard

ASTM D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous types)

CRD-C-572-74 - Polyvinyl chloride Waterstops

DOC PS-1-95 - Construction and Industrial Plywood

WCLIB Std. No. 17. - Grading Rules for West Coast Lumber

WWPA - Western Lumber Grading Rules 2011 with Supplements

B. Conform to the requirements of Section 01 45 23 – Testing and Inspection Services.

C. Construct and erect formwork in accordance with ACI 318 and 347.

D. Design forms and falsework to adequately support live and dead loads, including equipment, concrete drops, pressures of foundations, etc.

E. Follow recommendations of ACI 318 and 347.

F. Title 24, Parts 1 and 2, California Building Code.

1.03 ARCHITECT'S REVIEW

A. Architect will review formwork for architectural suitability where exposed concrete finish occurs. Contractor shall be responsible for design of formwork for structural stability and sufficiency.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Earthen Forms: Provide earthen forms for footings only where the soil is firm and stable and the concrete will not be exposed, and subject to approval of the Division of the State Architect. Cut earthen forms square, neat and accurate to size. Clean bottoms of excavations.

B. Wood Forms: Provide wood forms**,** based on PS 1-95 Plywood or B-B Class I exterior, high density overlaid one side for forms, sound, undamaged, and clean, 5/8-inch thick minimum for exposed concrete work.

1. Lumber: Provide Douglas fir, construction grade lumber for framing, studding and bracing.

2. For site walls provide HDO or HDO 7 layer minimum grade B-B for all exposed walls.

2.02 COMPONENTS

A. Formed Construction Joints: Provide minimum 24 gage galvanized steel foam filled type, with release tape sealed slots, bent tab anchors, securable to formwork.

2.03 ACCESSORIES

A. Provide accessories and anchorages required, of sufficient strength, length and character to maintain formwork during pouring operations.

B. Use anchors and hangers which do not leave exposed metal at surface.

C. Use snap-off, removable, or adjustable type metal ties, hot-dip galvanized. Provide standard metal form clamp assembly, spreader type leaving no metal within 1 inch of concrete exposed face. Leave inner tie rod within concrete when forms are removed.

D. Provide colorless mineral oil type form coating, non-grain raising and non-staining type, Nox-Crete Company Nox-Crete Form Coating, or other approved equal.

E. Rigid foam plastic fillets may be used for chamfered corners.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to commencing work, inspect the work of others and verify that such work has been properly completed and installed to allow for proper installation of materials and methods required of this section.

B. Inspect forms in accordance with Title 24, Part 2, Section 1705A.3.5, California Building Code.

3.02 PREPARATION

A. Earthen Forms: Trench earthen forms at least two inches wider than footing widths shown on drawings. Construct wood edge strips at each side of trench at top to secure reinforcing and prevent trench from caving. Form sides of footings where earth caves. Tap form and clean debris and loose materials in earthen forms before depositing concrete.

B. Design of forms and shoring in excess of 3 feet in height, shall be by a California State registered Civil Engineer.

C. Verify accuracy of lines, levels, and centers.

D. All embedded items must be installed prior to placement of concrete - *NO EXCEPTIONS*.

3.03 APPLICATION

A. Construct formwork and appurtenances to meet design and code requirements. Construct of sound materials, of correct shape and dimensions, mortar tight, and of sufficient strength to prevent sagging, buckling, movement and failures. Provide adequate shores of wood or metal to safely carry imposed loads and adjustable to prevent displacements during the work.

B. Align joints and make them watertight.

C. Set reinforcing accurately and ensure secure placement.

D. Maintain tolerances of ACI 347, within 1/8-inch in 10 feet and ¼" maximum deviation from theoretical dimensions. Exposed concrete may require tighter specifications.

E. Assist in setting and placing blockouts and sleeves for materials and products to be embedded in and passing through concrete.

F. Set screeds and establish levels for tops of concrete for finish surfaces. Shape surfaces as indicated on drawings.

G. Screed supports for concrete over waterproof membranes or vapor barriers shall be of a cradle, pad, or base type which will not puncture membrane.

H. Wet formwork prior to placing concrete and keep wet during concrete curing process.

3.04 PROTECTION

A. Do not remove formwork, shoring and bracing until such time as masonry and concrete has gained sufficient strength to carry its own weight, and construction and design loads which are liable to be imposed upon.

Verify strengths by compressive strength test results. Loosen forms carefully. Do not wedge pry bars, hammers or other tools against masonry and concrete surfaces.

B. In addition to California Building Code Section 1903A, the following are minimum times for forms and shoring to remain in place prior to removal:

1. Footings and grade beams - 5 days.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Completion of reinforcing steel bars, welded wire fabric, support chairs, bolsters, bar supports and spacers as indicated on the drawings and specified herein.

B. Related Sections:

1. Curbs, Gutters, Sidewalks and Driveways; refer to Section 32 16 00.
2. Concrete Forming and Accessories; refer to Section 03 10 00.
3. Cast-in-Place Concrete; refer to Section 03 30 00.

1.02 QUALITY ASSURANCE

A. Conform to the testing and inspection requirements of Section 01 45 23 – Testing and Inspection Services.

B. Perform reinforcing work in strict conformance with Chapter 19A, Title 24, California Building Code (CBC) 2022, and CRSI, 2009, unless specified otherwise or required otherwise by local code jurisdiction.

1.03 REFERENCES STANDARDS

A. Refer to Section 01 42 19 – Reference Standards for information concerning availability and use of references.

ACI SP-66(04) - Detailing Manual

ACI 318-08 - Building Code Requirements for Structural Concrete

ASTM A82 - Steel Wire, Plain, for Concrete Reinforcement

ASTM A185 - Steel Welded Wire Reinforcement, Plain, for Concrete

ASTM A497 - Steel Welded Wire Reinforcement, Deformed, for Concrete

ASTM A615 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

ASTM A706 - Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

CRSI MSP, 28th Edition, 2009 - Manual of Standard Practice

AWS A5.1: 2004 - Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

AWS A5.5: 2006 - Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding

AWS D1.4: 2011 - Structural Welding Code---Reinforcing Steel

B. In addition to CRSI specifications, follow ACI 315 and 318, AWS welding codes and qualifications, and ASTM A185, A615 and A706.

C. Testing of bars in accordance with Title 24, Section 1910A.2

1.04 TESTING

A. Comply with Title 24, Section 1910A.2

B. Where samples are taken from bundles as delivered from the mill, with the bundles identified as to heat number, and provided that the mill analysis accompany the report, then one tensile test and one bend test shall be made from a specimen from each 10 tons or fraction, of each size of reinforcing steel.

C. Where positive identification of the heat number cannot be made or where random samples are to be taken, then one series of tests shall be made from each 2-1/2 tons or fraction, of each size of reinforcing steel.

1.05 SUBMITTALS

A. The Contractor shall be responsible for providing steel reinforcing as indicated on the Drawings for concrete reinforcing and as specified herein. Prepared Shop Drawings shall be reviewed by the Architect or Structural Engineer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not allow reinforcing materials to have direct contact with the ground. Cover materials adequately to prevent rusting, and contact with materials or construction injurious to proper bonding.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars: Deformed billet steel reinforcing bars, ASTM A615, plain finish see Drawings for grade.

2. Where called for, provide ASTM A706.

2.02 ACCESSORIES

A. Welded Wire Fabric: Provide plain type, ASTM A185, in coiled rolls, plain finished, void of rust, dust, scale, paint, grease and other coatings.

B. Provide minimum 16 gauge galvanized annealed tie wires, and chairs, bolsters, bar supports, and spacers sized and shaped for strength and support of reinforcing. Plastic accessories may be acceptable if approved by Architect prior to use.

2.03 FABRICATION

A. Fabricate in accordance with details shown.

B. Accurately bend, cut and place bars as shown on Drawings and in accordance with the requirements of Title 24, Part 2, Section 1903A and ACI 318. Bend bars cold; heating of bars is not permissible. Do not bend or straighten bars in any manner that will injure materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to commencing work of this section, inspect work of others and verify that such work has been properly completed and installed to allow for proper installation of all materials and methods required of this section.

3.02 INSTALLATION

A. Fabricate reinforcing in accordance with ACI 315. Locate reinforcing splices not shown on drawings, at points of least stress. Where shown or required, weld reinforcing bars in accordance with AWS D1.4.

B. Place reinforcing supported and secured against displacement. Do not deviate from true alignment.

C. Ensure that reinforcing used is clean, free of scale, dirt, dust, rust and other matter.

D. Provide lap splices for bars noted as "cont.". Provide a Class “B” lap splice in concrete. Wire all laps and splices in welded wire mesh and provide side and end laps of at least 6 inches.

1. Spacing - minimum center-to-center distance between parallel reinforcing bars is to be in compliance with that shown on drawings, or in the absence of such information on drawings, the clear spacing is to be one bar diameter, but in no case less than 1-1/2 inch, nor less than 1-1/3 times the maximum size of aggregate.

2. Where possible, stagger splices of adjacent vertical bars.

E. Only splice reinforcing where shown or noted. Splices at other locations must be approved by the Architect. Provide continuous reinforcement between splice locations in vertical walls. No splices of vertical wall reinforcing may occur except at foundations, unless specifically approved by Division of the State Architect, and the Architect.

1. Securely tie reinforcing with 16 gage tie wire at all splices and intersections, and as may be directed.

2. Point ends of wire ties away from forms.

F. Stagger splices in adjacent horizontal wall reinforcing bars a minimum of 4 feet.

G. Provide dowels in footings and/or grade beams the same size and number as vertical wall or column reinforcing. Provide a minimum dowel projection equal to Class “B” lap splices unless noted otherwise.

1. Securely tie dowels in place before depositing concrete. Install No. 3 bars for securing dowels where no other reinforcement is provided.

H. Provide the minimum coverage of reinforcing by concrete as noted on the drawings.

I. Reinforcing bars shall not be re-bent.

3.03 APPLICATION

A. Correction during concreting: Maintain capable steel workers during placement of concrete for properly resetting reinforcement displaced by runways, workers, or other causes.

B. Reinforcement: As a minimum for slab reinforcement, provide 6 x 6 W4.0 x W4.0 wire mesh ASTM A185, if no other reinforcement is indicated.

3.04 DEFECTIVE WORK

A. The following reinforcing work will be considered defective and may be ordered by Owner to be removed and replaced at no additional expense to Owner:

1. Bars with kinks or bends not shown on Drawings.
2. Bars injured due to bending or straightening.
3. Bars heated for bending.
4. Reinforcement not placed in accordance with Drawings or Specifications.
5. Rusty or oily reinforcement.

3.05 FIELD QUALITY CONTROL

A. Refer to Section 01 45 23 - Testing and Inspection Services for requirements.

B. Prior to pouring concrete, notify all parties to the inspections, that reinforcing is ready for inspections. Secure approvals by testing laboratory and inspector before concrete operations commence.

3.06 CURING

A. Concrete (other than high-early-strength) shall be maintained above 50 degrees F. and in a moist condition for at least the first seven (7) days after placement, except when cured in accordance with Section 1905A, 2022 CBC.

END OF SECTION

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SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Completion of sand bed, vapor barrier, cast-in-place concrete, and finishes as indicated on the drawings and specified herein.

B. Related Sections:

1. Curbs, Gutters, Sidewalks and Driveways; refer to Section 32 16 00.

2. Concrete Forming and Accessories; refer to Section 03 10 00.

3. Formwork, Earthen forms: See Section 03 10 00 Concrete Forming and Accessories.

4. Concrete Reinforcing: See Section 03 20 00.

5. Miscellaneous steel, see Section 05 12 00 Structural Steel Framing.

1.02 QUALITY ASSURANCE/SUBMITTALS

A. Conform with the requirements of Section 01 45 23 - Testing and Inspection Services.

B. Perform concrete work in accordance with ACI 301 and 318, unless specified otherwise. Provide continuous inspection and testing for concrete placement in accordance with Sections 1701A, 1705A.3, 1903A and 1913A Title 24, Part 2, California Building Code.

C. Sample Panels: When and where instructed to do so, provide on-site sample panel with specified finishes. Construct additional panels as may be necessary to gain approval of finishes desired. After rejection of panel, remove from site immediately. Approved and reviewed panel is to be left in place at site for project duration as a project standard.

D. Testing Laboratory Services:

1. Owner will employ and pay for an Independent Testing Laboratory to review the various concrete mixes required to produce concrete of the strengths required for the project. Submit and obtain approvals before proceeding with the work. Concrete mix shall be designed per Title 24, Part 2, Section 1903A

2. Separately, Owner will employ and pay for a testing laboratory to perform tests and inspections, but the cost of subsequent and additional testing and inspections due to failed items will be backcharged to the Contractor.

E. Submit design mixes to Architect for Structural Engineer, and Testing Lab review and approval. Contractor shall pay for review of more than two (2) designs for each strength required.

F. Submit shrinkage test for each design minimum. Perform the following shrinkage tests for lightweight concrete, for each 150 cubic yards and fraction:

1. Specimens - 4-inch x 4-inch and 11 inch long bars, cured for seven (7) days in a moist room and as specified in ASTM C157. Make measurements at 7 day intervals until 35 days of curing has elapsed.

G. Concrete paving shall be stable, firm and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.

1.03 REFERENCE STANDARDS

A. Refer to Section 01 42 19 – Reference Standards for information concerning availability and use of references.

ACI 318 - Building Code Requirements for Structural Concrete and Commentary

ASTM C33 - Standard Specification for Concrete Aggregates

ASTM C94 - Standard Specification for Ready-Mixed Concrete

ASTM C114 - Standard Test Methods for Chemical Analysis of Hydraulic Cement

ASTM C156 - Standard Test Method for Water Loss [from a Mortar Specimen] through Liquid Membrane-Forming Curing Compounds for Concrete

ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete

ASTM C227 - Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)

B. All work under this section shall be in accordance with applicable provisions of CBC, 2022, Title 24, Part 2, Chapter 19A.

C. Refer to the following information for compliance of materials, products, and installation techniques: ASTM C33, C94, C150, C260, C494 and ACI 301, 304R-00 and 305R-99.

D. Handling and Placing: Concrete transported and placed as per ACI 318. Concrete shall be thoroughly compacted and worked into forms around reinforcing steel using suitable equipment. Vibrating of formwork will not be permitted.

E. Where conditions make placing difficult or reinforcing is congested, batches containing the same proportions of sand and cement used in the concrete plus a maximum of 50 percent of coarse aggregate shall be used.

F. Inspections: Notify the Architect, Structural Engineer, and the Division of the State Architect (DSA) at least forty-eight hours in advance of the first pour of concrete and sufficiently in advance of subsequent pours, see 1704A, Title 24, Part 2, California Building Code and chapter 7, section 7-145, Title 24, Part 1, California Administrative Code.

G. Testing: The Inspector will take at least four cylinders of concrete from each day's run of 50 yards, or 2,000 sq. ft. of surface area for slabs, or fractional part thereof, per ACI 318. Field specimens of concrete taken and tested in accordance with 2022 CBC Standard. Label each cylinder with job name, date, number, result of slump test, and the point in the pour in the structure from which the sample was taken noted thereon. One cylinder shall be tested at seven days and two at 28 days. The fourth cylinder shall be stored for 56 days unless instructed otherwise. Core test to comply with ACI 318 if cylinder tests indicate deficiencies.

H. Embedded Items: Pipes and conduit in concrete, located, sized and if required, sleeved in accordance with the requirements of ACI 318. Bolts and anchorage devices embedded in concrete to fastened sills, tie-down columns and other structural and framing members to concrete installed and secured in place before concrete is placed.

1. Concrete shall be placed in a continuous operation between predetermined joint locations. Location of construction joints shall be as shown on the drawings or at locations approved by the Engineer and the Division of the State Architect.

2. Joints shall be straight, exactly horizontal or vertical and the surface of the concrete shall be level wherever a run is stopped. Reinforcement shall be extended through joints or dowels to develop the full strength of the reinforcement. Construction joints shall be per ACI 318.

1.04 TESTING

A. Provide free access to work. Provide laboratory design mix. No substitutions will be accepted. Cement and aggregates shall be tested.

B. Cement: Test Portland cement in accordance with Sections 1910A.1, Title 24, Part 2, and Section 26.4.2, ACI 318.

C. Core Tests: Take and test composite construction cores in accordance with Section 1705A.3.7, Title 24, Part 2

D. Batch Plant Inspection: Provide in accordance with Section 1705A.3.3, Title 24, Part 2.

E. Placing Record: Keep records of placing in accordance with Section 1705A.3.6, Title 24, Part 2.

F. Cylinder Test: Provide in accordance with Section 1705A.3.7, Title 24, Part 2.

G. Slump Test: Provide in accordance with ASTM C143 for each set of test cylinders.

H. Placing Inspection: Provide in accordance with ACI 318.

I. Moisture Testing: All slabs to receive flooring materials other than ceramic tile shall be calcium chloride dome tested at least 54 days after placement. Readings exceeding requirements of flooring manufacturer (generally 3 lbs. per 1,000 s.f. per 24 hours) will require retesting prior to installation of flooring. Readings in excess of 5 lbs. per 1000 s,f, will require testing by Owner using petrographic analysis to determine water/cement ratio at time of placement.

1. All tests in areas where concrete was placed with a water/cement ratio in excess of .45 will be paid for by Owner, but may be back charged to Contractor.

J. Compaction Testing: Provide in accordance with ASTM D689.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement: For site walls – Colton II - Provide ASTM C150 TYPE II/V conforming to requirements of 1910A.1, Title 24, Part 2. If aggregates contain reactive substances, reactive with cement alkalies they may not be used.

B. Aggregates:

1. Base and Aggregate base shall conform to the State of California, Department of Transportation (CALTRANS) Standard Specifications, Current Edition. All base, whether called out as aggregate base or base shall be in conformance with CALTRANS Section 26 for Class 2 Aggregate Base, 3/4-inch maximum. The maximum percentage of recycled material allowable shall not exceed 50% of the total volume of aggregate used.

2. Base and Aggregate Base shall be provided by a licensed commercial materials supplier. Certifications shall be submitted with each submittal. Use of on-site asphalt materials in aggregate base or base is strictly prohibited. The use of Crushed Miscellaneous Base is strictly prohibited.

3. Aggregates: ASTM C33, 1-inch maximum conforming to CBC 2022, Title 24, Part 2, 1903A.5 Aggregates and ACI 318.

C. Curing Materials:

1. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per square yard, complying with AASHTO M182, Class 2.

2. Moisture-Retaining Cover: One of the following, complying with ASTM C171:

a. Curing paper
b. Polyethylene film
c. Burlap Polyethylene-coated

3. Liquid Membrane-Forming Curing Compound: Liquid type non-wax membrane-forming curing compound complying with ASTM C309, Type I, Class B. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal/ product shall be compatible with finishes to be applied to concrete.

a. Products: Subject to compliance with requirements, provide one of the following:

"2000 Kure 1315"	BASF Building Systems.
"Kurez W Vox"	Euclid Chemical Co.
"Sealtight 1100-Clear"	W.R. Meadows, Inc.

b. Surface Treatment for Slabs Receiving Wood Flooring, Sheet Vinyl, or Resilient Flooring including Sheet vinyl and Vinyl Cementitious Tile, Carpet with a Vinyl, Rubber or Unitary Type Backing: Waterproof, Seal and Cure Application, CS 2000 by Creteseal (800) 278-4273, or equivalent, Floor Seal Technology, Inc. (800) 572-2344.

4. Warranty: 15 years Labor and Materials backed by a $1,000,000 Insurance Policy

a. A trained applicator shall apply CS 2000, or a technician must be on site during the spraying applications for verification to receive the 15 year warranty on floor coverings.

b. When a floor covering system is installed on a slab treated with the product according to manufacturer's instructions, the manufacturer shall warrant the floor covering system against delamination due to negative, ground originated moisture migration or moisture-born contaminates for a period of ten years from the date of original installation.

The warranty shall cover labor and materials necessary to repair or replace the floor covering system if repair cannot be made.

5. After pouring, placing, bullfloating, final finishing, soft cutting, and the surface of the concrete has hardened sufficiently to sustain foot traffic, CS 2000 Sealer shall be applied.

6. Apply CS 2000 Concrete Sealer at the rate of 200 square feet per gallon coverage. If puddling or bird bathing occurs, lightly broom product evenly over the substrate.

7. Continue brooming the product evenly over the substrate until the CS 2000 product has penetrated into the concrete.

8. Provide one of the following, or other approved equal:

Creteseal CS 2000.
Ashford Formula
Kure N Harden – By BASF

D. Water: Provide clean water free from injurious substances, per Section 3.4, ACI 318.

E. Vapor Barrier: Provide Stego Industries, 15-MIL Specifications, comply with ASTM E 1745, Class A, requirements.

F. Admixtures: *(No Calcium Chloride)* Admixtures to be used in concrete shall be subject to prior approval by the IOR and the Division of the State Architect, CBC 2022.

1. Water Reducing: Reduce water 5 percent minimum, increase 28 day compressive strength, decrease 21 day drying shrinkage, ASTM C494.

2. Provide one of the following, or other approved:

BASF The Chemical Co. Pozzolith 300 R.

3. Acceleration or Retarding: ASTM C494.

4. Air Entraining: 4 percent minimum, 6 percent maximum air content by volume, ASTM C260.

5. Admixtures shall be in accordance with Title 24, Part 2, 1903A.6 and Section 26.4.1.4 ACI 318.

6. Concrete Sealer: Dayton Superior “Cure & Seal 309 J18”, W.R. Meadows "VOCOMP®-25", or Sonneborn® Products "Kure-N-Seal W" as manufactured by BASF.

    1. For site walls use Sinak HLQ 125.
    2. 3000 psi concrete 3/8” – 1/2” aggregate.

7. Non-Slip Surface: Trowel finish aluminum oxide grains, at exterior stairs and where indicated on the Drawings.

8. Add shrinkage reducing agent, such as “Eclipse®” as manufactured by Grace Construction Products or Peramin® SRA as manufactured by Peramin.

2.02 COMPONENTS

A. Non-Shrink Grout: Premixed compound consisting of non metallic aggregate, cement, water reducing and plasticizing agents, capable of developing non-shrink characteristics in both the horizontal and vertical direction with minimum compressive strength of 4,800 p.s.i. in two (2) days, and 6,000 p.s.i. in twenty-eight (28) days.

    1. Provide Embeco Grout as manufactured by BASF, or other approved by Five Star, Dayton Superior, or Sika.

B. Cement Grout and Drypack: Precision support grout shall be BASF Masterflow® 713 Grout as manufactured by Master Builders, Cleveland, Ohio consisting of a hydraulic cementitious system, specially graded and processed natural fine aggregate and additional technical components. Other products will only be acceptable providing written approval of the Engineer is obtained prior to bidding. Acceptance will be granted only upon satisfactory evidence proving that the substitute material meets the following requirements, conforming to CRD C-621 Corps of Engineers.

    1. Free of gas producing or releasing agents.

    2. Free of oxidizing catalysts.

    3. Free of inorganic accelerators, including chlorides.

    4. Drypack: Pre-mixed grout shall be used. Use only enough water to make a stiff mix consistency. Pre-mixed grout shall be used under base plates per manufacturer's recommendations, and packed solid under pressure treated mudsills, per Structural Details, so as to obtain a continuous bearing. Minimum compressive strength of 6000psi.

C. Joint Materials: Provide tooled joints or plastic control joints.

1. Construction Joints: Provide metal keyed dividers for cold joints, subject to review and approval by Architect.

2. Expansion Joint Fillers:

a. 1/2-inch asphalt impregnated fiber conforming to ASTM D545 Type 5, where slab abutts wall or other vertical elements.

b. Where joint will be finished with sealant, set expansion strip with a 1/2-inch deep removable expansion strip cap.

D. Under Slab Vapor Barrier: 15 mil Stego Wrap, Fortifiber Building Systems, or W.R. Meadows, or equal, over 2" compacted sand. Refer to plans and Geotechnical Report for installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Certifications: Provide legible copies of the delivery tickets of each load of concrete with the following information:

1. Name and location of plant.
2. Serial number of ticket.
3. Date and truck number.
4. Name of contractor.
5. Name of project.
6. Type of class of concrete and how to be used.
7. Amount of concrete.
8. Time loaded, time of arriving and unloading at project site.
9. Water added at site and total water content.
10. Type, name and amount of admixtures.
11. Name and signature of person making slump tests.
12. Testing number of test cylinders.

3.02 PREPARATION FOR PLACEMENT

A. Remove foreign debris and matter which may have accumulated within forms, and close ports and openings left in formwork.

B. Thoroughly clean tools used in transportation, placing and consolidating concrete immediately after each pour.

C. Ensure that required inspections have taken place prior to pour.

3.03 APPLICATION

A. Mixes: The minimum concrete ultimate twenty-eight (28) day compressive strength to be per structural drawings and shall be controlled by the following method:

1. Designed Mix: Concrete mixes shall be based upon previously proven mixes and material tests made by a recognized testing agency. The design of such mixes shall be based on the ultimate strength of the concrete assumed in the design of the structure and shall take into consideration both the workability of the mix and the durability of the concrete. Refer to Sections 1903A.1 and ACI 318.

2. When strengths in excess of 3,000 pounds per square inch are required, or special aggregates not having a record of satisfactory performance are used, or admixtures are used to reduce the cement content, ACI 318, shall be used to determine the mix.

3. Where design criteria in Title 24, Part 2, chapter 19A and ACI 318 Section 4.6, provide for the use of a splitting tensile strength value of concrete as a modifier, laboratory tests shall be made in accordance with the CBC to establish the value of fct corresponding to the specified value of f'c.

4. Tensile-splitting tests of field concrete shall not be used as a basis for acceptance.

5. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement not less than 1 inch and not more than 4 inches.

6. The maximum water to cement ratio shall not exceed 0.5 (50%).

7. Project specific shrinkage test. Perform test using actual proposed mix with some aggregates used in the project. Limit 28-Day shrinkage to 0.045 percent.

B. Flowable Concrete Fill: Provide batch plant design mix of 4000 p.s.i., flowable concrete and submit to Architect, for information.

3.04 CONVEYING

A. Handle concrete from mixer to location of placing as rapidly as practical, avoiding separation or loss of ingredients and rehandling. Use carts, wheelbarrows, concrete pumps, conveyors or buggies to deliver concrete to location of placement.

B. Do not permit a free fall of more than 4 feet when placing concrete.

C. Use elephant trunk spouts for placing concrete in vertical elements. Space so that concrete does not exceed 4 foot flow horizontally.

3.05 PLACEMENT

A. In general, place concrete in accordance with ACI 301, and in the presence of the inspecting personnel required.

B. Ensure that anchors, seats, plates, and other items to be cast into concrete are placed, held securely, and will not cause hardship in placing concrete.

C. Maintain records of poured concrete. Record date, location, quantity, air temperatures, and test samples taken.

D. Ensure that reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

E. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.

F. Pour concrete continuously between predetermined construction, control and expansion joints. Pour in a checkerboard pattern, unless otherwise directed.

G. Excessive honeycomb and embedded debris is not acceptable.

H. Conform to ACI 305R-10 when concreting in hot weather.

I. Install vapor barrier in widest widths possible, under interior slabs on grade. Place at center of 4 inches of sand (minimum of 2 inches of sand top and bottom) lapping joints at least 18 inches and sealing joints, taping pipe penetrations.

J. Screed slabs and concrete bases level to a tolerance of 1/8-inch in 10 feet. Vary slab thickness as required to maintain top of slab elevation as design. Maintain top of slab elevation within ± 3/8" of intended elevation. Continually survey top of concrete elevations during concrete pour.

K. Inspect concrete surfaces immediately upon removal of forms. Patch imperfections.

L. Modify or replace concrete not conforming to required lines, details, shapes and elevations. Do not patch, fill, touch-up, repair, or replace exposed architectural concrete except upon express direction of Architect.

M. Provide smooth rubbed finish on concrete surfaces to be left exposed such as concrete walls, columns, beams, and joists, except as otherwise indicated.

N. Beginning immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete. Moisture cure for seven (7) days minimum all interior slabs.

O. Drypack shall be packed solid under baseplates and thoroughly packed under pressure treated mudsills, per Structural Details, so as to obtain a continuous bearing.

3.06 CONSTRUCTION JOINTS

A. Provide construction joints in slabs in accordance with ACI 318.

1. For slabs-on-grade, place control joints as shown on Drawings.

B. The surface of horizontal construction joints shall be cleaned and roughened by removing the entire surface and exposing clean aggregate solidly embedded in mortar matrix, in accordance with the following procedure:

The contact surface shall be thoroughly cleaned by chipping or sand-blasting the entire surface not earlier than 5 days after initial pour, or by an approved method that will assure equal bond, such as a thorough hose-washing of the surface not less than two or more than four hours after the concrete is placed (depending on setting time), wash water and chalk-like material being entirely cleaned from the surface.

In the event that the contact surface becomes coated with earth, sawdust, etc. after being cleaned, the entire surface so coated shall be re-cleaned.

A mix containing the same proportion of sand and cement used in the concrete, plus a maximum of 50 percent of the coarse aggregate, shall be placed on horizontal joints before proceeding with the regular specified mix. A delay at least until the concrete in columns and walls is no longer plastic must occur before casting or erecting beams, girders, or slabs supported thereon. Beams, girders, brackets, column capitals, and haunches shall be considered as part of the floor system, and shall be placed monolithically therewith.

3.07 FIELD QUALITY CONTROL

A. Testing: Comply with CBC, 2022, Title 24, Part 2, Section 1903A.

B. If compressive strength tests of cylinder specimens fail to show strengths assumed in sdesign, take 4 inch diameter cores at representative locations throughout structure as designated by Inspector. Take cores in accordance with ASTM C42. The strength level of the concrete shall be considered satisfactory if the average strengths of the area or panel equals or exceed the specified strength at 28 days, with no individual strength test of such area or panel less than 5 percent below that specified. Concrete that does not meet or exceed these criteria shall be removed by the contractor and replaced with concrete that conforms to these criteria. Remove and replace defective concrete at no additional cost to Owner. Be financially responsible for repair and replacement of other in-place materials affected by such removal and replacement.

Costs of taking core samples and performing tests required will be paid by Owner if tests prove satisfactory. If test fail to show required strengths, concrete contractor will be held financially responsible.

C. If the strength of the molded test cylinder falls below the minimum ultimate compressive strength assumed in the design, adjust the proportions of the mix for the remaining portion of the structure to give concrete of the assumed minimum strength.

D. Concrete will also be deemed defective which is not formed properly as indicated, is not true to intended alignment, is not plumb or level where so intended, is not true to intended grades, has sawdust or other debris embedded within it, or does not fully conform to other provisions of these specifications. As directed, remove and replace with concrete complying with these specifications.

3.08 CONCRETE FINISHES

A. Slab Levels: Surfaces shall finish true to 1/8-inch in 10 feet on a straight-edge and in direction with maximum high and low variance occurring in not less than 20 feet and with 1/16-inch maximum tolerance in one running foot. Particular care shall be taken to finish troweling around the edges of the slabs so finish surface edges shall be at same

elevations as the rest of the top surface of the slab. Slabs shall be surveyed continuously during pour.

B. Concrete Sealer: Concrete floors not indicated in the schedule to receive other finish shall receive two coats of sealer specified this section. Concrete to receive sealer shall be cured with specified concrete sealer that functions also as cure. Use the same material for each application.

C. Steel Trowel Finish: Interior slabs shall receive a monolithic steel trowel finish. Surfaces shall be screeded, wood floated, and steel-troweled. Finish shall be a smooth, hard, dense, impervious surface, free of defects. Finishers shall work from knee boards laid flat upon the surface. Mechanical troweling machines may be used if the desired finish and level tolerances can be obtained by their use, but finishing shall be by hand troweling.

1. Slabs to receive tile, carpet or adhered finishes shall receive light/medium broom finish to create "tooth" for adhesive.

2. Unfinished exposed to view slabs in service closets, mechanical, electrical, stairs, ramps, and similar spaces shall receive a medium/heavy broom finish. See Section 32 16 00 for site flatwork.

D. Depressed slabs shall be finished by tamping slab with an open grid tamper, screeding with a straightedge and wood floating to a true and uniform surface, true to tolerance of 1/4-inches in 10 feet.

3.09 CONCRETE CURING AND PROTECTION

A. General: At slabs that do not receive concrete sealer, per 2.01D, provide the following: Concrete Curing per Section 26.5.3, ACI 318. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Concrete shall be maintained above 50 degrees and continuously moist for not less than 7 days.

Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Slab Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover during, and by combinations thereof, as herein specified. Provide Moisture-Curing by the following Methods:

1. Keep concrete surface continuously wet by covering with water. Continuous water-fog spray, for seven (7) days minimum.
2. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof type of adhesive. Immediately repair holes or tears during curing period using cover material and waterproof tape, for seven (7) days minimum.

3. Provide Curing and Sealing Compound to exterior slabs, walks, and curbs, as follows:

   a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Re-coat areas subjected to heavy rainfall within 3 hours after initial application.

   b. Maintain continuity of coating and repair damage during curing period.

   c. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, such as liquid floor hardener, waterproofing, damp proofing, membrane roofing, ceramic or quarry tile, vinyl composition tile (VCT), glue-down carpet, painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

C. Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Curing Unformed Surfaces:

1. Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of moisture curing method.

2. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

E. Sealer and Dustproofer: Apply two (2) coats of specified curing and sealing compound to Interior slab surfaces not receiving any other finish.

F. Concrete (other than high-early-strength) shall be maintained above 50 degrees F. and in a moist condition for at least the first seven (7) days after placement, except when cured in accordance with Section 26.5.3, ACI 318.

3.10 PROTECTION

A. Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Exposed Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

1. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

2. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.

3. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and finish concrete surfaces as scheduled.

C. Concrete Surface Repairs: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

1. Cut out honeycomb, rock pockets, voids over 1/4 inch in dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

D. Repair of Formed Surfaces:

1. Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

2. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

E. Repair of Unformed Surfaces:

1. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

2. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

3. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

4. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

5. Site walls: Remove cracked, honeycombed or defective concrete as required by the Architect from joint to joint. Patching, calking, filling or repairing will not be permitted.

F. Repair Defective Areas:

1. Repair defective areas, except random cracks and single holes not exceeding 1 inch diameter, by cutting-out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance around.

2. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

3. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

4. Site walls: Remove cracked, honeycombed or defective concrete as required by the Architect from joint to joint. Patching, calking, filling or repairing will not be permitted

5. Perform structural repairs with prior approval of Architect of Structural Engineer for method and procedure, using specified epoxy adhesive and pressure grouting.

6. Repair method not specified above may be used, subject to acceptance of Architect.

G. Mitigation of Unacceptable High Moisture Emission Levels: Interior slabs-on-grade tested at levels in excess of 5.0 lbs/1000 s.f. shall be further evaluated with additional calcium chloride tests. Once levels are established, additional preparation measures shall be employed (depending on the magnitude of moisture levels) using one or both of the following products:

2 coats of Super-Krete
2 coats of Rust-Oleum 6000 system.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Single application cure-densifier-hardener for new and existing concrete floors.
   2. Precautions for avoiding staining concrete before and after application.

B. Related Requirements:
   1. Section 03 30 00 “Cast-In-Place Concrete.”

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 REFERENCES

A. Product American National Standards Institute (ANSI):
   1. ANSI B101.1 Test Method for Measuring Wet SCOF of Common Hard-Surface Floors.
   2. ANSI B101.3 Test Method for Measuring Wet DCOF of Common Hard-Surface Floors.

B. ASTM International (ASTM):
   1. ASTM C779 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
   2. ASTM C805 Standard Test Method for Rebound Number of Hardened Concrete.
   3. ASTM D3359 Standard Test Methods for Measuring Adhesion by Tape Test.
   4. ASTM F150-06(2018) Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring.
   5. ASTM G23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials (Withdrawn 2000).

C. National Floor Safety Institute (NFSI):
   1. Certified as High Traction by the National Floor Safety Institute (NFSI), Phase 2 testing.

D. USGBC LEED Version 4
   1. Indoor VOC Emission Test; California Department of Public Health CDPH/EHLB/Standard Method Version 1.2, 2017.

E. Health Product Declaration Collaborative (HPD)
   1. HPD v1.0.
   2. HPD v2.1.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans indicating substrates, locations

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer.

1.08 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 01 Product Requirements section.

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

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

D. Handling: Protect materials from dirt, corrosion, oil, grease and other contaminants.

PART 2 PRODUCTS

2.01 MATERIAL

A. Manufacturer: Curecrete Distribution, Inc.

B. Or Equal.

2.02 BASIS OF DESIGN PRODUCT

A. Hydraulic Cure-Densifier-Hardener: Ashford Formula is a transparent, chemically reactive, water-based treatment that penetrates into the concrete surface, forming a chemical reaction of crystalline growth that fills in the natural pores and voids in the concrete surface.
   1. Abrasion Resistance to Revolving Disks: At least a 32.5% improvement over untreated samples when tested in accordance with ASTM C779.
   2. Surface Adhesion: At least a 22% increase in adhesion for epoxy when tested in accordance with ASTM D3359.
   3. Hardening: As follows when tested in accordance with ASTM C39:
      a. After 7 Days: An increase of at least 40% over untreated samples.
      b. After 28 Days: An increase of at least 38% over untreated samples.
   4. Rebound Number: An increase of at least 13.3% over untreated samples when tested in accordance with ASTM C805.
   5. Electrical Resistance: To ASTM F150.
   6. Light Exposure Degradation: No evidence of adverse effects on treated samples when tested in accordance with ASTM G23.
   7. Test Method for Measuring Wet SCOF of Common Hard-Surface Floors in accordance with ANSI B101.1.
   8. Test Method for Measuring Wet DCOF of Common Hard-Surface Floors in accordance with ANSI B101.3.
   9. Certified as High Traction by the National Floor Safety Institute (NFSI), Phase 2 testing.
   10. Certified Compliant according to California Department of Public Health CDPH/EHLB/Standard Method Version 1.2, 2017.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of the Work.

B. Do not begin installation until substrates have been properly prepared and are suitable for application of product.

C. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Do not use frozen material. Thaw and agitate prior to use.

D. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid or other liquids.

3.03 APPLICATION

A. New Concrete: Apply cure-densifier hardener to new concrete as soon as the concrete is firm enough to work on after troweling; with colored concrete, wait a minimum of 30 days before application.

1. Spray on at rate of 200 ft2/gal (5 m2/L).
2. Keep surface wet with cure-densifier-hardener for a minimum soak-in period of 30 minutes without allowing it to dry or become slippery. If slipperiness occurs before the 30 minute time period has elapsed, apply additional cure-densifier-hardener, as needed, to keep the entire surface in a non-slippery state for the first 15 minutes; for the remaining 15 minutes, mist the surface as needed with water to keep the material in a non-slippery state. In hot weather conditions, follow manufacturer's special application procedures.
3. When the treated surface becomes slippery after this period, lightly mist with water until slipperiness disappears.
4. Wait for surface to become slippery again, and then flush entire surface with water to remove all cure-densifier-hardener residue.
5. Squeegee surface completely dry, flushing any remaining slippery areas until no residue remains.
6. Wet vacuum or scrubbing machines can be used in accordance with manufacturer's instructions to remove residue.

B. Existing Concrete: Apply cure-densifier-hardener only to clean, bare concrete.

1. Thoroughly remove previous treatments, laitance, oil and other contaminants.
2. Saturate surface with cure-densifier-hardener; respray or broom excess onto dry spots.
3. Keep surface wet with cure-densifier-hardener for a minimum soak-in period of 30–40 minutes.
4. If most of the material has been absorbed after the 30 minute soak-in period, remove all excess material, especially from low spots, using broom or squeegee.
5. If most of the material remains on the surface after the 30 minute soak-in period, wait until the surface becomes slippery and then flush with water, removing all cure-densifier-hardener residue. Squeegee completely dry, flushing any remaining slippery areas until no residue remains.
6. If water is not available, remove residue using squeegee.

3.04 PROTECTION

A. Do not allow temporary placement and storage of steel members on concrete slabs.

B. Clean up spills immediately and spot-treat stains with degreaser or oil emulsifier.

C. Clean floor regularly in accordance with manufacturer's recommendations.

END OF SECTION 03 35 00

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Wood framing, miscellaneous furring for wall finishes, miscellaneous blocking and rough hardware.

B. Related Sections:

1. Finish Hardware, see Section 08 71 00 – Door Hardware.
2. Millwork and other finish carpentry.

1.02 REFERENCE STANDARDS

A. Softwood Lumber: PS 20 - American Softwood Lumber Standard.

B. NFPA - National Forest Products Association, National Design Specifications for Stress Grade Lumber and its Fastening.

C. West Coast Lumber Inspection Bureau (WCLIB), Standard No. 17 Grading Rules for West Coast Lumber.

D. Chapter 23, Part 2, Section 2303, Title 24, California Building Code, 2022.

E. Chapters 7, 23 and 35, California Building Code, 2022.

F. Plywood: U.S. Product Standard PS 1-09.

G. Lumber: U.S. Product Standard, PS 20-10.

1.03 QUALITY ASSURANCE

A. Provide lumber with visible grade stamp of an approved agency certified by NFPA.

1.04 DELIVERY, STORING AND HANDLING

A. Deliver and store materials at job site in a safe area, out of traffic and shored up, off ground surface.

B. Identify framing lumber by grades and store grades separately from each other.

C. Protect products with adequate waterproofing.

D. Exercise care in off-loading lumber to prevent damages, splitting and breaking.

E. Seasoning:

1. Deliver materials at earliest date possible to allow maximum; drying time on site.

2. Pile and strip lumber at site to allow free circulation of air with pile protected from sun and moisture.
3. Air-season lumber for at least 60 days before covering with finish materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber: PS 20 and WCLIB Standard Number 17; Douglas Fir/Larch; graded in accordance with NFPA Grading Rules; maximum moisture content of 19 percent, grades as scheduled on drawings.

1. Douglas fir shall bear WCLIB grade stamp.

2. Pressure treated Douglas fir shall be No. 2 minimum and bear the AWPA quality mark. Cuts and holes shall be treated per AWPA Standard U1 (statements such as "or to refusal" are not permitted).

3. Comply with provisions of Title 24, CBC, 2022, Part 2, Section 2303.

B. Plywood:

1. Plywood for Roofs, and wall Sheathing: PS 1-09 Structural I grade, APA C-D, exterior glue, except B-D for electrical and telephone panels.

2. Comply with CBC, 2022, Section 2303.

3. Roof and shearwall plywood shall be nominally 4 ft. x 8ft. in size. Do not use sheets less than 8 square feet, nor less than dimensions noted in paragraph 3.08 Plywood Placement.

2.02 ACCESSORY MATERIALS

A. Nails, Spikes, and Staples: Common (with standard lengths), except as otherwise indicated, galvanized for exterior locations, high humidity within conditioned spaces, and treated wood; plain finish for other interior locations; size and type to suit application.

B. Steel Hardware and Stock Framing Products by Connectors: ASTM A36 steel, galvanized for exterior applications, Simpson Strong-Tie Company. Products by KC Metal Products, or other approved manufacturer, may be substituted if equal. Comply with CBC, 2022, Title 24, Part 2, Chapter 23.

C. Lag Bolts: ANSI/ASME B18.2.1 and ASME B18.18.1.

D. Wood Preservative: Wolmanizing treatment at least two weeks prior to delivery to site. Treatment shall meet or exceed AWPA P5.

E. Machine Bolts: ASTM A307.

F. Pressure Treatment: Sills and plates in contact with concrete within 48 inches of the ground, and wood posts and columns bearing directly on concrete shall be water-borne preservative pressure treated in accordance with paragraph, CBC 2022, Title 24, Part 2, Chapter 23.

1. At cuts, holes, notches and other field operations which expose a surface not factory treated with preservative, field apply preservative material compatible with original material shall bear mark AWPA Standard U1.

2. Meet local Air Quality Control Board Standards for field applied preservative treatment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Selection of Lumber: Carefully select members. Ensure that exposed members are free of heart center. Select members so that knots and obvious defects will not interfere with placement of bolts, proper nailing or making proper connections, and not impair achievement of proper finished appearances where to be exposed.

B. Cut out and discard defects which will render a piece unable to serve its intended function. Lumber may be rejected by Architect, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.

3.02 GENERAL FRAMING

A. In addition to framing operations normal to fabrication and erection indicated on drawings, install wood backing required for work of other trades, and for casework, chalkboards, toilet partitions and etc. as required. Wood backing to be installed in high traffic and high impact areas.

B. Set horizontal and sloped members with crown up.

C. Non-bearing stud walls, sills, and trimmers may be anchored to concrete per Structural Drawings.

D. Wall and partition studs and mullions shall be continuous from sill to plates. Run at least two studs on each side of openings in stud walls for openings in exterior walls and in partition openings larger than 5 feet, and partitions from sill to plate. In addition, place one stud trimmer to support each end of lintels over openings, unless shown otherwise.

E. Provide double plates with joints staggered and lapping at least four feet, and splice. Nail as required on Drawings.

F. Install nailing blocks and backing necessary for attachment of grounds, finishes, trim, fixtures, and do required cutting, furring, and backing for plumbing and heating pipes, fixtures, etc., as detailed in the Drawings or approved by the Structural Engineer and approved by the Division of the State Architect, Office of Regulations Services.

G. Frame stud partitions, furring and walls containing fire extinguisher cabinets, electric panels, plumbing, heating, or other pipes to give proper clearance. Cutting of studs in bearing partitions and shear walls is prohibited unless specifically detailed.

H. Do not place pipes exceeding 1/3 of plate width in partitions used as bearing or plywood-sheathed walls, but place them in furring completely clear of studs, unless detailed otherwise. Place approved piping in center of plates using neat hole. No notching is allowed. In no case allow pipes to pass through plates less than 5-1/2 inches wide.

I. Unless otherwise indicated provide 2 inch by 6 inch studs at 16-inches on centers. Refer to Structural Drawings for Simpson Metal Strap Ties, strap length, nail size and nail spacing where plates are broken.

J. Provide cross-bridging at 10 feet on centers maximum for all joists and rafters more than 10-inches deep. Use wood 2 inch by full depth of joist or rafter or approved metal type bridging. Nail metal bridging.

K. Provide isolated posts with connections at top and bottom; Simpson CC caps or CB base unless specifically detailed otherwise.

L. Provide a Simpson "CB" Steel Base Plate for untreated wood posts where they are or will be in contact with concrete.

M. Framing for horizontal plaster assemblies shall comply with the requirements of CBC 2022, Title 24, Part 2, Section 2504.2.

3.03 FIRE BLOCKING

A. Fire blocking shall conform to the requirements of CBC 2022, Title 24, Part 2, Chapter 7, Section 718.2

B. Ensure that no fire stop is less than nominal 2 inches thick and no less in width than enclosed space within partition.

C. Provide stud wall and partitions with continuous rows of bridging or fire stops which will form a complete and effective separation in entire width of partitions, placed in such a manner that there will be no concealed air spaces greater than 8 feet in vertical dimension. Intermediate stops may be in line with opening headers. Provide furred space between stud walls and partitions with continuous fire stops at same elevation as those in the enclosing walls which must be installed horizontally, thus forming a solid stop from outside to outside of studs. At concealed draft passages or shafts including furring spaces, ensure that maximum dimension is no more than 8 feet. Provide fire stop partitions at suspended ceilings.

3.04 BEARINGS

A. Make bearings full unless shown otherwise.

B. Finish bearing surfaces on which structural members are to rest so as to give sure and even support. Where framing members slope, cut or notch ends as required to give uniform bearing surface.

3.05 SHIMMING

A. Do not shim framing member except where specifically shown or required by drawings.

3.06 BLOCKING

A. Install blocking required to support items of finish and to cut off concealed draft openings, both vertical and horizontal, between ceiling and floor.

3.07 ALIGNMENT

A. On framing members to receive a finished surface, align finish sub-surface to vary not more than 1/8-inch from plane of surface of adjacent framing and furring members.

3.08 PLYWOOD PLACEMENT

A. All installed plywood shall be in 4' x 8' sheets except where restricted by boundaries or changes.

B. Minimum Plywood Panel Sizes shall be as follows:

1. In horizontal plywood diaphragms, no panel less than 24 inches wide or 48 inches long shall be used.

2. In vertical plywood diaphragms, no panel less than 16 inches wide shall be used.

C. Center joints accurately over support unless otherwise shown on Drawings. Provide gapping of plywood substrate of 1/8-inch at abutting joints at all wall.

D. Protect plywood from moisture until succeeding component or materials are installed to cover plywood. Delaminating plywood shall be removed and replaced.

3.09 FASTENING

A. Use only common wire nails or spikes of standard lengths and gages as specified Table 2304.10.1, of the California Building Code, 2022.

B. For conditions not covered on drawings, Contractor to request clarification or provide penetration into piece receiving point not less than 1/2 length of the nail or spike, provided that 16d nails may be used to connect two pieces of nominal 2 inch thickness as specified by the Architect, and/or Structural Engineer and approved by the Division of the State Architect.

C. For bolts, drill holes 1/32-inch to 1/16-inch larger in diameter than bolts being used. Drill straight and true from one side only.

D. Bolt threads shall not bear on wood. Use washers under head and nut where both bear on wood. Use washers under nuts.

E. For lag-screws, and wood screws, pre-bore holes in accordance with CBC 2022, Title 24, Part 2, Chapter 23.

F. Screw, do not drive, lag screws and wood screws.

G. Nailing schedule shall be per CBC 2022, Title 24, Part 2, Chapter 23.

3.10 HOLLOW METAL FRAME GROUTING

A. At all exterior hollow metal jambs, drypack/grout the bottom 6-inch space between the hollow metal and 6-inch concrete curb at the wall. The intent is to fill solid the void between the frame and concrete curb. Install drypack/grout before any finishes are applied to the studs.

END OF SECTION

SECTION 06 17 13

LAMINATED VENEER LUMBER

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes: Microllam® Laminated Veneer Lumber (LVL) including complete furnishings and installation as shown on the drawings herein specified and necessary to complete the work.

B. Related Sections:

1. Rough Carpentry, see Section 06 10 00.

1.02 REFERENCE STANDARDS

A. Chapter 23, Part 2, Section 2303, Title 24, California Building Code, 2022.
B. ASTM D-2559 Standard Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (West Use) Exposure Conditions
C. ASTM D-5456 Standard Specification for Evaluation of Structural Composite Lumber Products Scope

1.03 QUALITY ASSURANCE

A. Code Approval

1. These products shall be designed and manufactured to the standards set forth in the ICC Evaluation Service, Inc. report ESR-1387.

1.04 DELIVERY, STORING, AND HANDLING

A. Deliver and store materials at job site in a safe area, out of traffic and shored up, off ground surface.

B. Protect products with adequate waterproofing.

C. Handle Microllam® in a flat orientation. Protect the edges and ends from damage, keep the load level, and lift the stack from the center.

1.06 DESIGN

A. Products

1. Microllam® LVL shall be designed to fit the dimensions and loads indicated on the plans.

B. Design Calculations

1. Member calculations shall be prepared by Weyerhaeuser. (Service Fees may apply)

1.07 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 00 – Submittal

B. Drawings

1. Drawings showing layout and detail necessary for determining fit and placement in the building shall be provided by Weyerhaeuser. (Fees may apply)

C. Production

1. Fabrication and/or cutting shall not proceed until the architect and/or engineer have approved the submittal package.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Code Reports

1. Materials shall comply with ICC ES ESR-1387.

B. Adhesives

1. Adhesives shall be of the waterproof type conforming to the requirements of ASTM D-2559.

C. Material Properties
1. Allowable design stresses shall confirm with minimum values listed on Structural Drawings.

2.02 FABRICATION

A. Microllam® LVL shall be manufactured by Weyerhaeuser in a plant listed in the reports referred to above and under the supervision of an approved third-party inspection agency. It shall be manufactured in a continuous process with all grain parallel with the length of the members. All members are to be free of finger or scarf joints or mechanical connections in full-length members.

2.03 TOLERANCES (DRY MATERIAL)

Finished Length (as specified):	± 1/4"
Width/Depth	≤ 3.5” wide / ≤ 14” deep: ± 1/8"
	> 3.5” wide / > 14” deep: ± 3/16”

2.04 IDENTIFICATION

A. Microllam® LVL shall be identified by a stamp indicating the product type and grade and ICC ES evaluation report number, manufacturer's name, plant number and the independent inspection agency’s logo.

2.05 HARDWARE

A. Not applicable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Microllam® LVL, if stored prior to installation, shall be protected from the weather. It shall be installed in accordance with the plans and any Weyerhaeuser drawings and installation suggestions. Temporary construction loads that cause stresses beyond design limits are not permitted. Safety bracing is to be provided by the installer to keep the Microllam® LVL straight and plumb as required and to assure adequate lateral support for the individual Microllam® LVL members and the entire system until the sheathing material has been applied.

The contractor may give notification to the manufacturer prior to installation of Trus Joist products to review and discuss product installation guidelines.

3.02 PERFORMANCE STANDARDS

A. Products shall be proven by testing and evaluation in accordance with the provisions of ASTM D-5456.

3.03 FIRE RATING

A. Microllam® LVL is permitted as a substitute for conventional wood framing in fire-resistive assemblies. Microllam® LVL shall be sized for the same load-carrying capacity as the sawn lumber specified in the assembly, and its dimensions shall be equal to or greater than those specified for the sawn lumber. The fire resistance of exposed Microllam LVL members may be calculated in accordance with Chapter 16 of the ANSI/AWC NDS.

3.04 WARRANTY

A. The products delivered shall be free from manufacturing errors or defects in workmanship and material. The products, when correctly installed and maintained, shall be warranted to perform as designed for the normal and expected life of the building.

PART 4 - ALTERNATES AND/OR EQUALS

4.01 MODIFICATIONS/ALTERNATES:

A. Due to the customized detailing and engineering characteristics of the roof and/or floor framing assembly, it is a requirement that Microllam LVL be used in the base bid.

The specification is based on Trus Joist engineered wood products. No alternatives, modifications or substitutions are allowed unless the General Contractor and Sub-Contractors submits in writing for such requests to the Project Engineer for approval, no later than two weeks prior to bid. Alternate products must have a current ICC-ES code evaluation report with listed design properties equivalent to or greater than specified products. Substantiating calculations shall be submitted. All floor performance, fire endurance, holes, tapered cuts and notching shall be justified for alternate. Contract shall reflect any price changes. The engineer of record shall be reimbursed for any review time.

END OF SECTION

SECTION 06 41 00

ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Furnish and install complete, plastic laminate countertops, laminated plastic casework, shelves, open shelving, fixture work and miscellaneous millwork and hardware required for this work as indicated on the Drawings and that is required, and as specified herein. Includes delivery to rooms, unpacking, setting in place, leveling and fastening to walls and floors as required.

B. Related Sections:

1. Rough Carpentry; refer to Section 06 10 00.

1.02 REFERENCE STANDARDS

A. NEMA LD3 - High Pressure Decorative Laminates.

B. Woodwork Institute, Architectural Woodwork Standards:

C. Title 24, California Code of Regulations, 2022.

1.03 QUALITY ASSURANCE

A. Millwork shall be manufactured in accordance with the standards in the latest edition of the Architectural Woodwork Standards of the Woodwork Institute in the grade or grades hereinafter specified or shown on the Drawings.

B. Before delivery to the job site, the millwork supplier shall issue a Woodwork Institute Certified Compliance Certificate indicating the millwork products he will furnish for this project and certifying that they will fully meet the requirements of the grade or grades specified.

C. Each elevation of casework shall bear the Certified Compliance label.

D. Each countertop shall bear the Certified Compliance label.

1.04 SUBMITTALS

A. Before delivery to the jobsite, the millwork supplier shall issue a W.I. Certified Compliance Certificate indicating the millwork products he will furnish for this job and certifying that they will fully meet the requirements of the grade or grades specified.

B. Upon completion of the job, submit a Woodwork Institute Certified Compliance Certificate for Installation.

C. Submit shop drawings and product data under provisions of Section 01 33 00 – Submittal Procedures, and in accordance with Woodwork Institute, Architectural Woodwork Standards “Section 1 – Submittals”.

D. Shop drawings shall bear the Woodwork Institute Certified Compliance label on the first

page of the Drawings.

E. Submit minimum 18" wide sample portion of casework unit showing typical construction including representation of all finished hardware proposed for use. Sample unit shall be typical base unit including drawer, door, top, splash and sidesplash, and interior shelf.

F. Submit literature and data sheets as necessary to establish "formaldehyde free" nature of the proposed materials.

G. Provide sample of TV tray, elbow catch, and flipper door hardware. Items will be returned to Contractor for inclusion in the job.

H. Where required or necessary, submit samples of standard color choices for Architect's selection.

I. Installed cabinets shall meet the requirements of CBC, 2022, Title 24, Part 2, Chapter 16A**.**

J. Submit VOC content of all glues and adhesives.

1.05 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered to the site in undamaged condition, stored in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity, as recommended by Woodwork Institute, Architectural Woodwork Standards “Section 2 – Care and Storage”.

B. In the event of damage, immediately make necessary repairs or replacements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Grades:

1. Wood (Section 10 Casework, WI)

a. Exposed Materials:

b. Semi-Exposed Materials:

c. Door and Drawer Front Style: Flush Overlay, Style “A”

d. Current doors to be W.I. Type 1, with black colored resilient plastic “Tee” on door meeting style only; other sides to have solid banding to match door.

2. Provide plastic covered casework in accordance with Woodwork Institute "Architectural Woodwork Standards", (Section 10 Casework), for Premium Grade. Custom Grade for library shelving, display cases and all casework with visible interiors, except at custodian storage, storage, and food service rooms.

a. Provide scribe mold at junctions with walls and ceilings.
b. Provide plywood core construction laminate finish. Medium density fiberboard cores will not be acceptable.

c. Provide stainless steel corner guards at all exposed casework corners.

3. Construction Style Required: Style A Frameless.

4. Construction Type: Type I Multiple self-supporting units, rigidly joined together.

B. Casework construction shall be entirely of formaldehyde free products. Manufacturer to submit published data sheets for casework materials for Architect's approval. So called "Low-emitting" formaldehyde containing products will not be allowed. Burden of proof rests with the casework manufacturer.

C. Exposed Materials: Vertical and Horizontal Surfaces (cabinet bodies and wall paneling): Surface material shall be high pressure laminate: 0.028-inch minimum thickness at vertical surfaces conforming to ANSI/NEMA LD-3. Provide matte finish standard colors by Wilson Art, Formica or Nevamar; color to be selected by Architect.

C. Semi-Exposed Materials: High pressure laminate as specified for exposed materials. Color at top, bottom and front edge of shelves to match casework laminate, typical for all casework, except as follows: Custodial, and storage rooms with semi-exposed casework surfaces shall receive low pressure decorative Melamine overlay. Masonite Class I made with formaldehyde free substrate, or approved equivalent; white in color. Top and bottom of shelves shall match exposed materials in material and color. Front edge of all shelves to match casework laminate.

E. Door and Drawer Front Style: Flush overlay with high pressure laminate, per exposed materials, with 3mm thick PVC edge banding on edges, 1mm thick PVC edge banding on case bodies. All edge banding shall be machine applied. Edge banding at outside edges shall be "eased" so as to eliminate sharp edges. Submit manufacturer's standard edge banding colors for Architect's selection.

F. Exposed Wood: Species – per finish schedule, veneer cut-rotary

G. Laminated Plastic Countertops and Splashes:

1. Surface material shall be high pressure, low luster, laminated plastic conforming to NEMA LD-3, 0.042-inch thickness post forming grade for tops and 0.028-inch thickness for wall paneling.

2. Laminated plastic countertops and splashes shall be Woodwork Institute Custom Grade. Scribe tops and splashes to walls. There shall be no joints between walls and countertops or splashes larger than 1/16". Caulk all gaps with caulk to match color of countertop, or as approved by Architect.

3. Provide splashes at all countertops. Provide end splashes with square butt joints. Back splash shall have a rolled edge at the top with an integral cove at the junction of the countertop and splash. Front edge of all countertops shall be a rolled "waterfall" edge, self edge countertops are unacceptable. Provide a non-drip bullnose edge at all countertops with sinks.

H. Fasteners:

1. Screws: Straight shank double thread particle board screws.

I. Glues: Type 3 adhesives throughout with less than 20 g/L VOC content.

J. Solid Plastic Countertops and Splashes:

1. Provide 1/2-inch thick solid surfaces at all countertops and splashes as specified herein.

2. Manufacturers:

   a. Avonite Surfaces
   b. DuPont™ Corian®
   c. or equal.

3. Color: from the manufacturer's full range of colors, including recycled products as selected by Architect

4. Finish: Matte finish.

5. Shop Drawings: Provide detailed shop drawings, showing accurate dimensions and edge conditions.

6. Fabrication and Installation: Solid plastic surfaces in accordance with manufacturer's printed instructions and final approved shop drawings. Solid plastic work shall be performed by an accredited fabrication shop.

K. Operable parts for all accessible casework shall comply with ***CBC Section 11B-309***.

2.02 ACCESSORIES

A. Finish Hardware: Provide all required finish hardware for casework in accordance with the Architectural Woodwork Standards, 1st Edition, except as modified below:

1. Hinges: Screwed in, fully concealed self-closing with 120-degree opening angle. Blum European Style Hinge, or equal. Heavy Duty.

2. Pulls: U-shaped metal. Amerock Solid Brass – 4" AME 19549 dull chrome wire pulls. Pulls to be glued and screwed in place.

3. Catches: Magnetic, Amerock 3473PT, and IVES #2 Elbow Catch, or equal for all doors; for inactive leaf of pairs of doors with locks. Omit where self-closing hinge provides latch function. Elbow catches to be installed maximum 1-1/2 inch from front edge of door.

4. Drawer Slides: Provide 100 pound capacity, full extension slides, Accuride model number C3017 or equivalent.

5. Keyboard Drawer Slide: Accuride variable height keyboard slide with 3/4-inch plastic laminate tray, model number 2109, 20 inches long. Provide one (1) keyboard slide and tray at each knee space, typical.

6. File Drawer Slides: Heavy duty, full extension, three section slide, .63-inch slide space, 200-pound load capacity, Accuride model number C3640 or equivalent.

7. Shelf Clip: 32mm system, earthquake proof shelf clip in accordance with ANSI/BHMA A156.9.

8. Guides for Sliding Glass Cabinet Doors: KV P1092 or equal. Locks for sliding glass doors: KV #965 CHR.

9. Door and Drawer Locks: Olympus Lock series 500 DR and 600 DW. Provide with lip or escutcheon to completely cover hole in casework. Color: chrome finish. All doors and drawers shall be provided with locks. Provide two (2) keys for each room with casework. Key cabinets in each room alike, each room different.

    a. Provide locks at all casework doors and drawers. Provide two (2) keys in each room alike; each room different and Master keyed.

    b. Metal Strike Plates: Provide Cabinet door and drawer locks with metal strike plates to protect against particle board rip-out.

10. Countertop Grommets: Doug Mockett MM4, 2-1/2-inches clear diameter black plastic with snap-on cover, provide one grommet per knee space compartment. Grommet to be 3/4-inch deep to completely conceal raw inside edges of countertop hole. Submit sample for approval. Provide trim grommet for computer paper access-slot where shown on Drawings. Grommets to be located in field by Architect.

11. Display Cases: Complete assembly for sliding 1/4-inch clear tempered glass doors:

    a. Knape & Vogt #P992 ZC.

    b. Standards and Brackets: Knape & Vogt #80, and 12" deep bracket #180.

    c. Locks: KV #963 CHR,

    d. Pulls: EPC-GP17 – stainless steel

    e. Glass Shelves: 5/16-inch tinted light bronze float plate, tempered.

    f. Anodized Aluminum Extrusions.

    g. Sliding or Hinged Doors

    h. Tackable Back Panel

    i. Fluorescent Down Lighting

B. Cabinet hardware shall be installed by casework fabricator.

C. Products:

1. Polyvision
2. Claridge
3. ABC School Equipment

2.03 FABRICATION

A. General: Fabricate the casework to the shape indicated on the Drawings and in strict accordance with the Woodwork Institute grade specified.

B. Field Verification: Contractor shall field verify finish dimensions prior to fabrication of casework.

C. Compliance: The Architect reserves the right to require an inspection by a representative of the Woodwork Institute, to determine whether fabrication and installation was in accordance with the specified standard.

PART 3 - EXECUTION

3.01 PREPARATION

A. Conform to requirements of Woodwork Institute "Architectural Woodwork Standards," for casework construction details.

3.02 INSTALLATION

A. Woodwork Institute Certified Installation is required. Install work in this section as specified in Woodwork Institute "Architectural Woodwork Standards" 1ST Edition.

B. All components of casework which are notched, chipped, dinged, scratched, scuffed, or otherwise damaged or marred during course of construction shall be replaced with a matching "like new" component, to the satisfaction of the Architect. Components which are incorrectly cut or drilled shall not be used.

C. All cabinet backs shall be fully trapped (dadoed & glued).

D. Joints between countertop sections shall not be installed over knee spaces or other open span.

3.03 CLEANING

A. Upon completion of installation *in each room*, remove debris, sawdust, excess materials, packages, equipment and trash which may have accumulated from this work. DO NOT ALLOW SAWDUST OR DEBRIS TO FALL ON CARPET SURFACES. Casework installer shall clean any sawdust on carpets to the satisfaction of the Architect.

B. Cabinets and adjacent surfaces shall be left clean and acceptable for final approval.

C. Contractor to provide a copy of cleaning and maintenance recommendations for countertops and casework to the underneath side of furniture, in addition to requirements listed above and outlined in Section 01 78 23 – Operating and Maintenance Data.

3.04 WARRANTY

A. Provide ten (10) year warranty for material defects from date of substantial completion. Provide two (2) year warrant against installation defects.

END OF SECTION

SECTION 07 10 00

DAMPPROOFING AND WATERPROOFING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes: Waterproofing membrane systems for below-grade, vertical and horizontal applications, around pits, and beneath finish flooring systems over occupied, or to-be-occupied areas, as indicated on the drawings and specified herein.

B. Related Sections:

1. Roofing, see Division 7 – Thermal and Moisture Protection.
2. Traffic membranes

1.02 GUARANTEE

A. Provide a (10) ten year unconditional guarantee against defects of materials and workmanship which allows water or moisture into areas of the structure which were to be protected by this membrane. Pay for costs of repairing or replacing the defective membrane, as well as all costs of exposing and recovering membrane, and consequential damages to persons and property resultant of defective materials or workmanship.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Horizontal Locations:

1. Provide a fluid applied, self-leveling, polyurethane system such as Sonneborn® HLM 5000 manufactured by BASF, Vulkem 201L manufactured by Tremco, or Perma-Gard III manufactured by Neogard.

2. Horizontal Protection Course: Sonneborn Protection Course II manufactured by BASF, or "Sealtight PC-2" by W.R. Meadows.

B. Vertical Below-Grade (Liquid applied not permitted):

1. Provide CCW MiraDRI by Carlisle, Bituthene 4000 by W.R. Grace, or MEL-ROL by W.R. Meadows.

2. Below grade provide 1/2-inch thick fiberboard, 1/2-inch polystyrene insulation or 1/8 inch asphaltic hardboard protection course. Provide 1/4-inch asphaltic board at planter areas.

3. Provide min. 3” PVC perforated pipe at fiberboard bottom, in 1-foot diameter ¾” gravel and Mirafi 140N by Tencate down length of vertical surface. Connect pipe to nearest storm drain.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install systems using waterproofing installers. Roofing trades will not be acceptable to perform this work.

B. Install systems in strict accordance with manufacturer's specifications. Obtain manufacturer's approval of substrate conditions prior to installing materials.

C. Filter Fabric Installation:

1. Install the filter fabric facing out toward the backfill (the direction from which the water will come).

2. Panels shall be lapped by a minimum of 2 rows of dimples (2 inches) on all edges. Both the core and the filter fabric should be shingled in the direction of the water flow.

3. Attach the drain using a general construction grade adhesive, pressure -sensitive adhesive, or a mastic used for membrane applications. The membrane and drain core should be clean and dry. Care should be taken that the adhesive is compatible with the damp-proofing material or waterproofing membrane and the drain core.

4. At the footing, place the core behind the perimeter drain tile and wrap the filter fabric around it and up behind the drain core.

5. The drain shall be cut with a sharp knife or shears.

6. Tuck the filter fabric behind the core to cover exposed edges.

7. Tears or punctures in fabric shall be covered with new filter fabric.

8. Backfill as soon as possible taking care not to over compact.

D. Provide reinforcing strips, and backer rods necessary for joints and cracks.

3.02 FIELD QUALITY CONTROL

A. Tests: Once systems (except horizontal protection course) are installed, applications shall be water tested. Perform in such a way that watertight integrity is fully demonstrated with standing water for at least 24 hours. Allow Architect and Owner to witness this test. Correct defects, then re-test. Continue this procedure until no leaks exist.

END OF SECTION

SECTION 07 13 00

SHEET WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Extent of sheet membrane waterproofing work as shown on the Drawings and is hereby defined to include all sheet materials applied with sealed joints and flashings as needed to form concealed waterproof membranes.

1.02 SUBMITTALS

A. Comply with pertinent provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit specifications, installation instructions and general recommendations from waterproofing manufacturer, for sheet membrane waterproofing.

1.03 QUALITY ASSURANCE

A. Manufacturer: Obtain primary waterproofing materials of each type required from a single manufacturer to greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Installer: Firm shall have not less than 3 years of successful experience in installation of waterproofing sheets similar to requirements for this project, and which is acceptable to, or licensed by, manufacturer of primary waterproofing materials.

1.04 PROJECT CONDITIONS

A. Substrate: Proceed with work of this section only after substrate construction, openings, and penetrating work have been completed.

B. Weather: Proceed with waterproofing an associated work only when existing forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.

1.05 SPECIAL PROJECT WARRANTY

A. Provide written warranty agreeing to replace/repair defective materials and workmanship. Warranty includes responsibility for removal and replacement of other work which conceals sheet waterproofing.

1. Warranty period is 5 years after date of substantial completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use one of the following products, except on horizontal surface where water test is required. Do not use the 'bentonite' type.

1. Asphalt/Polyethylene Sheet Waterproofing: Self-adhering membrane of rubberized asphalt integrally bonded to polyethylene sheeting, formed into uniform flexible sheets of no less than 56 mils thickness, in widths of no less than 36 inches, and complying with the following:

a. Tensile Strength (ASTM D412): 250 psi minimum

b. Ultimate Elongation (ASTM D412): 200% minimum

c. Brittleness Temperature (ASTM D746)" -25 degrees F. (-32 degrees C.)

d. Hydrostatic Head Resistance: 75 feet minimum

e. Water Absorption (ASTM D570): Not more than 0.5% weight gain for 48 hours of immersion at 70 degrees F. (21 degrees C.).

f. Products/Manufacturers: Provide one of the following, or approved equal:

Bituthene®: W.R. Grace & Co.
Polyguard No. 650: Polyguard Products, Inc.
Mel-rol: W.R. Meadows, Inc.

2. Bentonite Butyl Rubber/Polyethylene Sheet Waterproofing: Self-adhering membrane of rubberized bentonite adhered to polyethylene sheeting, formed into 36 inch wide sheets of 60 mils thickness, complying with the following:

a. Pliability (ASTM D146): Unaffected by 180° bend over 1" mandrel at -25°F.

b. Tensile strength-membrane (ASTM D412 [DIEC]) modified: 260 psi minimum.

c. Permeability (ASTM E96 Method B): 0.1 perms maximum.

d. Specific gravity (ASTM D71): 1.57 at 77°F.

e. Flash point (ASTM D93-10a): 465.

f. Penetration (ASTM D217): 150 GTL is 58; 300 GTL is 85.

g. Products/Manufacturer: CETCO Swelltite® Dual Membrane Waterproofing Protection System by AMCOL International Corp., or approved equal.

2.02 ACCESSORIES

A. Adhesives: Provide types of adhesive compound and tapes recommended by waterproofing sheet manufacturer, for bonding to substrate (if required), for waterproof sealing of seams in membrane, and for waterproofing sealing of joints between membrane and flashings, adjoining surfaces and projections through membrane.

B. Primers: Provide type of concrete primer recommended by manufacturer of sheet waterproofing material for applications required.

C. Flashing Materials: Except as otherwise indicated, provide types of flexible sheet material recommended by waterproofing sheet manufacturer for flashing.

D. Protection Course: Provide type recommended by waterproofing sheet manufacturer, include adhesive recommended by Manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect substrate and conditions under which waterproofing work is to be performed. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prior to installation of waterproofing and associated work, meet at project site with Waterproofing Materials Manufacturer's Representative, and Inspection and Testing Agency Representative (if any), for purpose of reviewing material selections and procedures to be followed in performing work.

B. On concrete decks, immediately before placement of waterproofing sheet, grind surface lightly with terrazzo grinder or similar device, to ensure removal of projections which might penetrate sheet. Clean deck of loose material.

C. Apply primer to concrete and masonry surfaces at rate and when recommended by manufacturer of primary waterproofing materials. Prime only area which will be covered by waterproofing membrane in same working day; reprime areas not covered by waterproofing membrane within 24 hours.

3.03 INSTALLATION

A. Comply with manufacturer's instructions for handling and installation of sheet waterproofing materials, except where more stringent requirements are shown or specified.

B. Coordinate installation of waterproofing materials and associated work to provide complete system complying with recommendations of manufacturer. Schedule installation to minimize period of exposure of sheet waterproofing materials.

C. Extend waterproofing sheet and flashings as shown to provide complete membrane over area indicated to be waterproofed. Seal to projections through membrane and seal seams. Bond to vertical surfaces and also, where shown or recommendations by manufacturer, bond to horizontal surfaces.

D. Install protection course of type indicated over completed membrane, complying with

manufacturer's recommendations for both waterproofing sheet and protection course materials.

3.04 PERFORMANCE REQUIREMENTS

A. It is required that waterproof membranes be watertight and not deteriorate in excess of limitations published by manufacturer.

B. In-Place Testing: Before completed membranes on horizontal surfaces are covered by protection course or other work, test for leaks with 2 inch depth of water maintained for 24 hours. Repair all leaks revealed by examination of substructure and repeat test until no leakage is observed.

3.05 PROTECTION

A. Institute all required procedures for protection of completed membrane during installation of work over membrane and throughout remainder of construction period. Do not allow traffic of any type on unprotected membrane.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Thermal, fire, and acoustical insulation and isolation materials as indicated on the Drawings and specified herein.

B. Related Sections:

1. Framing to which insulation is to be attached, see Division 5 and Division 6.
2. Roofing, see Division 7.

1.02 REFERENCE STANDARDS

A. Ensure installation compliance with CBC 2022, Title 24.

B. ASTM C553 and E84.

1.03 SUBMITTALS

A. Submit manufacturer's product literature and installation instructions for each type of insulation material required.

B. Submit certified test reports showing compliance with performance values, including r-ratings (aged for plastic insulations), densities, compression strengths, fire performance characteristics, perm ratings, water absorption ratings and similar properties.

1.04 QUALITY ASSURANCE

A. Provide a certification of insulation and post on project, stating that work of this section conforms to the requirements of this section of specifications and Title 24.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Batt Insulation at Horizontal Locations:

1. Provide CertainTeed Corporation, CertaPro Batts, Kraft Faced, or Foil Faced, flanged, in thicknesses necessary to meet aged R-30 value at Roofs (unless otherwise noted), expressed as average in and out value. Chips certified for low emitting and recycled content.

2. Flame Spread Rating: 25 or less in accordance with ASTM E84.

3. Smoke Density Developed Rating: 50 or less in accordance with ASTM E84.

B. Batt Insulation at Vertical Locations:

1. Provide CertainTeed Corporation, CertaPro Batts, Kraft Faced, or Foil Faced, flanged (or approved equal), in thickness necessary to meet aged R-19 value (unless otherwise noted), expressed as average in and out value. Chips certified for low emitting and recycled content.

2. Flame Spread Rating: 25 or less in accordance with ASTM E84.

Note: Specified R-values are for materials only and are not to include installation values.

3. Smoke Density Factor: Not to exceed 450.

C. Acoustical Insulation:

1. Provide CertainTeed Corporation, CertaPro Batts, Plain, fiberglass batts (or approved equal), minimum of 3-1/2 inches thick, installed as specified in indicated assemblies.

2. Flame Spread Rating: 25 or less in accordance with ASTM E84.

3. Smoke Density Factor: Not to exceed 450.

4. Provide acoustical insulation in all interior partitions, and extend insulation to underside of roof structure.

2.02 COMPONENTS

A. Acoustical Isolators: Provide isolating and acoustical clamps and sleeves manufactured by Specialty Products & Insulation Company, or other approved, as approved by local codes.

2.03 ACCESSORIES

A. Sag Wires: At all types of batt insulation, provide 18 gage galvanized wire at 16 inches on center. Staple wire at wood structure or sheet metal screw to metal structure to underside of structure, minimum three (3) per connection. Sag wires are not required where gypsum board is attached to the underside of roof framing.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Batt Insulation:

1. Insulate exterior areas adjacent and contiguous to spaces unheated, except where shown otherwise by Drawings.

2. Ensure secure attachment so that insulation will not sag over time. Friction fitting is not sufficient. Mechanically attach insulation. Double sided tape attachment is not acceptable.

a. Install foil and paper facing on warmer side of area being insulated.

b. Where insulated walls and underside of structure are being left exposed and unfinished, install sag wires at 16" o.c. (minimum) to support insulation.

c. Where insulation is being installed using impaling pins, ensure that washers are installed over pins after insulation is in place. Space pins as necessary to provide insulation installation which will not sag over time, and as recommended in writing by insulation manufacturer.

3. Ensure the continuous insulation of the building envelope. Tape joints, both ends and sides.

4. Provide two layers of insulation lapping openings by 14 inches or more where intended to be of sound resistive construction at locations such as telephone outlets, electrical, mechanical, or plumbing penetrations.

3.02 DEMONSTRATION

1. Comply with State of California Noise Insulation Standards.

2. Upon completion of installation of building envelope, certify compliance with requirements for Title 24.

END OF SECTION

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SECTION 07 54 00

THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope – Install a complete adhered Sika Sarnafil, or equal roofing system including membrane, flashings and other components.

B. Related Work - The work includes but is not limited to the installation of:

1. Removal of Existing Roofing and Insulation
2. Substrate Preparation
3. Roof Drains
4. Vapor Barrier
5. Wood Blocking
6. Insulation
7. Separation Layers
8. Roof Membrane
9. Fasteners
10. Adhesive for Flashings
11. Roof Membrane Flashings
12. Walkways
13. Metal Flashings
14. Sealants

C. Upon successful completion of work the following warranties must be submitted:

1. Sika Sarnafil Warranty – 30 years
2. Roofing Applicator Warranty – 20 years

1.02 QUALITY ASSURANCE

A. This roofing system shall be applied only by a Roofing Applicator authorized by Sika Sarnafil prior to bid. Equal roofing systems and applicators shall be submitted and approved prior to bid.

B. There shall be no deviation made from the Project Specification or the approved shop drawings without prior written approval by the Owner, the Owner's Representative and Sika Sarnafil, or equal.

C. All work pertaining to the installation of roofing membrane and flashings shall only be completed by Applicator personnel trained and authorized by Sika Sarnafil, or equal in those procedures.

1.03 SUBMITTALS

A. At the time of bidding, the Applicator shall submit to the Owner (or Representative) the following:

1. Specific adherence to specification guideline.

2. Samples of each primary component to be used in the roof system and the manufacturer's current literature for each component.

3. Written approval by the insulation manufacturer for use and performance of the product in the proposed system.

4. Sample copy of manufacturer’s warranty.

5. Sample copy of Applicator's warranty.

6. Dimensioned shop drawings which shall include:

7. Outline of roof with roof size and elevations shown.

8. Details of flashing methods for every penetration and flashing condition.

B. Certifications by manufacturers of roofing and insulating materials that all materials supplied comply with all requirements of the identified ASTM and other industry standards or practices.

C. Certification from the Applicator that the system specified meets all identified code and insurance requirements as required by the Specification.

D. Material Safety Data Sheets (MSDS)

1.04 CODE REQUIREMENTS

A. The Applicator shall submit evidence that the proposed roof system meets the requirements of the local building code and has been tested and approved or listed by the following test organizations. These requirements are minimum standards and no roofing work shall commence without written documentation of the system's compliance, as required in the "Submittals" section of this specification.

B. System shall be designed to meet a minimum wind design requirements of the most recent version of ASCE 7.

C. Factory Mutual Research Corporation (FM) - Norwood, MA

1. Class 1-90 (for high wind exposure)

D. Underwriters Laboratories, Inc. - Northbrook, IL

1. Class A assembly

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All products delivered to the job site shall be in the original unopened containers or wrappings bearing all seals and approvals.

B. Handle all materials to prevent damage. Place all materials on pallets and fully protect from moisture.

C. Membrane rolls shall be stored lying down on pallets and fully protected from the weather with clean canvas tarpaulins. Unvented polyethylene tarpaulins are not accepted due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weldability.

D. As a general rule all adhesives shall be stored at temperatures between 40 degree F (5 degree C) and 80 degree F (27 degree C). Read instructions contained on adhesive canister for specific storage instructions.

E. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on containers or supplied by material manufacturer/supplier.

F. All materials which are determined to be damaged by the Owner's Representative or Sika Sarnafil, or equal representative are to be removed from the job site and replaced at no cost to the Owner.

1.06 JOB CONDITIONS

A. Sarnafil, or equal, materials may be installed under certain adverse weather conditions but only after consultation with manufacturer as installation time and system integrity may be affected.

B. Only as much of the new roofing as can be made weathertight each day, including all flashing and detail work, shall be installed. All seams shall be heat welded before leaving the job site that day.

C. All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.

D. All surfaces to receive new insulation, membrane or flashings shall be dry. Should surface moisture occur, the Applicator shall provide the necessary equipment to dry the surface prior to application.

E. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.

F. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.

G. The Applicator is cautioned that certain Sarnafil membranes are incompatible with asphalt, coal tar, heavy oils, roofing cements, creosote and some preservative materials. Such materials shall not remain in contact with Sarnafil membranes. The Applicator shall consult Sika Sarnafil regarding compatibility, precautions and recommendations.

H. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Applicator shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of plywood over Sarnafelt or plywood over insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.

I. Prior to and during application, all dirt, debris and dust shall be removed from surfaces either by vacuuming, sweeping, blowing with compressed air or similar methods.

J. The Applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction.

K. All roofing, insulation, flashings and metal work removed during construction shall be immediately taken off site to a legal dumping area authorized to receive such materials. Hazardous materials, such as materials containing asbestos, are to be removed and disposed of in strict accordance with applicable City, State and Federal requirements.

L. All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site by the Applicator and properly transported to a legal dumping area authorized to receive such material.

M. The Applicator shall take precautions that storage and application of materials and equipment does not overload the roof deck or building structure.

N. Flammable adhesives and deck primers shall not be stored and not be used in the vicinity of open flames, sparks and excessive heat.

O. The Applicator shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such blockages in writing to the Owner's Representative for corrective action prior to the installation of the roof system.

P. Applicator shall immediately stop work if any unusual or concealed condition is discovered and shall immediately notify Owner of such condition in writing for correction.

Q. Site cleanup, including both interior and exterior building areas that have been affected by construction, shall be completed to the Owner's satisfaction.

R. All landscaped areas damaged by construction activities shall be repaired at no cost to the Owner.

S. The Applicator shall conduct fastener pullout tests in accordance with the latest version of the SPRI/ANSI Fastener Pullout Standard to verify condition of the deck/substrate and to confirm expected pullout values.

T. The Sarnafil membrane shall not be installed under the following conditions without consulting Sika Sarnafil's Technical Dept. for precautionary steps:

1. The roof assembly permits interior air to pressurize the membrane underside.

2. Any exterior wall has 10 percent or more of the surface area comprised of opening doors or windows.

3. The wall/deck intersection permits air entry into the wall flashing area.

U. Precautions shall be taken when using any adhesives at or near rooftop vents or air intakes. Adhesive odors could enter the building. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odor while ventilating the building. Keep lids on unused cans at all times.

V. Protective wear shall be worn when using solvents or adhesives or as required by job conditions.

W. Membranes are slippery when wet or covered with snow, frost, or ice. Working on surfaces under these conditions is hazardous. Appropriate safety measures must be implemented prior to working on such surfaces. Always follow OSHA and other relevant fall protection standards when working on roofs.

1.07 BIDDING REQUIREMENTS

A. Pre-Bid Meeting:

A pre-bid meeting shall be held with the Owner's Representative and involved trades to discuss all aspects of the project. The Applicator's field representative or roofing foreman for the work shall be in attendance. Procedures to avoid rooftop damage by other trades shall be determined.

B. Site Visit:

Bidders shall visit the site and carefully examine the areas in question as to conditions that may affect proper execution of the work. All dimensions and quantities shall be determined or verified by the Applicator. No claims for extra costs will be allowed because of lack of full knowledge of the existing conditions unless agreed to in advance with the Owner or Owner's Representative.

1.08 WARRANTIES

A. Manufacturer's Membrane Warranty – 30 years.

B. Manufacturer's Standard System Warranty – all products installed shall be covered by a standard warranty of 30 years.

C. Applicator/Roofing Contractor Warranty – Applicator's/Contractor's warranty shall be 30 years. Applicator/Contractor shall supply Owner with a separate workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within Applicator warranty term, defective or otherwise not in accordance with Contract Documents, the Applicator shall repair that defect at no cost to the Owner. Applicator's warranty obligation shall run directly to the Owner, and a copy shall be sent manufacturer.

D. Owner Responsibility - Owner shall notify the contractor of any leaks, within one month, as they occur during the time period when both warranties are in effect.

PART 2 - PRODUCTS

2.01 GENERAL

A. Manufacturer: The components of the Sarnafil Adhered roof system, or equal, are to be products of Sika Sarnafil, or equal, as indicated on the Drawings and specified in the Contract Documents.

B. Other acceptable manufacturers: Johns Manville, Tremco or equal, upon submission of an acceptable pre-bid submittal.

C. Roof assembly shall be Class A

2.02 MEMBRANE

A. Sarnafil G410 fiberglass reinforced membrane with a lacquer coating.

B. Membrane shall conform to ASTM D4434 (latest version), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type II, Grade I.

1. Sarnafil 6G410-20, 80 mil (2.0 mm), thermoplastic membrane with fiberglass reinforcement.

C. Certified Polymer Thickness

D. Color of Membrane - EnergySmart White, initial solar reflectance of 0.83, emittance of 0.90, and solar reflective index (SRI) of 104 (ENERGY STAR listed).

E. Typical Physical Properties (1)

Parameters	ASTM Test Method	ASTM D-4434 Spec. Requirement	Typical Physical Properties
Reinforcing Material	-	-	Fiberglass
Overall Thickness(1), min., inches (mm)	D638	0.045 (1.14)	[0.0__inches)]
Thickness Above Scrim	-	-	0.023 (avg.)
Tensile Strength, min., psi (MPa)	D638	1500 (10.4)	1600 (11.1)
Elongation at Break, min. (machine / transverse)	D638	250% / 220%	250% / 220%
Seam strength(2), min. (% of tensile strength)	D638	75	80
Retention of Properties After Heat Aging	D3045	-	-
Tensile Strength, min., (% of original)	D638	90	95
Elongation, min., (% of original)	D638	90	90
Tearing Resistance, min., lbf (N)	D1004	10 (45.0)	14 (63.0)
Low Temperature Bend, -40º F (-40º C)	D2136	Pass	Pass
Accelerated Weathering Test (florescent light, uv exposure)	G154	5,000 Hours	10,000 Hours
Cracking (7x magnification)	-	None	None
Discoloration (by observation)	-	Negligible	Negligible
Crazing (7x magnification)	-	None	None
Linear Dimensional Change	D1204	0.10 % max.	0.02%
Weight Change After Immersion in Water	D570	± 3.0% max.	2.5%
Static Puncture Resistance, 33 lbf (15 kg)	D5602	Pass	Pass
Dynamic Puncture Resistance, 7.3 ft-lbf (10 J)	D5635	Pass	Pass
Initial Solar Reflectance	E903	-	0.83
Emissivity	E408, C1371, Other	-	0.90
Solar Reflective Index (SRI)	E1980	-	104
Recycled Content (5 & 10 ft. sheets only)	8 to 12% Pre-Consumer / Up to 1% Post Consumer.		

Notes
(1) Typical Physical Properties data is applicable for 0.048 in (1.2 mm) membrane thickness and greater.
(2) Failure occurs through membrane rupture not seam failure.

2.03 FLASHING MATERIALS

A. Wall/Curb Flashing - Sarnaclad, or equal - A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Sarnaclad is a 24 gauge, G90 galvanized metal sheet with a 20 mil unsupported Sarnafil membrane laminated on one side. The dimensions of Sarnaclad are 4 ft x 8 ft (1.2 m x 2.4 m) or 4 ft x 10 ft (1.2 m x 3.0 m

B. Perimeter Edge Flashing - Sarnaclad, or equal - A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles for a high wind installation. Sarnaclad is a 24 gauge, G90 galvanized metal sheet with a 20 mil (0.5 mm) unsupported Sarnafil membrane laminated on one side. The dimensions of Sarnaclad are 4 ft x 8 ft (1.2 m x 2.4 m) or 4 ft x 10 ft (1.2 m x 3.0 m). Consult Product Data Sheet for additional information.

C. Miscellaneous Flashing – all miscellaneous flashing are referenced in terms of Sarnafil. Equal products shall be submitted for review and approval by Architect.

1. Sarnaflash - Prefabricated expansion joint cover made from Sarnafil membrane. Sarnaflash is designed for securement to vertical or horizontal surfaces to span and accommodate the movement of new and existing expansion gaps from 1 inch to 4-1/2 inches (25 mm to 114 mm) across. Available in 40 foot (12 m) rolls.

2. Sarnareglet - Heavy-duty, extruded aluminum flashing termination reglet used at walls and large curbs. Sarnareglet is produced from 6063-T5, 0.10 inch to 0.12 inch (2.5 mm to 3.0 mm) thick extruded aluminum. Sarnareglet has a 2-1/4 inch (57 mm) deep profile, and is provided in 10 foot (3 m) lengths. Use prefabricated Sarnareglet mitered inside and outside corners where walls intersect.

3. Sarnastack - Prefabricated vent pipe flashing made from 0.048 inch (48 mil/1.2 mm) thick Sarnafil G410 membrane.

4. Sarnadrain-RAC - PVC-coated, heavy-duty aluminum roof drain insert that mechanically seals to the drainpipe interior. Sarnadrain-RAC is made of 0.080 inch (2 mm) thick 6063 aluminum with a urethane seal installed at the end of the drainpipe. The large 14 inch x 14 inch (0.36 m x 0.36 m) drain strainer is also made of 0.080 inch (2 mm) thick aluminum stock. The flange dimensions of Sarnadrain-RAC are 18 inches x 18 inches (0.46 m x 0.46 m).

5. Sarnacircle-"G" - Circular 0.048 inch (48 mil/1.2 mm) thick G410 membrane patch welded over T-joints formed by overlapping thick membranes.

6. Sarnacorners – Universal - Prefabricated outside and inside flashing corners made of 0.060 inch (60 mil/1.5 mm) thick membrane that are heat-welded to membrane or Sarnaclad base flashings.

7. Open Post Flashing - Prefabricated post flashing, 0.048 inch (48 mil/1.2 mm) thick, with an open seam used to flash obstructed rooftop conduits and pipes 1/2 to 1-1/4 inch (12.7-31.8 mm) in diameter. Available in 2 sizes; 1/2 to 3/4 inch (12.7-19 mm) and 3/4 to 1-1/4 inch (19-31.8 mm) diameter. Open Post Flashings are heat welded in place and terminated at the top of the penetration completing the pipe penetration detail.

8. Sikaflex-1a Sealant

9. Sarnafiller - A two-component urethane adhesive used for pitch pocket filler. Cures with excellent elasticity and adhesion to various surfaces.

10. Sarnacol 2170 Adhesive - Solvent-based reactivating adhesive used to attach membrane to flashing substrate.

11. Sarnacol 2170 VC Adhesive - Solvent-based, low VOC, reactivating adhesive used to attach membrane to flashing substrate.

12. Sarnafelt - A non-woven polyester or polypropylene mat cushion layer that is necessary behind G410 or G459 Flashing Membrane when the flashing substrates are rough or incompatible with the flashing membrane.

2.04 INSULATION/OVERLAYMENT/RECOVER BOARD

A. Sarnatherm, - Atlas AC Foam-IV, or equal, - 2 layers of rigid isocyanurate foam insulation composed of a losed cell polyisocyanurate foam core laminated to a high performance coated glass facer. DensDeck, or equal – ½" Siliconized gypsum, fire-tested hardboard with glass-mat facers.

2.05 ATTACHMENT COMPONENTS

A. Membrane Adhesive - Sarnacol, or equal, 2170 VC Adhesive:

A solvent-based, low VOC, reactivating adhesive used to attach the membrane to the substrate, either horizontally or vertically. Consult Product Data Sheets for additional information. Application rates are as follows:

SARNACOL 2170 VC APPLICATION RATES FOR BARE BACK MEMBRANE							
	Adhesive Rates – Gallons per 100 Square Feet *(Liters per Meter²)*						Approximate Sq. Ft./Pail *(meter²)*
	Substrate		Membrane		Total		
Isocyanurate Paper Facer	1.25 *(0.51)*	+	0.50 *(0.20)*	=	1.75 *(0.71)*		285 *(26.48)*
Smooth Plywood	1.00 *(0.41)*	+	0.50 *(0.20)*	=	1.50 *(0.61)*		333 *(30.94)*
Metal	0.75 *(0.31)*	+	0.50 *(0.20)*	=	1.25 *(0.51)*		400 *(37.16)*
Concrete Wall	1.25 *(0.51)*	+	0.50 *(0.20)*	=	1.75 *(0.71)*		285 *(26.48)*
GP DensDeck	1.25 *(0.51)*	+	0.50 *(0.20)*	=	1.75 *(0.71)*		285 *(26.48)*
GP DensDeck Prime GP DensDeck DuraGuard	1.00 *(0.41)*	+	0.50 *(0.20)*	=	1.50 *(0.61)*		333 *(30.94)*
USG Securock Gypsum-Fiber	0.75 *(0.31)*	+	0.50 *(0.20)*	=	1.25 *(0.51)*		400 *(37.16)*

SARNACOL 2170 VC APPLICATION RATES FOR MEMBRANE FLASHINGS USING SARNAFELT									
	Adhesive Rates – Gallons per 100 Square Feet *(Liters per Meter²)*								Approximate Sq. Ft./Pail *(meter²)*
	Substrate (1st coat)		Substrate (2nd coat)		Membrane		Total		
Smooth Plywood	1.00 *(0.41)*	+	1.00 *(0.41)*	+	0.50 *(0.20)*	=	2.50 *(1.02)*		200 *(18.58)*
Concrete Wall	1.00 *(0.41)*	+	1.00 *(0.41)*	+	0.50 *(0.20)*	=	2.50 *(1.02)*		200 *(18.58)*
Masonry Wall	1.00 *(0.41)*	+	1.00 *(0.41)*	+	0.50 *(0.20)*	=	2.50 *(1.02)*		200 *(18.58)*
Granular Bitumen	1.00 *(0.41)*	+	1.00 *(0.41)*	+	0.50 *(0.20)*	=	2.50 *(1.02)*		200 *(18.58)*
Smooth Aged Bitumen	1.00 *(0.41)*	+	1.00 *(0.41)*	+	0.50 *(0.20)*	=	2.50 *(1.02)*		200 *(18.58)*

Notes:

a) Due to an increase in viscosity when outdoor temperatures during installation are below 40 degree F (5 degree C), add 1/2 gallon per 100 square feet (0.2 l per m²) to rate for estimating purposes. Do not install when air temperature is within 5 degree F of dew point. Solvent evaporation time increases significantly when temperatures drop. Ensure first layer of Sarnacol 2170 is fully dry before second layer is applied to the back of the membrane for proper reactivation.

b) Use a water-filled, foam-covered lawn roller to consistently and evenly press the membrane into the adhesive layer.

B. Insulation Board Placement –

1. Sarnacol 2163 Adhesive - A low odor, VOC compliant, one step, low-rise urethane foam used to attach insulation to approved compatible substrates. Adhesive is applied with a gravity fed applicator or by hand with a dual component caulk gun. Additional adhesive may be required for rougher surfaces. Consult Product Data Sheets for additional information.

   Notes:
   a) Not recommended for use with insulation boards larger than 4x4 feet (1.2x1.2 m).

   b) Place insulation board into the adhesive shortly after it has reached its maximum rise [typically within 30 to 45 seconds at 60 to 80 degree F (16 to 27 degree C)] and walk into place.

   c) Minimum product temperature before entering the dispenser should be 70 degree F (21 degree C).

   d) Store between 60 degree F (16 degree C) and 80 degree F (27 degree C).

   e) Adhesive shall not be used during inclement weather.

   f) Adhesive shall not be applied to wet or damp surfaces.

   g) A minimum of 1 Sarnabar placed 4 feet (1.2 m) from the roof edge and fastened 12 inches (305 mm) on center to the structural deck with acceptable fasteners is required after installation of the Sarnafil roof membrane. The Sarnabar is to have a cover strip hot air welded over it.

2. Sarnacol 2164 Adhesive - A low odor, VOC compliant, single component, low-rise urethane foam used to attach insulation to approved compatible substrates.

   Notes:
   a) Not recommended for use with insulation boards larger than 4x4 feet (1.2x1.2 m).

   b) Place insulation board into wet adhesive immediately.

   c) Adhesive shall not be used during inclement weather.

   d) Adhesive shall not be applied to wet or damp surfaces.

   e) A minimum of 1 Sarnabar placed 4 feet (1.2 m) from the roof edge and fastened 12 inches (305 mm) on center to the structural deck with acceptable fasteners is required after installation of the Sarnafil roof membrane. The Sarnabar is to have a cover strip hot air welded over it.

3. Sarnaplate - Used with various Sarnafasteners to attach insulation boards to roof deck. Sarnaplate is a 3 inch (75 mm) square or round, 26 gauge stamping of SAE 1010 steel with an AZ 55 Galvalume coating.

4. Sarnaplate-HD/CD - Used with Sarnafastener-HD or Sarnafastener-CD10 to attach insulation boards to wood or concrete roof decks. Sarnaplate-HD/CD is a 3 inch (75 mm) round stamping of SAE 1010 steel with an AZ 55 Galvalume coating. Consult Product Data Sheet for additional information.

5. Sarnaplate-Preassembled Combination of a 3 inch round plate and a #12 fastener used to attach insulation boards to steel or wood roof decks. Sarnaplate-Preassembled consists of a 3 inch (75 mm) round, 26 gauge stamping of SAE 1010 steel with an AZ 55 Galvalume coating and Sarnafastener #12 with modified buttress thread. The fastener shank diameter is approximately 0.168 inch (4 mm) and the thread diameter is approximately 0.214 inch (5 mm). Consult Product Data Sheet for additional information.

6. Sarnafastener #12A #12 corrosion-resistant fastener used with Sarnaplates to attach insulation boards to steel or wood roof decks. Sarnafastener #12 has a modified buttress thread, a shank diameter of approximately 0.168 inch (4 mm) and a thread diameter of approximately 0.214 inch (5 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement. Consult Product Data Sheet for additional information.

7. Sarnafastener-HD A #14 corrosion-resistant fastener used with Sarnaplate-HD/CD to attach insulation boards or with Sarnastop and Sarnabar to attach membrane to structural concrete or wood roof decks. Sarnafastener-HD has a shank diameter of 0.190 inch (4.8 mm), a thread diameter of 0.245 inch (6.2 mm) and a #3 Phillips drive head with a diameter of 0.435 inch (11 mm). Consult Product Data Sheet for additional information.

8. Sarnafastener-XP –

   A #15, heavy-duty, corrosion-resistant fastener used with Sarnaplate to attach insulation or with Sarnadisc, Sarnastop and Sarnabar to attach Sarnafil G410 roof membrane to steel or 1/2-3/4 inch wood roof decks. Sarnafastener-XP has a shank diameter of approximately 0.21 inch (5.3 mm) and the thread diameter is approximately 0.26 inch (6.6 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement. Consult Product Data Sheet for additional information.

9. Sarnafastener-XPS - A specially designed, heavy-duty, corrosion-resistant fastener used with Sarnastop or Sarnabar to attach Sarnafil G410 roof membrane to steel roof decks. Sarnafastener-XPS has a shank diameter of approximately 0.21 inch (5.3mm) and a thread diameter of approximately 0.26 inch (6.6). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement and simplicity of application. Consult Product Data Sheet for additional information.

10. Sarnafastener-CD10 - A nail-in, corrosion-resistant fastener used with Sarnaplate-HD/CD to attach insulation to normal weight concrete roof deck. Sarnafastener-CD10 has a shank diameter of 0.215 inch (5.5 mm), a split diameter of 0.265/0.275 inch (6.7/7.0 mm) and a flat head with a 0.435 inch (11 mm) diameter. Consult Product Data Sheet for additional information.

11. Sarnastop - An extruded aluminum, low profile bar used with certain Sarnafasteners to attach to the roof deck or to walls/curbs at terminations, penetrations and at incline changes of the substrate. Sarnastop is a 1 inch (25 mm) wide, flat aluminum bar 1/8 inch (3 mm) thick that has predrilled holes every 6 inches (152 mm) on center. Consult Product Data Sheet for additional information.

12. Sarnabar - An FM-approved, heavy-duty, 14 gauge, galvanized or stainless, roll-formed steel bar used to attach membrane to roof decks. The formed steel is pre-punched with holes every 1 inch (25 mm) on center to allow various Sarnafastener spacing options. Consult Product Data Sheet for additional information.

13. Sarnacord - A 5/32 inch (4 mm) diameter, red-colored, flexible thermoplastic extrusion that is welded to the top surface of the Sarnafil membrane and against the side of the Sarnabar, used to hold the membrane in position. Consult Product Data Sheet for additional information.

2.06 DECK PRIMERS

A. Sarnacol LR-2001 Deck Primer - Designed for use with Sarnacol LR-2001 adhesive to condition surfaces and promote adhesion between certain vapor barriers, acceptable deck substrates such as perlite, vermiculite and Zonolite with insulation board products. Consult Product Data Sheet for additional information.

B. Sarnavap Self-Adhered Primer - A solvent-based primer designed for use with Sarnavap Self-Adhered vapor barrier to prime wood, concrete, lightweight concrete, gypsum boards and decks prior to application Sarnavap Self-Adhered vapor barrier. Consult Product Data Sheet for additional information.

C. Sarnavap Self-Adhered Primer WB - A water-based primer designed for use with Sarnavap Self-Adhered vapor barrier to promote adhesion to most substrates. Particularly recommended when use of solvent-based primer is not advised or permitted. Consult Product Data Sheet for additional information.

2.07 WALKWAY PROTECTION

A. Sarnatred - A polyester reinforced, 0.096 inch (96 mil/2.4 mm), weldable membrane with surface embossment. Used as a protection layer from rooftop traffic. Sarnatred is supplied in rolls of 39.3 inches (1.0 m) wide and 32.8 feet (10 m) long. Consult Product Data Sheet for additional information.

2.08 VAPOR BARRIER

A. Sarnavap-10 - A 10 mil (0.25 mm) thick polyethylene vapor barrier/air barrier. Sarnavap-10 is supplied in a folded panel that is rolled onto a core. The core width is 5 feet (1.5 m). When unrolled off the core and unfolded, the sheet dimensions are 20 feet (6.9 m) wide by 100 feet (33 m) long. Consult Product Data Sheet for additional information.

2.09 MISCELLANEOUS ACCESSORIES

A. Aluminum Tape - A 2 inch (50 mm) wide pressure-sensitive aluminum tape used as a separation layer between small areas of asphalt contamination and the membrane and as a bond-breaker under the coverstrip at Sarnaclad joints.

B. Sealing Tape Strip - Compressible foam with pressure-sensitive adhesive on one side. Used with metal flashings as a preventive measure against air and wind blown moisture entry.

C. Multi-Purpose Tape - A high performance sealant tape used with metal flashings as a preventive measure against air and wind blown moisture entry.

D. Sarnamatic 641mc or 661 - 220 volt, self-propelled, hot-air welding machine used to seal Sarnafil membrane seams.

E. Sarnasolv - A high quality solvent cleaner used for the general cleaning of residual asphalt, scuff marks, etc., from the membrane surface. Sarnasolv is also used daily to clean seam areas prior to hot-air welding in tear off or dirty conditions or if the membrane is not welded the same day it is unrolled. Consult Product Data Sheet for additional information.

F. Perimeter Warning Tape - Designed for use on PVC membranes as a reflective, highly visible pressure sensitive tape used to draw attention to roof perimeters and potential hazardous areas. Perimeter Warning Tape exceeds reflectivity 3 requirements and Federal spec. L-S-300, Class 1.

2.10 SEALANTS AND PITCH POCKET FILLERS

A. Sarnafil Sikaflex-1a Sealant, or equal.

B. Sarnafiller (two-component urethane adhesive for pitch pocket toppings).

Depending on substrates, the following sealants are options for temporary overnight tie-ins:

1. Type III hot asphalt conforming to ASTM D312 (latest version).
2. Sarnafiller.
3. Multiple layers of roofing cement and felt.
4. Spray-applied, water-resistant urethane foam.
5. Mechanical attachment with rigid bars and compressed sealant.

2.11 MISCELLANEOUS FASTENERS AND ANCHORS

A. All fasteners, anchors, nails, straps, bars, etc. shall be post-galvanized steel, aluminum or stainless steel. Mixing metal types and methods of contact shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1-1/4 inch (32 mm) and shall be approved for such use by the fastener manufacturer. All miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch (25 mm) and shall be approved for such use by the fastener manufacturer.

2.12 RELATED MATERIALS

A. Wood Nailer - Treated wood nailers shall be installed at the perimeter of the entire roof and around such other roof projections and penetrations as specified on Project Drawings. Thickness of nailers must match the insulation thickness to achieve a smooth transition. Wood nailers shall be treated for fire and rot resistance (wolmanized or osmose treated) and be #2 quality or better lumber. Creosote or asphalt-treated wood is not acceptable. Wood nailers shall conform to Factory Mutual Loss Prevention Data Sheet 1-49. All wood shall have a maximum moisture content of 19 percent by weight on a dry-weight basis.

B. Plywood - When bonding directly to plywood, a minimum 1/2 inch (12 mm) CDX (C side out), smooth-surfaced exterior grade plywood with exterior grade glue shall be used. Rough-surfaced plywood or high fastener heads will require the use of Sarnafelt behind the flashing membrane. Plywood shall have a maximum moisture content of 19 percent by weight on a dry weight basis.

2.13 ROOF NUMBERS

A. Provide roof numbers to all buildings. Roof numbers shall be a minimum of 6’-3” high and 14” to 16” wide. Numbers shall be cut from roof membrane and adhered using the system approved by the roofing manufacturer. All roof numbers shall be black. Submit roof numbers and obtain approval from Project Manager prior to application. See plans for exact building number. Use “Administration” for the administration building and numbers or letters, in accordance with the building numbering system for the school.

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION CONFERENCE

A. The Applicator, Owner's Representative/Designer and Manufacturer(s) shall attend a pre-construction conference.

The meeting shall discuss all aspects of the project including but not limited to:

1. Safety
2. Set up
3. Construction schedule
4. Contract conditions
5. Coordination of the work

3.02 SUBSTRATE CONDITION

A. Applicator shall be responsible for acceptance or provision of proper substrate to receive new roofing materials.

Applicator shall verify that the work done under related sections meets the following conditions:

1. Roof drains and scuppers have been reconditioned or replaced and installed properly.

2. Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.

3. All surfaces are smooth and free of dirt, debris and incompatible materials.

4. All roof surfaces shall be free of water, ice and snow.

3.03 SUBSTRATE PREPARATION

A. The roof deck and existing roof construction must be structurally sound to provide support for the new roof system. The Applicator shall load materials on the rooftop in such a manner as to eliminate risk of deck overload due to concentrated weight. The Owner's Representative shall ensure that the roof deck is secured to the structural framing according to local building code and in such a manner as to resist all anticipated wind loads in that location.

B. Existing Poured Structural Concrete Deck:

The contractor shall provide a smooth and level finish and shall be free of dust, excess moisture, oil-based curing agents and loose debris. Sharp ridges or other projections above the surface shall be removed before roofing.

3.04 SUBSTRATE INSPECTION

A. A dry, clean and smooth substrate shall be prepared to receive the Sarnafil Adhered roof system.

B. The Applicator shall inspect the substrate for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect the quality of work.

C. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.

D. All roof surfaces shall be free of water, ice and snow.

E. Sarnafil shall be applied over compatible and accepted substrates only.

3.05 VAPOR BARRIER/AIR BARRIER INSTALLATION

A. Sarnavap Self-Adhered

1. Primer Application - The substrate must be clean, dry and free of dust, grease or other contaminants. Shake well before using. Apply to clean and dry surfaces with a paint brush, roller or sprayer. Application rates will vary depending on substrate. Sarnavap Self-Adhered vapor barrier must be installed on the same day as the primer application. Acceptable substrates for primer application include wood, concrete, lightweight concrete, gypsum boards and decks. Drying time is typically 30 minutes to 3 hours.

Spraying equipment recommendations - Spray tip size: between 20 and 25 mils at 1300 psi continuous.

To Install:

a. Apply primer to prepared substrate.
b. Allow primer to dry completely.
c. Install Sarnavap Self-Adhered vapor barrier.

Notes:

a) Do not install when it is raining, snowing, or on wet/humid surfaces.
b) Install Sarnavap Self-Adhered Primer at temperatures 32 degree F (0 degree C) and above. Average coverage rate is 0.25 to 1.22 gallons per square (0.1 to 0.5 L per m²).

c) Install Sarnavap Self-Adhered Primer WB at temperatures 41 degree F (5 degree C) and above. Average coverage rate is 0.25 to 0.75 gallon per square (0.1 to 0.3 L per m²). KEEP FROM FREEZING.

d) Do not use Sarnavap Self-Adhered Primer WB to seal Sarnavap Self-Adhered vapor barrier membrane joints.

e) Sarnavap Self-Adhered Primer WB is not suitable for plastic surfaces.

f) Do not use Sarnavap Self-Adhered Primer WB on asphaltic boards.

B. Membrane Application over Concrete Deck (Reroofing with Removal of Existing Roofing):

Install Sarnavap Self-Adhered over a clean and dry substrate. In concrete applications allow concrete to cure for at least 7 days. Do not install when it is raining, snowing, or on wet/humid surfaces. Install in temperatures 32 degree F (0 degree C) and above. The use of a primer is required on the following substrates: wood, concrete, lightweight concrete, gypsum boards and decks. On metal decks use a metal plate (6 x 42 inches - 15 x 106 cm) to support the membrane end lap between metal flutes ensuring a complete end lap seal.

a. Begin application at the bottom of the slope. Unroll Sarnavap Self-Adhered onto the substrate without adhering for alignment. Overlap each preceding sheet by 3 inches (75 mm) lengthwise following the reference line and by 6 inches (150 mm) at each end. Stagger end laps by at least 12 inches (300 mm). Do not immediately remove the silicone release sheet.

b. Once aligned, peel back a portion of the silicone release sheet and press the membrane onto the substrate for initial adherence. Hold Sarnavap Self-Adhered tight and peel back the release sheet by pulling diagonally.

c. Use a 75 lb. (34 kg) roller to press Sarnavap Self-Adhered down into the substrate including the laps. Finish by aligning the edge of the roller with the lower end of the side laps and rolling up the membrane. Do not cut the membrane to remove air bubbles trapped under the laps. Squeeze out air bubbles by pushing the roller to the edge of the laps.

3.06 WOOD NAILER INSTALLATION

A. Install continuous wood nailers at the perimeter of the entire roof and around roof projections and penetrations as shown on the Detail Drawings.

Nailers shall be anchored to resist a minimum force of 300 pounds per lineal foot (4,500 Newtons per lineal meter) in any direction. Individual nailer lengths shall not be less than 3 feet (0.9 meter) long. Nailer fastener spacing shall be at 12 inches (0.3 m) on center or 16 inches (0.4 m) on center if necessary to match the structural framing. Fasteners shall be staggered 1/3 the nailer width and installed within 6 inches (0.15 m) of each end. Two fasteners shall be installed at ends of nailer lengths. Nailer attachment shall also meet the requirements of the current Factory Mutual Loss Prevention Data Sheet 1-49.

B. Thickness shall be as required to match substrate or insulation height to allow a smooth transition.

C. Any existing nailer woodwork which is to remain shall be firmly anchored in place to resist a minimum force of 300 pounds per lineal foot (4,500 Newtons per lineal meter) in any direction and

shall be free of rot, excess moisture or deterioration. Only woodwork shown to be reused in Detail Drawings shall be left in place. All other nailer woodwork shall be removed.

D. Stainless steel, corrosion resistant, fasteners are required when mechanically attaching any Sika Sarnafil product to wood nailers and wood products treated with ACQ (Alkaline copper Quaternary). When ACQ treated wood is used on steel roof decks or with metal edge detailing, a separation layer must be placed between the metal and ACQ treated wood.

3.07 INSULATION INSTALLATION

A. General Criteria:

Insulation shall be installed according to insulation manufacturer's instructions.
General Criteria:

Insulation shall be neatly cut to fit around penetrations and projections.

Install tapered insulation in accordance with insulation manufacturer's shop drawings.

Install tapered insulation around drains creating a drain sump.

Do not install more insulation board than can be covered with Sarnafil membrane by the end of the day or the onset of inclement weather.

Use at least 2 layers of insulation when the total insulation thickness exceeds 2-1/2 inches (64 mm). Stagger joints at least 12 inches (0.3 m) between layers.

B. Mechanical Attachment (if required – Architect to specify)

1. Insulation shall be mechanically fastened to the deck with approved fasteners and plates at a rate according to the insulation manufacturer's and Sika Sarnafil's recommendations for fastening rates and patterns. The quantity and locations of the fasteners and plates shall also cause the insulation boards to rest evenly on the roof deck/substrate so that there are no significant and avoidable air spaces between the boards and the substrate. Each insulation board shall be installed tightly against the adjacent boards on all sides.

2. Fasteners are to be installed consistently in accordance with fastener manufacturer's recommendations. Fasteners are to have minimum penetration into structural deck recommended by the fastener manufacturer and Sika Sarnafil.

3. Use fastener tools with a depth locator and torque-limiting attachment as recommended or supplied by fastener manufacturer to ensure proper installation.

C. Sarnacol 2163 Adhesive (if required – Architect to specify)

1. With a utility knife, cut away the plastic plugs from the Sarnacol 2163 mixing head. Attach a mixing tip to the threaded mixing head. Place the cartridge into the applicator. At the beginning of the tube, some of the material should be pumped out initially to make sure of a proper mix. Apply using a gravity fed applicator or by hand with a dual component caulk gun over properly installed and prepared substrates in bands 12 inches (305 mm) on center. Bands are 1/4 to 1/2 inch (6 to 13 mm) wide before foaming. Adhesive will quickly, within 30 to 45 seconds at 60 to 80 degree F (15 to 27 degree C), transform from a liquid into a low rise foam. Immediately set insulation boards into wet adhesive. Do not allow the adhesive to skin over. Walk insulation boards into place to ensure full embedment. Within 5 to 15 minutes the boards are securely attached to the substrate. In warmer weather this process is a little quicker. In colder weather the process is a little slower. CAUTION: Walking insulation boards in immediately after placement into adhesive may cause slippage/movement until adhesive starts to set up. On roof slopes greater than 1/2 inch (13 mm) in 12 inches (305 mm), begin adhering insulation at low point and work upward to avoid slippage. One person should be designated to walk in, trim/slit and apply weight to all insulation boards to ensure adequate securement. Only areas that can be made completely watertight in the same day's operations shall be coated. Un-used adhesive can be applied at a later date by simply replacing the mixing tip.

   For multiple layers of insulation spray adhesive over the base layer once fully secured and follow procedures above for attachment of each insulation layer.

2. Approved Insulation Boards:

   a. Sarnatherm Polyisocyanurate, 1 inch (25 mm) minimum thickness (required for Systems Warranty).

   b. Or equal – DensDeck, or Securock Gypsum-Fiber

3. Approved Substrate/Deck:

   a. Structural Roof Decking: Concrete, Gypsum, Cemetitious Wood Fiber (Tectum), Wood or Steel.

   b. Base sheets: Standard or Granular surfaced.

   c. Smooth Built-Up Roof Surfaces: Re-Roof Applications.

4. Re-cover Applications - A moisture survey must be performed. Any wet materials must be removed and replaced with compatible materials. For existing B.U.R., modified bitumen or mineral surface cap sheets inspections shall be performed for adhesion between the plies, insulation and deck. Deficiencies such as blisters, buckles, wrinkles and fishmouths shall be cut out or mechanically fastened. Apply Sarnacol 2163/2164 Universal Primer to all substrates prior to the application of Sarnacol 2163 adhesive.

5. Installation Guidelines:

   a. Not recommended for use with insulation boards larger than 4x4 feet (1.2x1.2 m).

   b. For ease of application, maintain a minimum material temperature of 70 degree F (21 degree C) prior to use.

c. Store between 60 degree F (16 degree C) and 80 degree F (27 degree C).

d. Adhesive shall not be used during inclement weather.

e. Adhesive shall not be applied to wet or damp surfaces.

f. Do not use warped or curled insulation boards.

g. For uneven surfaces, trimming or slitting of boards may be necessary.

h. Approximate Set-Time:

Air Temperature between 60 to 90 degree F (15 to 32 degree C) = 5 to 8 minutes.

Air Temperature between 32 to 60 degree F (0 to 15 degree C) = 8 to 15 minutes.

i. Coverage:

Approximately 600 square feet per case. Rates are based on an application pattern of 4 ribbons, 1/4 to 1/2 inch (6 to 13 mm) beads, 12 inches (30 cm) on center per 4 x 4 feet (121.9 x 121.9 cm) insulation board. Coverage rates may vary over irregular surfaces.

j. A minimum of 1 Sarnabar placed 4 feet (1.2 m) from the roof edge and fastened 12 inches (305 mm) on center to the structural deck with acceptable fasteners is required after installation of the Sarnafil roof membrane. The Sarnabar is to have a cover strip hot air welded over it.

3.08 INSTALLATION OF SARNAFIL MEMBRANE

The surface of the insulation or substrate shall be inspected prior to installation of the Sarnafil roof membrane. The substrate shall be clean, dry, free from debris and smooth with no surface roughness or contamination. Broken, delaminated, wet or damaged insulation boards shall be removed and replaced.

A. Sarnacol 2170 / 2170 VC Adhesive:

1. Over the properly installed and prepared substrate surface, adhesive shall be applied using solvent-resistant 3/4 inch (19 mm) nap paint rollers. The adhesive shall be applied to the substrate at a rate according to Sika Sarnafil requirements. The adhesive shall be applied in smooth, even coating with no gaps, globs, puddles or similar inconsistencies. Only an area which can be completely covered in the same day's operations shall be coated with adhesive. The first layer of adhesive shall be allowed to dry completely prior to installing the membrane.

2. When the adhesive on the substrate is dry, the Sarnafil roof membrane is unrolled. Adjacent sheets shall be overlapped 3 inches (75 mm). Once in place, one-half of the sheet's length shall be turned back and the underside shall be coated with adhesive at a rate of 1/2 gallon per 100 square feet (0.2 liters per m²). When the membrane adhesive has dried slightly to produce strings when touched with a dry finger, the coated membrane shall be rolled onto the previously-coated substrate being careful to avoid wrinkles. Do not allow adhesive on the underside of the Sarnafil membrane to dry completely. The amount of membrane that can be coated with adhesive before rolling into substrate will be determined by ambient temperature, humidity and crew. The bonded sheet shall be pressed firmly in place with a water-filled, foam-covered lawn roller by frequent rolling in two directions. The remaining un-bonded half of the sheet shall be folded back and the procedure repeated.

   Notes: The Applicator shall count the amount of pails of adhesive used per area per day to verify conformance to the specified adhesive rate. No adhesive shall be applied in seam areas. All membrane shall be applied in the same manner.

3.09 HOT-AIR WELDING OF SEAM OVERLAPS

A. General –

1. All seams shall be hot-air welded. Seam overlaps should be 3 inches (76 mm) wide when automatic machine-welding and 4 inches (100 mm) wide when hand-welding, except for certain details.

2. Welding equipment shall be provided by or approved by Sika Sarnafil. All mechanics intending to use the equipment shall have successfully completed a training course provided by a Sika Sarnafil Technical Service Representative prior to welding.

3. All membrane to be welded shall be clean and dry.

B. Hand-Welding

Hand-welded seams shall be completed in two stages. Hot-air welding equipment shall be allowed to warm up for at least one minute prior to welding.

1. The back edge of the seam shall be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.

2. The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to "flow", the hand roller is positioned perpendicular to the nozzle and rolled lightly. For straight seams, the 1-1/2 inch (40 mm) wide nozzle is recommended for use. For corners and compound connections, the 3/4 inch (20 mm) wide nozzle shall be used.

C. Machine Welding

1. Machine welded seams are achieved by the use of Sika Sarnafil's automatic welding equipment. When using this equipment, Sika Sarnafil's instructions shall be followed and local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable generator is recommended. No other equipment shall be operated simultaneously off the generator.

2. Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.

D. Quality Control of Welded Seams

1. The Applicator shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark gray material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the Applicator at locations as directed by the Owner's Representative or Sika Sarnafil's representative. One inch (25 mm) wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no extra cost to the Owner.

3.10 MEMBRANE FLASHINGS

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and Sika Sarnafil. Approval shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Applicator's expense. Flashing shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces. Use caution to ensure adhesive fumes are not drawn into the building.

A. Sarnacol Adhesive for Membrane Flashings

1. Over the properly installed and prepared flashing substrate, Sarnacol adhesive shall be applied according to instructions found on the Product Data Sheet. The Sarnacol adhesive shall be applied in smooth, even coats with no gaps, globs or similar inconsistencies. Only an area which can be completely covered in the same day's operations shall be flashed. The bonded sheet shall be pressed firmly in place with a hand roller.

2. No adhesive shall be applied in seam areas that are to be welded. All panels of membrane shall be applied in the same manner, overlapping the edges of the panels as required by welding techniques.

3. Install Sarnastop/Sarnabar/Sarnacord according to the Detail Drawings with approved fasteners into the structural deck at the base of parapets, walls and curbs. Sarnastop is required by Sika Sarnafil at the base of all tapered edge strips and at transitions, peaks, and valleys according to Sika Sarnafil's details.

4. Sika Sarnafil's requirements and recommendations and the specifications shall be followed. All material submittals shall have been accepted by Sika Sarnafil prior to installation.

5. All flashings shall extend a minimum of 8 inches (0.2 m) above roofing level unless otherwise accepted in writing by the Owner's Representative and Sika Sarnafil Technical Department.

6. All flashing membranes shall be consistently adhered to substrates. All interior and exterior corners and miters shall be cut and hot-air welded into place. No bitumen shall be in contact with the flashing membrane.

7. All flashing membranes shall be mechanically fastened along the counter-flashed top edge with Sarnastop at 6 to 8 inches (0.15 to 0.20 m) on center.

8. Sarnafil flashings shall be terminated according to Sika Sarnafil recommended details.

9. All flashings that exceed 30 inches (0.75 m) in height shall receive additional securement. Consult Sika Sarnafil Technical Department for securement methods.

3.11 METAL FLASHINGS

A. Metal details, fabrication practices and installation methods shall conform to the applicable requirements of the following:

1. Factory Mutual Loss Prevention Data Sheet 1-49 (latest issue).

2. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - latest issue.

3. Metal, other than that provided by Sika Sarnafil, is not covered under the Sika Sarnafil warranty.

4. Complete all metal work in conjunction with roofing and flashings so that a watertight condition exists daily.

5. Metal shall be installed to provide adequate resistance to bending to allow for normal thermal expansion and contraction.

6. Metal joints shall be watertight.

7. Metal flashings shall be securely fastened into solid wood blocking. Fasteners shall penetrate the wood nailer a minimum of 1 inch (25 mm).

8. Airtight and continuous metal hook strips are required behind metal fascias. Hook strips are to be fastened 12 inches (0.3 m) on center into the wood nailer or masonry wall.

9. Counter flashings shall overlap base flashings at least 4 inches (100 mm).

10. Hook strips shall extend past wood nailers over wall surfaces by 1-1/2 inch (38 mm) minimum and shall be securely sealed from air entry.

3.12 SARNACLAD METAL BASE FLASHINGS/EDGE METAL

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary

flashings shall be allowed without the prior written approval of the Owner's Representative and Sika Sarnafil. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Applicator's expense.

A. Sarnaclad metal flashings shall be formed and installed per the Detail Drawings.

1. All metal flashings shall be fastened into solid wood nailers with two rows of post galvanized flat head annular ring nails, 4 inches (100 mm) on center staggered. Fasteners shall penetrate the nailer a minimum of 1 inch (25 mm).

2. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.

3. Adjacent sheets of Sarnaclad shall be spaced 1/4 inch (6 mm) apart. The joint shall be covered with 2 inch (50 mm) wide aluminum tape. A 4 inch minimum (100 mm) wide strip of Sarnafil flashing membrane shall be hot-air welded over the joint. Exercise caution at perimeter of roof.

3.13 EDGE METAL

All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and Sika Sarnafil. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Applicator's expense.

A. Edge Grip Extruded

1. Position the roof membrane over edge of roof and down outside face of wall covering wood nailer(s) completely. Allow 1/2 inch (13 mm) of excess membrane to extend down past the wood nailer. Hot-air weld all seams making sure there are no voids in welds.

2. Apply a 3/8 inch (10 mm) continuous bead of Sikaflex – 1a sealant to the clean bottom of heavy-duty extruded retainer. Install extruded retainer from right to left as seen from rooftop. Field cut sections as necessary.

3. Install retainer splice under intersecting sections of extruded retainer.

4. Fasten extruded retainer into side of nailer 12 inches (0.3 m) on center. Use fasteners provided with Edge Grip Extruded system; 1-1/2 inch (38 mm) hex head stainless steel fasteners with neoprene washers. Allow 1/8 inch (3 mm) gap between extruded retainer sections for thermal expansion [1/4 inch (6 mm) if temperature is below 40 degrees F (4 C)].

5. Fasteners shall provide a minimum 240 lbs. (109 kg) pull-out resistance; suitable for the substrates to which being installed.

6. Install concealed joint splice plates at intersecting sections of snap-on fascia cover joints.

7. Position snap-on fascia cover so that it’s top engages the extruded retainer top. Rotate downward engaging bottoms of snap-on fascia cover and extruded retainer base plate. Allow 1/4 inch (6 mm) gap between snap-on fascia sections for thermal expansion. Field cut where necessary.

3.14 WALKWAY INSTALLATION

A. Sarnatred Walkway - Roofing membrane to receive Sarnatred Walkway shall be clean and dry. Place chalk lines on deck sheet to indicate location of Walkway. Apply a continuous coat of Sarnacol 2170 or 2170 VC adhesive to the deck sheet and the back of Walkway in accordance with Sika Sarnafil's technical requirements and press Walkway into place with a water-filled, foam-covered lawn roller. Clean the deck membrane in areas to be welded. Hot-air weld the entire perimeter of the Walkway to the Sarnafil deck sheet. Check all welds with a rounded screwdriver. Re-weld any inconsistencies. Important: Check all existing deck membrane seams that are to be covered by Walkway with rounded screwdriver and reweld any inconsistencies before Walkway installation. Do not run Walkway over Sarnabars.

3.15 PERIMETER WARNING TAPE

Areas of membrane where tape is to be applied must be cleaned to a “like new” condition. Failure to properly clean the membrane will result in less than satisfactory adhesion. The membrane should be cleaned as follows:

A. New membrane: Remove loose dirt and dust by wiping clean with water. For areas where dirt is embedded, scrub the application area with a commercial cleaner such as Simple Green, 409 or other similar all purpose cleaner using a Scotch Brite scrubbing pad or similar product. Wash away residual cleaning material with clean water.

B. Weathered membrane: For older membranes or areas where there is excessive dirt buildup, use the above cleaning procedure followed by cleaning with a natural fiber rag wet with MEK, and wipe away all residual cleaning solution and remaining dirt until membrane has a “like new” appearance.

C. After surface is clean and dry, apply tape to surface taking care to avoid trapping air and creating blisters as tape is smoothed over with hand pressure. If a chalk line is used be sure to keep chalk dust clear of application area.

D. Do not apply Perimeter Warning Tape to surfaces where the temperature is below 40 degrees Fahrenheit.

E. Perimeter Warning Tape may be slippery when wet.

3.16 TEMPORARY CUT-OFF

A. All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. All temporary waterstops shall be constructed to provide a 100 percent watertight seal. The stagger of the insulation joints shall be made even by installing partial panels of insulation. The new membrane shall be carried into the waterstop. Waterstop shall be sealed to the deck or substrate so that water will not be allowed to travel under the new or existing roofing. The edge of the membrane shall be sealed in a continuous heavy application of sealant as described in Section 2.10. When work resumes, the contaminated membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc. shall be removed from the work area and properly disposed of off site. None of these materials shall be used in the new work.

B. If inclement weather occurs while a temporary waterstop is in place, the Applicator shall provide the labor necessary to monitor the situation to maintain a watertight condition.

C. If any water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced at the Applicator's expense.

3.17 COMPLETION

A. Prior to demobilization from the site, the work shall be reviewed by the Owner's Representative and the Applicator. All defects noted and non-compliances with the Specifications or the recommendations of Sika Sarnafil shall be itemized in a punch list. These items must be corrected immediately by the Applicator to the satisfaction of the Owner's Representative and Sika Sarnafil prior to demobilization.

B. All Warranties referenced in this Specification shall have been submitted and have been accepted at time of contract award.

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SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Flashings, counter flashings, seismic joint covers, vents, and copings as indicated on the Drawings and specified herein.

B. Related Sections:

1. Metal Fabrications; refer to Section 05 50 00.

2. Refer to Division 7 for Roofing Sections

3. Prefabricated roof curbs, hatches, and skylights, see Section 07 72 00 – Roof Accessories.

4. Joint Sealants; refer to Section 07 92 00.

5. Painting and Coating; refer to Section 09 90 00.

6. Mechanical Equipment

1.02 REFERENCE STANDARDS

A. Preform sheet metal work, including fabrications, in strict accordance with Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Architectural Sheet Metal Manual, and the Aluminum Association.

1.03 SUBMITTALS

A. Submit copies of standard details covering all sheet metal conditions and fabrications to be necessary on the project. Where standard details do not exist, prepare and deliver such details to Architect.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fabricate sheet metal items from sheet steel in accordance with ASTM A653, galvanized in accordance with ASTM A653, G90. Galvanizing on exposed surfaces not receiving paint shall receive an appearance grade finish.

B. Unless shown otherwise on Drawings, provide steel sheet metal of at least 22 gauge steel.

C. Where sheet aluminum is shown on Drawings, provide 0.032-inch thickness (20 gauge) and in accordance with ASTM B209, for 3003-H14, in color finish as selected by Architect.

D. Extruded Aluminum: Manufacturer's standard extrusions of sizes and profiles indicated, and in accordance with ASTM B221 for 6063-T52 alloy and temper, AA-C22A41 clear anodized finish; 0.080-inch minimum thickness for primary legs of extrusions that are anodized.

E. Stainless Steel: AISI Type 302/304, complying with ASTM A167, with No. 2D soft annealed finish, except where harder temper required for forming or performance; 0.0187-inch (.05 mm) thick, except as otherwise indicated.

2.02 ACCESSORIES

A. Fasteners and Clips: Provide as required and appropriate for the materials being fastened. Where fasteners or clips may be exposed to outside weather conditions, provide stainless steel type.

1. Provide fasteners such as bolts, screws and nails hot-dip galvanized as specified in accordance with ASTM A153.

B. Where rivets will be used, provide malleable iron type with rust-inhibitive coating.

C. If drive pins are incorporated into work, provide cadmium plated with neoprene facing, at least one-inch long, with neoprene washers.

D. Solder: For use with steel or copper, provide 50 - 50 tin/lead solder (ASTM B32) with rosin flux.

E. Solder: For use with stainless steel, provide 60 - 40 tin/lead solder (ASTM B32) with acid-chloride type flux, except use rosin flux over tinned surfaces.

F. Bituminous Coating: Solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

G. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.

H. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 92 00 Joint Sealants.

I. Epoxy Seam Sealer: Two part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.

J. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet metal.

K. Paper Slip Sheet: 5 lbs. rosin-sized building paper.

L. Polyethylene Underlayment: Minimum 6-mil carbonated polyethylene film resistant to decay when tested in accordance with ASTM E154.

M. Reglets: Metal or plastic units of type and profile indicated, compatible with flashing indicated, noncorrosive.

N. Conductor-Head Guards: 20 gage bronze or nonmagnetic stainless steel mesh or fabricated units, with selvedge edges and noncorrosive fasteners. Select materials for compatibility with gutters and downspouts.

O. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.

2.03 FABRICATION

A. General Metal Fabrication: Shop fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams.
For metal other than aluminum, in edges to be seamed, form seams and solder.
Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently weather/waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separations: Provide for separation of metal from incompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

F. Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed for extruded aluminum joint covers. Fabricate mitered and welded corner units.

2.04 PREFABRICATED COPINGS AND FLASHINGS

A. Provide factory prefabricated 0.050" aluminum continuous snap-on type copings with concealed mounting plate at joints. Copings shall be maximum 10’ lengths. Mounting plate shall be extended 5 inches minimum beyond space between coping lengths. Secure cover plate according to manufacturers’ recommendations. Provide copings manufactured by W.P. Hickman, or others, as approved by Architect. Provide flashing manufactured by Fry Reglet or other as approved by Architect.

1. Pre-finish coping in Kynar 500 coating of custom color as selected by Architect.

2. Copings shall be Factory Mutual Class I-90 certified. Provide certification to Architect.

3. Arched copings shall be factory pre-fabricated true-arch copings, CNC machine cut heli-arc welded and finish ground prior to Kynar 500 finish. Segmented copings shall not be accepted. Arched coping sections shall be fabricated from 0.063" aluminum and not

exceed 5' in length."

PART 3 - EXECUTION

3.01 PREPARATION

A. Inspect substrate conditions prior to installation of sheet metal items. Conditions which could be detrimental to correct and proper installation of sheet metal assemblies are to be called to the attention of the Owner for their disposition prior to sheet metal work being installed.

B. Coordinate fabrication and installation of sheet metal items with work of others such as roofing, curtainwall and windows, sealants, mechanical and electrical.

3.02 INSTALLATION

A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.

C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

D. Install reglets to receive counterflashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 sections. Where shown in masonry, furnish reglets to trades of masonry work, for installation as work of Division 4 sections.

E. Install counterflashings in reglets, either by snap-in seal arrangement or by welding in-place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated in depending on degree of sealant exposure.

F. Install elastic flashing in accordance with manufacture's recommendations. Where required, provide for movement as joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water for flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.

G. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3 inch overlap, to form a continuous, waterproof system.

H. Conductor Head Guards: Install "bee-hive type" strainer-guard at conductor heads, removable for cleaning downspouts.

I. Flash around exterior openings in the building where other waterproofing methods are insufficient.

3.03 JOINTS

A. Typically, provide flat locked joints with sealant between metal surfaces, unless shown otherwise. Where standing seams are required, provide with folded corners.

B. Provide minimum of 1 inch laps.

C. Where concealed joints are possible, provide flat locked joints with 3 inch reinforcing behind, set in full bed of sealant

D. Do not leave sheet metal joint unsealed. See sealant section of these specifications.

3.04 INSPECTION

A. Immediately following installation of sheet metal work, touch-up areas where primer has been removed during installation operations and where soldering has occurred.

B. Where architectural coatings are provided, touch-up marred or abraded finishes with compatible coating which can be expected to provide the same serviceability as factory applied coatings.

3.05 CLEANING

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

3.06 PROTECTION

A. Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION

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SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Provide materials, labor and equipment necessary for the completion, roof hatch, roof hatch guardrail and swing gate.

B. Related work:

1. Sheet Metal Flashing and Trim; refer to Section 07 62 00.

2. Signage, refer to Section 10 14 00.

1.02 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions by verifying existing conditions in the field.

1.03 SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and installation and operation instructions

B. Shop Drawings: For each type of roof accessory.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Coordination Drawings: For each type of roof accessory. Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.

2. Method of attaching roof accessories to roof or building structure.

3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

4. Required clearances.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

B. Warranty: Manufacturer's standard warranty unless noted otherwise.

1.05 PRE-INSTALLATION MEETING

A. Convene meeting at Project Site within one week of scheduled start of installation with representatives of the following in attendance: Owner or Owner's designated representative, Architect, Contractor, sub-contractor and manufacturer's representatives.

B. Review existing conditions, requirements of related work, installation instruction, storage and handling procedures and protection measures.

PART 2 - PRODUCTS

2.01 void

2.02 ROOF ACCESS HATCHES

A. Provide prefabricated units manufactured of galvanized sheet steel, prime painted complete with cam-action spring-loaded opener and positive latching device.

1. Provide one of the following units 2'-6" x 3'-0" size, unless noted otherwise:

a. Bilco,Type S
b. Milcor, Model M-1
c. Dur-Red Model LH

B. Provide unit with fully insulated 14 gauge lid and integral curb. Weatherstrip lid with continuous bulb seal.

C. Provide solid, non-compressible mounting blocking at railing anchor points for mounting the safety rail.

D. Provide each unit of size necessary to comply with Drawings. Weatherstrip lid.

E. Curb height shall be modified to make counterflashing at least 8-inches above surface of tapered roof insulation where it occurs. Coordinate with roof deck contractor.

2.03 ROOF ACCESS LADDER SAFETY POST

A. Provide spring balanced ladder safety post at all roof hatch ladder, Bilco Model LU-2-steel with hot dipped galvanized finish. Mount to the top two rungs of the roof access ladders.

2.04 SAFETY RAIL AT ROOF HATCH

1. KEEHATCH Model No. RHSR-SS Railing System for standard 2'-6" x 3'-0" roof hatch.

2.05 ROOF HATCH GUARDRAIL AND SWING GATE

A. Where indicated in the drawings, provide roof hatch guardrail and swing gate complying with OSHA 29 CFR 1910.23 and installation per manufacturers installation requirements. Installers must possess industry licenses, be appropriately trained, and comply with all relevant OSHA legislation during installation of the products. Remove existing hatch guardrails, E-Z up poles, and swing gates where indicated, including roof-mounted guardrails. Patch hatch and roofing to achieve water-tight assembly. Refer to specifications 01 73 29 Cutting and Patching and 02 41 19 Selective Demolition.

B. Do not modify or remove any existing structural component or product without prior authorization by architect and engineer. Provide generous bead of silicone around fastener penetrations per manufacturer instructions.

C. Fastener per manufacturer's instructions and provide weathertight fastening.

D. Maintain the integrity of the roof and roof hatch.

E. Notify architect of any concerns with existing roof hatches or mounting concerns.

F. Field verify all existing roof hatches and provide manufacturer's correct model for each roof hatch based on curb size ranges. Contract shall include custom size roof hatch railings as required to accommodate existing conditions.

G. Provide full railing around roof hatch opening with self-closing gate at open side of hatch, typical. Where indicated, or as required by existing conditions, provide self-closing gate at side of hatch for safe access to roof. All components to be galvanized finish.

H. Provide manufacturer's standard warranty.

A. Basis-of-Design:

A-Mezz Industrial Structures, Inc., Roof Hatch Railings
https://www.amezz.com/roof-hatch-safety-railing.html

Cleveland, Ohio 44236; 330-650-5561
Email: *indsales@amezz.com*

1. Size: Varies by location. Contractor to verify in field.

2. Finish: Powder coated. Architect to select from manufacturer's standard colors.

3. Installation: Gasketed connection to bolt directly to roof hatch curb. No piercing of roofing membrane.

4. Design requirements: OSHA Standard 29 CFR 1910.23 (a) (2)

5. Features: four-sided hatch protection with two hand rungs one at each side of the ladder

6. Gate: MLG self-closing gate, hot dipped galvanized finish

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Verification of Conditions: Verify that units are adequately braced for seismic conditions and loads, and that conjunctive roofing, mechanical and electrical operations will provide a watertight and weathertight installation.

3.02 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.

2. Coordinate installation of roof accessories with other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

3. Anchor roof accessories securely in place so they are capable of resisting indicated loads.

4. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.

5. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

C. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

D. Roof-Hatch Guardrail Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

2. Attach safety railing system to roof-hatch curb.

E. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.02 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Clean exposed surfaces according to manufacturer's written instructions.

C. Clean off excess sealants.

D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 84 13

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work specified in this section.

1.02 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.03 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

A. Only tested firestop systems shall be used in specific locations as follows:

1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

2. Blank openings through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

3. Openings and penetrations in fire-rated partitions or walls containing fire doors.

4. Openings around structural members which penetrate floors or walls.

1.04 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

1. Section 03 30 00 – Cast-In-Place Concrete
2. Section 07 92 00 – Joint Sealants
3. Section 09 24 00 – Cement Plastering
4. Section 09 29 00 – Gypsum Board
5. Section 23 00 01 – Mechanical General Requirements
6. Section 23 07 13 – Duct Insulation
7. Section 23 07 19 – HVAC Piping Insulation
8. Section 26 00 00 – General Electrical Requirements

1.05 REFERENCES

A. Test Requirements: ASTM E814, "Standard Method of Fire Tests of Penetration Firestop Systems."

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:

a. Firestop Devices (XHJI)
b. Fire-Resistance Ratings (BXUV)
c. Through-Penetration Firestop Systems (XHEZ)
d. Fill, Voids, or Cavity Materials (XHHW)
e. Forming Materials (XHKU)

C. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments

D. ASTM E84, “Standard Test Method for Surface Burning Characteristics of Building Materials.”

E. Inspection Requirements: ASTM E2174, “Standard Practice for On-Site Inspection of Installed Fire Stops.”

F. CBC California Building Code.

G. NFPA 101 - Life Safety Code

H. CEC California Electric Code

1.06 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council.

1.07 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Section 01 33 00.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor’s name who will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.08 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.02 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma, Phone: (800) 879-8000.

2. Provide products from the above acceptable manufacturer; *no substitutions will be accepted.*

2.03 MATERIALS

A. Use only firestop products that have been UL 1479 or ASTM E814 tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device

C. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. Hilti CP 604 Self-Leveling Firestop Sealant
3. Hilti CP 620 Fire Foam

D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti CP 601S Elastomeric Firestop Sealant
2. Hilti CP 606 Flexible Firestop Sealant
3. Hilti FS-ONE Intumescent Firestop Sealant
4. Hilti CP 604 Self-Leveling Firestop Sealant

E. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant

F. Foams, Intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. Hilti CP 618 Firestop Putty Stick
3. Hilti CP 620 Fire Foam

G. Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti CP 618 Firestop Putty Stick

H. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:

1. Hilti CP 617 Firestop Putty Pad

I. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), the following products are acceptable:

1. Hilti CP 643 Firestop Collar
2. Hilti CP 644 Firestop Collar
3. Hilti CP 648 Wrap Strips

J. Materials used for complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti CP 637 Firestop Mortar
2. Hilti FS 657 FIRE BLOCKS
3. Hilti CP 620 Fire Foam

K. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCKS

L. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:

1. Hilti FS 657 FIRE BLOCKS

M. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

3. Protect materials from damage on surfaces subjected to traffic.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTME 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.05 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Sealants and backing, primers, and bond-breakers as indicated on the Drawings and specified herein. Work will include, but is not limited to the following locations:

1. Joints between metal and cementitious building elements
2. Joints between cementitious elements
3. Expansion and control joints
4. Cross joints in copings and projecting work
5. Sills, jambs and heads of windows, doors, louvers and similar openings where they abut dissimilar materials.
6. Horizontal joints
7. Hidden joints expected to undergo minimal movement.
8. Sealing of penetrations thru fire rated assemblies.

B. Related Work:

1. Glass and glazing and appurtenant sealant systems
2. Aluminum entrances and windows
3. Concrete flatwork
4. Roofing and sheet metal

1.02 REFERENCE STANDARDS

A. Provide an installation in strict compliance with Title 24 requirements.

1.03 SUBMITTALS

A. Submit manufacturer's printed literature and installation instructions on specified materials for review.

B. Submit manufacturer's standard colors of materials for selection.

C. Submit standard size sample of back-up material, primer and bond-breaker proposed for each system.

1.04 QUALITY ASSURANCE

A. Proper caulking and proper installation of sealants requires that installers be thoroughly trained and experienced in the necessary skills and thoroughly familiar with the specified requirements.
B. For caulking and installation of sealants throughout project, use only personnel who have been

specifically trained in such procedures and who are completely familiar with the joint details shown or required, and the installation requirements called for in these specifications.

C. Coordinate this work with work of other sections to ensure proper installations.

D. Provide written certification that materials in contact with the sealants and appurtenant components, such as gaskets, spacers, setting blocks, concrete curing compounds, aluminum finishes, etc., are compatible with the sealants after 21-days exposure to ultra violet 2000 - 4000 (micro-watt radiation).

E. Provide adhesion test data to production samples of metal and glass/spandrels, tested in accordance with ASTM C794.

1.05 GUARANTEES AND WARRANTIES

A. Provide two year guarantee against defects in materials and workmanship of materials and installation. Include replacement or repairs as may be required by Owner.

PART 2 - PRODUCTS

2.01 SEALANTS

A. Horizontal Non-Traffic-Bearing Surfaces: Provide acrylic or terpolymer acrylic base, chemical curing, self-leveling type sealants, non-sagging, uniform, homogeneous and free from lumps, capable of being continuously immersed in water, withstand movement up to 12.5 percent of joint width, and satisfactorily gunnable at 70 degrees F., non-staining and non-bleeding, in colors to be selected by Architect.

1. Preferred product is Mono 555 manufactured by Tremco, and one part Acrylic Sealant manufactured by DAP.

B. Horizontal Traffic-Bearing Joints: Provide multi-component, self-leveling polyurethane joint sealant meeting ASTM C920, capable of movement to plus or minus 25 percent.

1. Preferred product is THC-900 as manufactured by Tremco, and Vulkem 245 as manufactured by Tremco.

C. Non-moving Interior or Exterior Joints: Provide two-part noncorrosive epoxy metal seam cementing compound, recommended by metal manufacturer, at 2 feet each side of seam.

D. Vertical Surfaces: Provide three-part epoxidized polyurethane terpolymer sealant, non-sagging, gun grade, meeting ASTM C920, Type M, Grade NS, Class 25, use NT, M, A and O.

1. Preferred product is Dymeric as manufactured by Tremco, and Vulkem 227 as manufactured by Tremco.

E. Hidden, Paintable, or Low Movement Interior Joints: Provide materials in compliance with Federal Specifications A-A-272, Type I, Butyl type, able to withstand joint movement to maximum five percent.

1. Preferred product is Butyl as manufactured by Tremco.

F. Acoustical Sealants: Where required, provide acoustical sealants manufactured by Tremco or other approved; highly resilient, permanently flexible, and shrink and stain resistant.

G. Fire Rated Sealants: Where scheduled and as required to maintain fire ratings of penetrations through fire rated assemblies. Provide UL listed products, passing ASTM E84 and E814. Provide "Fyre-Shield" by Tremco; "Semco PR-855" by PRC-DeSoto International a PPG Industries Co., or equal.

H. Acceptable Product Manufacturer's:

1. TREMCO
2. GE Silicones
3. Dow Corning
4. BASF

2.02 ACCESSORIES

A. Primers: Where necessary, provide primers compatible with not only sealant, but substrate and finish on which to be applied. Primers are to be non-staining type and must have been specifically tested for durability on the surfaces to be sealed, and are specifically recommended for this installation by their manufacturer.

B. Back-up Materials: Provide one of the following, as recommended for the particular joint construction and sealant type:

1. Close-cell resilient urethane or polyvinyl-chloride foam

2. Close-cell polyethylene foam

3. Closed-cell sponge of vinyl or rubber

4. Polychloroprene tubes or beads

5. Polyisobutylene extrusions

6. Oil-less dry jute

7. Preformed support strips for tile control joints and expansion joints, polyisobutyleen or poly- chloroprene rubber.

C. Bond Breaker: Use only one of the following as best suited for the specific application and as recommended by the manufacturer of the sealant to be used.

1. Polyethylene tape, pressure-sensitive adhesive, with the adhesive required only to hold tape to the construction materials shown.

2. Aluminum foil conforming to Federal Specifications QQ-A-1876.

3. Wax paper.

D. Masking Tape: For masking around joints, provide masking tape conforming to ASTM D6123.

PART 3 - EXECUTION

3.01 PREPARATION

A. Joints and surfaces which are to be caulked or sealed shall be clean, dry and free of dust, loose mortar and other foreign materials.

B. Clean ferrous metals of rust, mill scale and coatings by wire brush, grinding or sandblasting. Remove oil, grease and/or temporary protective coatings with high performance cleaners, as approved by sealant manufacturer.

C. Joint dimensions for sealant should be reviewed and installed in accordance with sealant manufacturer's printed instructions. In no case should the sealant application be less than 1/4-inch wide, and 1/4-inch deep, except in specific metal-to metal curtain wall applications, and then as recommended by the sealant manufacturer.

D. Concrete or masonry joint surfaces shall be wire brushed, then air-blown clean. The joint interface must be free of form release agents of chemical retarders which may interfere with sealant adhesion and performance.

E. Sealants shall not be applied to masonry joints where a water repellent or masonry preservative has been applied prior to caulking. When called for, waterproofing treatments should be applied after caulking.

F. Do not caulk joints until they are in compliance with requirements of the approved manufacturer of the materials, the details as shown on the Drawings, and the specific requirements of other sections of the specification.

3.02 INSTALLATION

A. Apply and install sealant where shown on drawings, or if not shown on Drawings, apply and install sealant materials and products which could lead to infiltration of moisture, water, light, or air blown particles into building; and within building where changes of materials in same or different planes could allow moisture, water, air, or light to penetrate.

B. Provide acoustical sealants on, around and between building construction members such as framing, panel boxes, cutouts for penetrations of other materials or equipment, etc., where walls and floors are designated to be sound attenuated or acoustically treated.

C. Install joint backing with a blunt instrument so as not puncture the surface skin. Size of joint backing should be determined by taking the joint width and adding 25 percent to assure proper compression of backer rod.

D. Apply sealant with a caulking gun, using proper nozzles. Use sufficient pressure to properly fill the joints with sealant to the back-up materials.

E. After joints have been completely filled, they shall be neatly tooled to eliminate air pockets or voids, and to provide a smooth, neat appearing finish in intimate contact with interfaces. After tooling, surface of sealant shall be free of ridges, wrinkles, sags, air pockets and embedded impurities.

F. It is recommended that a 40-degree F., minimum application temperature be maintained for joint sealant installations. When it is necessary, that applications be made at lower temperatures, take precautions to assure that joints have clean, dry, and frost-free surfaces. Submit a letter by sealant manufacturer's representative, verifying that surfaces are acceptable.

END OF SECTION

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SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes: Standard steel door frames and other light frames shown on Drawings, with fastening devices.

B. Related Sections:

1. Section 06 10 00 – Rough Carpentry.
2. Section 07 92 00 – Joint Sealants.
3. Section 08 14 00 – Wood Doors.
4. Section 08 71 00 – Door Hardware.
5. Section 08 80 00 – Glazing.
6. Section 09 90 00 – Painting and Coating.

1.02 REFERENCE STANDARDS

A. Follow Hollow Metal Manufactures Association (HMMA) and Steel Door Institute (SDI) recommendations for materials, construction and installation procedures.

B. Comply with 2022 California Building Code, Title 24, Part 2, Section 703.
C. Comply with NFPA #80

1.03 SUBMITTALS

A. Shop drawings shall be submitted for approval in accordance with section 01 33 00 – Submittal Procedures, covering each type of door frame condition.

B. Oversized Construction Certificates: For door assemblies required to be fire-protection rated and exceeding size limitations of labeled assemblies.

C. Schedule: Submit a schedule of frames using same reference numbers for details and openings as those on the Contract Drawings.

D. Templates will be furnished by hardware supplier for preparing shop drawings and for preparing and reinforcing hollow metal work to receive hardware.

E. Submit initial shop drawings, indicating attachment and fastening devices, reinforcement, gauges, paint type and certification that frames meet or exceed quality standards of SDI. Final submittal shall be made no later than 60 days after initial submittal.

1.04 QUALITY ASSURANCE

A. Provide doors frames and accessories manufactured by a certified SDI member company. Company must be a certified member in good standing of these organizations as of the past 5 years.

B. Steel Frame Standard: Comply with SDI 100, unless more stringent requirements are

indicated.

C. Mock-Up: Provide one fully painted, fully glazed combination window and door opening (all door hardware need not be installed) as soon as practicable after delivery of frames to the site. Approved opening will serve as a standard of quality for the balance of the hollow metal frames on the project.

D. Testing:

1. Contractor shall allow in his bid for replacement of four doors, which will be selected at random by the Architect for dismantling and inspection of internal construction. Contractor shall provide labor and tools to cut open and dismantle doors under Architect's direction. Owner reserves the right to dismantle additional doors, at Owner's expense, as deemed necessary by Owner.

2. Owner's testing lab will test gauges of selected door frame parts, interior and exterior welding, galvanizing, and shop priming, for conformance with SDI recommended specifications and additional requirements of this Section. Retesting, if necessary, shall be done in accordance with requirements of Division 01 – General Requirements of these specifications.

E. Replacement of Product and Manufacturer:

1. Failure of any hollow metal frame to meet specified standards shall be grounds to reject entire shipment of hollow metal frames, including those already installed. Items shall be replaced at Contractor's expense, including four additional doors for dismantling.

2. Failure of any hollow metal frame to meet specified standards shall be grounds to reject the manufacturer of the frames. Upon rejection of manufacturer, Contractor shall propose an alternate manufacturer acceptable to the Owner and Architect. No extensions of time or additions to the contract will be allowed due to an Owner mandated substitution of hollow metal manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide packaging, containers, separators, banding, spreaders, paper wrapping, etc., as required to completely protect units during transportation and storage.

B. Inspect door frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired, provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

C. Protection: Store frames at building site under cover. Place units on minimum 4 inch (100 mm) high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufactures offering products that may be incorporated into the Work included, but are not limited to the following for Steel Door Frames:

1. Door Components, Inc.
2. Ceco Door Products, a United Dominion Company
3. Republic Doors and Frames
4. Steelcraft, a Division of Ingersoll-Rand.

2.02 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A1008, Commercial Steel (CS), or ASTM A1008, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C. Hot-Dipped Zinc-Coated Steel Sheets: ASTM A653, Commercial Steel (CS), Type B; with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating, stretcher-leveled standard of flatness.

D. Electrolytic Zinc-Coated Steel Sheets: ASTM A879, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.03 FRAMES

A. Provide fully welded frames for doors, 16 gauge, prime painted steel, designed for butted, wrap-around, and keyed-in construction conditions, fire-rated where required. Frames for exterior locations shall be galvanized with A60 (absolute) coating.

1. All door frames shall have head section continuous welded to jamb section at the hinge side of the frame.

2. Exterior frames shall have all horizontal sections including mullions continuously welded to vertical sections on the exterior (from the room side of the fixed stop outward) portion of the frame. Intent is to seal driven water out of joints. Caulking will not be considered at these locations. Provide drip flashing at exterior heads.

3. Maximum allowable gap at stop miters shall be 1/16-inch.

4. All welds shall be ground smooth, and "Bondo" applied and sanded as necessary for a smooth, flush, quality appearance of the frame faces.

5. All frames shall be sized to provide for a minimum tolerance of 1/4-inch larger than wall or partition assembly unit is to be installed in.

6. Provide minimum three (3) wall anchors on jambs and two (2) on head.

2.04 ACCESSORIES

A. Include minimum three (3) 16 gauge jamb anchors for each side of frames, and as otherwise required by the Drawings.

B. Where required to be rated, provide fire-rated doors with UL label attached in an inconspicuous location.

C. Provide minimum two (2) 14 gauge steel floor anchors per door frame, and as otherwise required by the Drawings.

D. Prepare and reinforce door frames for hardware as follows: 12 gauge for surface applied closers, 3/16-inch for hinges, 12 gauge for hold-open arms, 9 gauge for floor checking hinges, and 14 gauge for other reinforcement.

E. Hardware Preparation: Prepare, reinforce, mortise, drill, and tap frames according to templates supplied by hardware supplier, reinforcing as standard with door and frame manufacturer except 3/16-inch steel behind butts and 12 gauge steel for mortised or surface-applied hardware. Conform to ANSI A115 Series as applicable to the hardware specified.

F. Finish: Thoroughly clean metal surfaces and chemically treat for paint adhesion. Paint inaccessible surfaces before assembling. Sand exposed surfaces of hollow metal and accessories and make smooth with mineral filler as required. Apply a baked-on coat of manufacturer's standard rust-inhibitive primer, including concealed surfaces of door frames and anchors. (Note: painter will be required to apply a "satin" finish final paint coat.)

PART 3 - EXECUTION

3.01 INSTALLATION

A. In general install door frames in accordance with SDI 100 Series.

B. Install frames for doors plumb, rigid and in true alignment, and fastened so as to retain their position and clearance during construction of partitions and walls. Frames and doors shall be installed so the appropriate door undercut is maintained (plus or minus 1/8") for thresholds, door shoes, and sweeps.

C. Ensure dimensional tolerance and stability of frames for proper installation and operation of hardware and doors.

D. Coordinate frame and drip flashing installation where shown on Drawings.

E. Touch up shop applied primer on frames following installation and just prior to finish painting.

F. Following installation, provide protection of frames until frames are to be finish painted.

G. Fire rated steel frames and doors shall be installed in accordance with their listing, NFPA 80, and the manufacturer's instructions.

END OF SECTION

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SECTION 08 14 00

WOOD DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Wood doors prepared for hardware as indicated on the Drawings and specified herein.

B. Related Sections:

1. Hardware: See Section 08 71 00 – Door Hardware

2. Job Site Finished Doors: See Section 09 90 00 - Painting and Coatings, for finishing wood doors.

1.02 REFERENCE STANDARDS

A. Follow American Woodwork Standard, current edition, recommendations for materials, construction, and installation procedures.

B. Manufactured units must be labeled and certified according to Section 1709.5.1 Exterior Windows and Doors of 2022 CBC, Title 24.

C. Non-Fire-Rated Wood Doors: WDMA Industry Standard I.S.1 latest edition shall be the standard of construction. In addition all solid core flush wood doors shall be in accordance with Woodwork Institute “Manual of Millwork” for custom and premium grade doors with core, stile, and rail components glued together with no voids permitted.

D. Fire-Rated Wood Doors: Where fire resistance classifications are shown or scheduled for wood door assemblies, doors shall be installed in compliance with the requirements of "NFPA-80 Standard for Fire Doors and Windows". Fire rated doors shall bear the label of an independent testing agency.

1.03 SUBMITTALS

A. Submit catalog cuts on doors.

B. Submit Woodwork Institute certifications issued by a Woodwork Institute licensee certifying that doors fully meet the requirements for the grades specified in these specifications.

C. Upon completion of the job, submit a Woodwork Institute Certified Compliance Certificate for Installation.

D. Submit two (2) flitches, 8-inches by 10-inches, of the veneer type to be used on doors for review.

E. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other pertinent data.

F. One extra door shall be furnished for destructive testing to verify that the product supplied correlates with samples approved.

1.04 DELIVERY, STORAGE AND HANDLING

A. Protect wood doors during transit, storage and handling to prevent damage, soiling and deterioration. Factory seal (4) sides of unfinished doors before delivery. The doors will be stored and handled in accordance with manufacturer's requirements and in accordance with NWMA pamphlet "Care and Finishing of Wood Doors".

1.05 GUARANTEE

A. The door shall be warranted by the manufacturer to be free of manufacturing defects for a life of the original installation. All exterior doors shall be warranted for exterior use. Warranty shall provide for replacement of the door as originally furnished. Manufacturer shall pay a reasonable charge to remove a defective door, refinish and replace with a new door providing the defect was not apparent prior to its installation.

B. Refer to Section 01 78 30 – Warrantees, Guarantees & Bonds for additional requirements.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Algoma Hardwoods, Inc.
B. Eggers Industries
C. Marshfield Door Systems

2.02 FABRICATION

A. Non-Label Doors: Doors shall be solid wood stave and shall be thoroughly seasoned, (7 ply construction) kiln dried with a moisture content of not less than 5% and not greater than 8%.

1. Core: Solid Stave Core: Low density wood blocks, kiln dried, not more than 2½" wide; random lengths, joints well staggered. Engineered composite doors with MDF veneer shall not be acceptable.

2. Cross Bands: Shall be 1/16-inch thick hardwood extending full width of door and laid with grain at right angles to face veneers. Cross bands and faces shall be laminated to the core with Type I melamine fortified urea glue by the hot press process. Entire core unit to be sanded before veneering to ensure minimal telegraphing of core through the veneer.

3. Skins: Shall be made of mill option sound Birch hardwood back and center ply with grain direction of center ply laid with grain at right angles to face and back. Skins shall be assembled and glued to core with type I glue.

4. Stiles, rails: Stile edge bands shall be two-ply laminated to the core. Outer stile shall be compatible with face veneers. Two-ply rails of mill option hardwoods shall be used. Stiles and rails must comply with wood stave doors and measure a minimum of 1-3/8" and glued securely to the core parts with no voids allowed. All doors shall be 1-3/4" thick unless designated otherwise.

B. Label Fire Doors: Type of construction shall be wood stave core doors for doors up to 1/3 hour rating. Doors required for rating over 1/3 hour shall be mineral core.

1. At rated doors to be finished with transparent finish, provide lite openings secured with wood or wood veneered lite beading to secure glass vision panels and provide veneer

wrapped non-overlapping metal edge guards on B and C labeled pairs where both doors are active.

2. At doors to be painted provide metal glazing strips.

3. Provide balanced construction by furnishing stile edge screw holding reinforcement to both vertical stiles on rated doors.

4. Rated door assemblies shall be provided with a smoke and draft control gasket in accordance with Section 716.2.1.4, Part 2, Title 24, California Code of Regulations.

C. Stiles:

1. Stile edge screw withdrawals when tested in accordance with ASTM D1037 shall exceed 740lbs. and VA 08210-TM (min. 700#).

2. Stile edge split resistance when tested in accordance with ASTM D143 Modified must exceed 751 lbs. and VA 08210-TM (minimum 500 PSI).

3. Provide mineral core doors with full length untreated solid lumber outer stiles compatible with face veneers.

4. Provide 45, 60 and 90 minute doors with special heavy duty reinforcement, as required, to allow surface mounted hardware to be attached with screws. Screws to be long enough to penetrate 1-1/2 inch into door.

2.03 FACE VENEERS

A. For door to receive transparent finish face veneer shall be premium grade per WI Sections 5 and 9 or WDMA I.S.1.1 Table 2 and at least 1/50-inch prior to field sanding.

B. For doors to receive opaque finish, provide manufacturer's standard medium density overlay over standard thickness hardwood face veneer.

2.04 ACCESSORIES

A. Door Louvers

1. Design is based on the use of the following louver manufactured by Anemostat Products:

a. For Installation in Non-fire-resistive Rated Doors: Model CHDL-2F (vision-proof, inverted V).

b. For Installation in Fire-resistive Rated Doors: Model FLDL-UL.

2. Provide louvers having the following characteristics and features:

a. When required to be installed in fire-resistive rated doors, bearing the listing mark of the Underwriters Laboratories (UL), and provided with an automatic closing mechanism activated by a fusible link device rated at 135 degrees F.

b. Factory finished to match color selected by Architect.

B. Moldings: Provide moldings for factory applied decorative surface application.

2.05 GLAZED DOORS

A. Where shown on Drawings, Provide Wood solid stiles and rails, and tempered glazed panels per section 08 80 00.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Installer must examine doors and door frames, and verify that frames are correct type and have been installed as required for proper hanging of corresponding doors. Notify Architect in writing of conditions detrimental to proper and timely installation of wood doors. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Do not hang doors with an apparent defect.

3.02 PREPARATION

A. Store doors in well ventilated building, cover to keep clean, but allow circulation. Relative humidity must be between 30% and 60%.

B. Condition doors to average prevailing humidity in installation area prior to hanging.

3.03 INSTALLATION

A. Manufacturer's Instructions: Install wood doors in accordance with manufacturer's instructions and as shown. Manufacturer's instructions shall be made available to inspecting authorities.

B. Install fire-rated doors in corresponding fire-rated frames in accordance with requirements of NFPA 80 and instructions attached to door. Do not undercut rated doors.

C. Job Fit Doors: Align doors to frame for proper fit and uniform clearance at each edge and machine for hardware. Seal cut surfaces immediately after fitting and machining.

D. Clearance: For non-fire rated doors provide clearances of 1/8-inch at each jamb, 1/8-inch at meeting stiles for pairs of doors and 1/4-inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4-inch clearance from bottom of door to top of threshold, unless otherwise noted; for fire-rated doors, provide clearances complying with the limitations of the authority having jurisdiction. Install all mortised butts with #12 x 1-1/4 inch threaded to the head steel wood screws.

E. Doors shall be pre-fit and pre-machined for finish hardware at manufacturer's mill.

F. Provide vision frame and lower assemblies complete, prefinished, and factory installed.

3.04 ADJUSTING

A. Operation: Re-hang or replace doors which do not swing or operate freely, as directed by Architect.

B. Finished Doors: Refinish or replace doors damaged during installation, as directed by Architect.

3.05 PROTECTION

A. Advise Architect of proper procedures required for protection of installed wood doors from damage or deterioration until acceptance of work.

END OF SECTION

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SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Access door and frame units, fire-rated, in wall, and ceiling locations.

B. Reference drawings for extent, location and size of each type of access door required.

1.02 RELATED SECTIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to work of this section.

B. Section 03 30 00 – Cast-In-Place Concrete: Openings in concrete.

C. Division 7 – Thermal and Moisture Protection: Roof hatches.

D. Division 9 – Finishes: Access tile in suspended or furred acoustic tile ceilings.

E. Section 09 90 00 – Paints and Coatings: Field paint finish.

F. Division 22 – Plumbing: Plumbing components requiring access.

G. Division 23 – Heating, Ventilating and Air Conditioning: Mechanical components requiring access.

H. Division 26 – Electrical: Electrical components requiring access.

1.03 REFERENCES

A. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

B. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 REGULATORY REQUIREMENTS

A. Comply with 2022 California Building Code

1.05 DESIGN REQUIREMENTS

A. Fabricate floor access assemblies to support live load of 100 lb/sq ft with deflection not to exceed 1/240 of span.

1.06 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures, for administrative requirements.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of all access door units. Obtain specific locations and sizes for required access doors from trades requiring access to concealed equipment and indicate on submittal schedule. Submit shop drawings for fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage and accessory items.

D. Samples: Submit two access units, [3x5] inch minimum size illustrating frame configuration, anchors, panel face material, and factory primer color.

E. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions. Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices. Including complete schedule, including types, general locations, sizes, wall and ceiling construction details, finishes, latching or locking provisions, and other data pertinent to installation.

F. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units which may vary slightly from sizes indicated.

G. Project Record Documents: Record actual locations of all access units.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated access doors.

1. Provide access doors of fire rating equivalent to the fire rated assembly in which they are to be installed. Provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in UnderWriters Laboratories, Inc., "Building Materials Directory" for rating shown.

B. Provide products listed and labeled by UL and/or ITS (Warnock Hersey) as suitable for the purpose specified and indicated. Provide UL label on each fire-rated access door.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of fire rated doors.

1.08 PROJECT CONDITIONS

A. Coordinate the work with other work requiring access doors. Coordinate locations with other work, furnish inserts and anchoring devices which must be built into other work for installation of access doors. Coordinate delivery with other work to avoid delays.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Access Doors and Frames:

1. Karp Associates, Inc.
2. Milcor Inc: www.milcorinc.com.
3. J.L. Industries.

2.02 ACCESS DOORS AND PANELS

A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

2.03 FABRICATION AND MATERIALS

A. General: Furnish each access door assembly manufactured as an integral unit, complete with all parts and ready for installation.

B. Steel Access Doors and Frames: Fabricate units of continuous welded steel construction, unless otherwise indicated. Grind welds smooth and flush adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of support shown.

C. Frames: Fabricate from 16-gage steel.

1. Fabricate frame with exposed flange nominal 1" wide around perimeter of frame for units installed in the following construction:

a. Exposed masonry.
b. Exposed concrete.
c. Drywall finish.

2. For gypsum drywall or gypsum plaster, furnish perforated frames with drywall bead.

3. For installation in masonry construction, furnish frames with adjustable metal masonry anchors.

4. For full-bed plaster applications, furnish frames with galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

D. Flush Panel Doors: Fabricate from not less than 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees. Finish with manufacturer's factory-applied prime paint.

1. For fire-rated units, provide manufacturer's standard insulated flush panel/doors, with continuous piano hinge and self-closing mechanism.

E. Recessed Panel Doors: Fabricate from not less than 18-gage sheet steel with face of panel formed to provide recess below surface of applied finish. Reinforce panel as required to prevent buckling. Finish with manufacturer's factory-applied prime paint.

1. Furnish recessed panels for concealed installation in acoustic tile ceiling systems.

2. Furnish recessed panels and frames with expanded metal lath for concealed installation in plaster.

F. Locking Devices: Furnish flush, screwdriver-operated cam locks of number required to hold door in flush, smooth plane when closed.

1. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

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

B. Install frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

D. Adjust hardware and panels after installation for proper operation.

E. Remove and replace panels or frames which are warped, bowed or otherwise damaged.

F. Paint to match adjacent finishes, unless otherwise noted in plans.

END OF SECTION

SECTION 08 71 00 – 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:

a. Swinging doors.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Installation.
6. Rough hardware.

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.

1.3 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

C. California Code of Regulations

1. Title 24: California Building Standards Code

Use date of standard in effect as of Bid date.

BHMA – Builders Hardware Manufacturers Association
2022 California Building Code

Chapter 11B – Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing

1.4 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.

    a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

    a. Door Index; include door number, heading number, and Architects hardware set number.
    b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
    c. Type, style, function, size, and finish of each hardware item.
    d. Name and manufacturer of each item.
    e. Fastenings and other pertinent information.
    f. Location of each hardware set cross-referenced to indications on Drawings.
    g. Explanation of all abbreviations, symbols, and codes contained in schedule.
    h. Mounting locations for hardware.
    i. Door and frame sizes and materials.

4. Key Schedule:

    a. Initiate and conduct meeting(s) with Owner representatives and hardware supplier to determine system keyway(s), keybow styles, structure, stamping, degree of physical security and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner.
    b. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
        1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier and Installer.
2. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:

a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Final approved hardware schedule, edited to reflect conditions as-installed.
d. Final keying schedule
e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.

1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)

a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.

2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.

B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
2. 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.

C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.

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. Inspect and discuss preparatory work performed by other trades.
3. Review required testing, inspecting, and certifying procedures.

F. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

    a. Attendees: Door hardware supplier, door hardware installer, Contractor.
    b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

    1. Deliver each article of hardware in manufacturer’s original packaging.

C. Project Conditions:

    1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
    2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

    1. Promptly replace products damaged during shipping.
    2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
    3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. 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.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

    a. Exit Devices:
        1) Mechanical: 3 years.

    b. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.9 MAINTENANCE

A. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.10 REGULATORY REQUIREMENTS (CODE CITATIONS ARE CBC 2022)

A. Doors/doorways as part of an accessible route shall comply with CBC Sections 11B-404.

B. The clear opening width for a door shall be 32” minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into it below 34” and 44” maximum projections into it between 34” and 80” above the finish floor or ground. Door closers and stops shall be permitted to be 78” minimum above the finish floor or ground. CBC Section 11B-404.2.3.

C. Handles, pulls, latches, locks, and other operable parts on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34” minimum and 44” maximum above finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides. CBC section 11B-404.2.7.

D. The force for pushing or pulling open a door shall be as follows: CBC Section 11B-404.2.9.

    1. Interior hinged doors, sliding or folding doors, and exterior hinged doors: 5 pounds (22.2 N) maximum. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed 15 pounds (66.7N). These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
    2. The force required for activation any operable parts, such as lever hardware, or disengaging other devices shall be 5 pounds (22.2N) maximum to comply with CBC Section 11B-309.4.

E. Door closing speed shall be as follows per CBC Section 11B-404.2.8:

    1. Closer shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum.
    2. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum.

F. Thresholds shall comply with CBC Section 11B-404.2.5.

G. Floor stops shall not be located in the path of travel and 4” maximum from walls.

H. Hardware (including panic hardware) shall not be provided with “Night Latch” (NL) function for any accessible doors or gates unless the following conditions are met: (Such conditions must be clearly demonstrated and indicated in the specifications)

1. Such hardware has a ‘dogging’ feature.
2. It is dogged during the time the facility is open.
3. Such ‘dogging’ operation is performed only by employees as their job function (non-public use).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturer” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.

E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

2.3 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series.
2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series, Stanley FBB Series.

B. Requirements:

1. Provide five-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

   a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
   b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

   a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

4. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
5. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins
   d. Out-Swinging Interior Lockable Doors: Non-removable pins
   e. Interior Non-lockable Doors: Non-rising pins

6. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
7. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.

2.4 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage L9000 series.
2. Acceptable Manufacturers and Products: No Substitute.

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.
2. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
4. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide a request to exit (RX) switch that is actuated with rotation of inside lever.
5. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

   a. Lever Design: As scheduled.

b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.5 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer: Schlage.
2. Acceptable Manufacturers: No Substitute.

B. Requirements:

1. Provide permanent cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Replaceable Construction Cores.

a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
1) 3 construction control keys
2) 12 construction change (day) keys.

b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.6 KEYING

A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Provide cylinders/cores keyed into Owner's existing factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

C. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

a. Master Keying system as directed by the Owner.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:

a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
b. Patent Protection: Keys and blanks protected by one or more utility patent(s) until the year 2029.

4. Identification:

a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.

b. Identification stamping provisions must be approved by the Architect and Owner.
c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.

a. Change (Day) Keys: 3 per cylinder/core.
b. Option for LFIC or SFIC**:** Permanent Control Keys: 3.
c. Master Keys: 6.

2.7 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP series.
2. Acceptable Manufacturers and Products: No Substitute.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 3/4 inch (19 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.8 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Rockwood, Trimco.

B. Requirements:

1. Provide door pulls as scheduled.

2.9 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Rockwood, Trimco.

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:

   a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.10 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Rockwood, Trimco.

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.11 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International.
2. Acceptable Manufacturers: National Guard, Pemko.

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:

   a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
   b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width

3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.12 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Rockwood, Trimco.

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.13 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Protection Plates: BHMA 630 (US32D)
3. Door Closers: Powder Coat to Match
4. Wall Stops: BHMA 630 (US32D)
5. Weatherstripping: Clear Anodized Aluminum
6. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of hardware, 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Lock Cylinders: Install construction cores to secure building and areas during construction period.

3.3 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.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer 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.

3.4 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 door hardware is without damage or deterioration at time of Substantial Completion.

3.5 DEMONSTRATION

A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.6 DOOR HARDWARE SCHEDULE

A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

B. Do not order material until submittal has been reviewed, stamped, and signed by Architect’s door hardware consultant.

C. Manufacturers and their abbreviations used in this schedule.

IVE Ives

LCN LCN Closers

SCH Schlage Lock

ZER Zero International

D. Hardware Sets:

OVERTUR: OPT0372312 (VER. 4)

HW SET: 01

DOOR NUMBERS:

301-A	301-B	304-A	304-B	306-A	306-B
308-A	308-B	309	311-A	311-B	314-A
314-B					

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CLASSROOM SEC HOLDBK W/ INSIDE INDICATOR	L9077T LLL OMEA IS-LOC L283-150	626	SCH
2	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	DOOR PULL	VR900 STD	630	IVE
1	EA	SURFACE CLOSER	4040XP EDA ST-1944 TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	SET	DOOR SEAL	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL (INCLUDE 103A-223 IF NONE SHOWN AND ASK FOR CLARIFICATION)	A	ZER

INSTALL DOOR SEAL BEFORE CLOSER.

HW SET: 02

DOOR NUMBERS:
302 303
EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	630	IVE
1	EA	CORRIDOR LOCK	L9456T OMEA L583-363	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	4040XP REG TBSRT	689	LCN
1	EA	WALL OR FLOOR STOP	WS406/407CVX OR FS436/438 AS REQ'D	630	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	SET	DOOR SEAL	429AA-S	AA	ZER
1	EA	DOOR SHOE	111AA	AA	ZER
1	EA	THRESHOLD	PER SILL DETAIL (INCLUDE 103A-223 IF NONE SHOWN AND ASK FOR CLARIFICATION)	A	ZER

HW SET: 03

DOOR NUMBERS:
305A 305B
EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CORRIDOR LOCK W/ OUTSIDE INDICATOR	L9456T OMEA L583-363 OS-OCC	626	SCH
1	EA	FSIC CORE	30-120 EV29 T	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	SET	DOOR SEAL	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL (INCLUDE 103A-223 IF NONE SHOWN AND ASK FOR CLARIFICATION)	A	ZER

HW SET: 04

DOOR NUMBERS:

316 317

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM W/DEADBOLT	L9480T LLL OMEA L583-363 L283-150	626	SCH
1	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	DOOR PULL	VR900 STD	630	IVE
1	EA	SURFACE CLOSER	4040XP HEDA ST-1944 TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	RAIN DRIP	142AA (OMIT WHERE OVERHANG OCCURS)	AA	ZER
1	SET	DOOR SEAL	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL (INCLUDE 103A-223 IF NONE SHOWN AND ASK FOR CLARIFICATION)	A	ZER

INSTALL DOOR SEAL BEFORE CLOSER.

HW SET: 05

DOOR NUMBERS:

307-A 307-B 307-C 307-D 310-A 310-B 310-D

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	L9071T OMEA IS-LOC	626	SCH
2	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL OR FLOOR STOP	WS406/407CVX OR FS436/438 AS REQ'D	630	IVE
1	EA	DOOR SEAL	188SBK PSA	BK	ZER

THE PREP ROOM SIDE OF THE DOOR IS THE INSIDE / SECURE SIDE.

HW SET: 06

DOOR NUMBERS:

310-C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	L9071T OMEA IS-LOC	626	SCH
2	EA	PRIMUS CORE	20-740-XP	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR SEAL	188SBK PSA	BK	ZER

THE PREP ROOM SIDE OF THE DOOR IS THE INSIDE / SECURE SIDE.

END OF SECTION

SECTION 09 24 00

CEMENT PLASTERING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Lath and cement plaster for soffits, exterior walls, interior walls and ceilings where indicated, and base coats for ceramic wall tile installation.

1. All exterior walls shall be provided with lath and cement plaster a minimum of 8 feet from ground level.

B. Related Work:

1. Substrates such as concrete masonry and cast-in-place concrete.
2. Plaster soffit backing material.
3. Wood and metal stud framing.
4. Section 09 30 00 – Tiling.
5. Section 09 90 00 – Painting and Coating.

1.02 REFERENCE STANDARDS

A. Comply with applicable provisions of Chapter 25, Part 2, Title 24, California Building Code, 2022. Where required for fire protection, shall also conform to the provisions of Chapter 7.

B. Install plaster work in accordance with the Plaster and Lathing Systems Manual issued by the Southern California Plastering Institute, Inc.. Acceptable practice per Technical Services Information Bureau, Technical Bulletins, www.tsib.org, Phone (714) 221-5530.

1.03 SUBMITTALS

A. Samples:

1. Submit in accordance with Section 01 33 00 – Submittal Procedures, and the General Conditions, samples of color and texture for Architect's review.

2. Provide samples of aluminum channel screeds and trim, three (3) of each color indicated.

3. Provide a 4 foot by 8 foot sample panel of each plaster system required on project, at a field location selected by Architect. Once sample installation has been approved, that sample becomes the standard of quality expected for that system throughout the project.

1.04 QUALITY ASSURANCE

Provide protection of materials and assemblies in place from plastering operations. Drawings are not necessarily intended to assign construction sequence or method, therefore, protection of in place materials and assemblies may be required in excess of that which can be construed from drawings. Furnish, install, then remove all that protection and scaffolding or staging at no additional cost.

PART 2 - PRODUCTS

2.01 PLASTER MATERIALS

A. Cement: ASTM C150, Type I or II, Portland, 50 percent (50%) plastic cement by TXI Riverside Cement.

B. Lime: ASTM C206, dry hydrated type. Lime putty, if proposed, shall weigh more than 83 pounds per cubic foot.

C. Sand: ASTM C144, clean and well graded from coarse to fine.

D. Water: Clean and free from injurious amounts of acid, alkali, and organic matter.

E. Fiber Reinforcing: Provide chopped alkali-resistant glass fibers or 15 denier polypropylene fibers for use in scratch and brown coats.

F. Color: Provide integral color stucco coat, colors as selected by Architect (3 minimum), manufactured by Expo Stucco, La Habra Stucco, Omega Products International, or equal. Integral coloring is to be used regardless of the fact that field painting is also required.

G. High-Strength Gypsum Plaster: Structo-Base by U.S. Gypsum Co., or approved equal with average dry compressive strength of 2,800 psi per ASTM C472 for mix of 100 pounds of plaster with two cubic feet of sand.

H. Gypsum Finish Coat: Red Top Keene’s Cement by U. S. Gypsum Co., or approved equal meeting ASTM C61.

2.02 LATH AND ACCESSORIES

A. Lath:

1. At vertical surfaces without rigid back-up (between framing members) provide 3.4 pound, expanded metal wire (diamond mesh), galvanized, ASTM C847, paper backed at exterior locations, manufactured by Clarkwestern Dietrich Building Systems, LLC, ClarkDietrich Metal Lath and Accessories, or other approved. Provide with paper meeting FS QQ-L-101C, Type I, Grade D, at soffits and walls in wet areas.
2. At vertical surfaces with rigid back-up (plywood) at exterior, over one layer of Grade D paper and one layer of leather back plaster felt, 1-1/2" x 17 gage woven wire galvanized stucco netting (self furring lath with staple attachment over plywood substrate is unacceptable), and at interior locations 1-inch x 20 gage woven wire stucco netting, ASTM C1032 as manufactured by Clarkwestern Dietrich Building Systems, LLC, ClarkDietrich Metal Lath and Accessories, or equal. Lath shall be held a minimum of 1/4-inch away from rigid back-up by the use of furring nails. Self furring lath with staple attachment over plywood substrate is unacceptable.

3. At Exterior Soffits: Provide 3/8-inch rib, expanded diamond mesh weighing 3.4 pounds per square yard, fabricated from galvanized steel sheets, ASTM C847.

B. Accessories: Provide galvanized trim such as Dietrich Cornerite TM, beads, screeds, and prefabricated joints for control and expansion/contraction, unless otherwise noted on Drawings.

1. Wire Staples: 16 gage by 1-3/8 inches long by 3/4- inches wide, or barbed roof nails 1-1/2 inches long with 7/16-inch head. At horizontal soffits provide 5/8-inch wide, 1-1/2 inches long, No. 9 W&M gauge ring shank hook staples.

2. Hanger Wires: 8 gage

3. Tie Wires: 16 gage or 18 gage. See Drawings.

4. Sheet Metal Items: 26 gage corner beads, base screeds, runners, and expansion screeds.

5. Expansion joint with expansion flange, including prefabricated joints for control and expansion/ contraction.

6. Hot-Rolled Carrying Channels: 1-1/2 inches deep, weighing 1.12 pounds per lineal foot with wire hangers spaced 36 inches on centers.

7. Cold-Rolled Furring Channels: 7/8-inch deep x 22 gage hat section, spaced at 16 inches on centers.

8. Drip screeds as indicated on Drawings, or vented casing style bead.

9. Vent Screeds: Fry channel screed aluminum extruded alloy 6063 TS, PCS-75-V 300 factory baked on custom color to match exterior plaster at soffit. Install where indicated on Drawings.

10. Plaster Screeds and Moldings: Provide aluminum extruded alloy 6063 TS channel screeds and moldings by Fry Reglet Corp., as shown on the Drawings. Provide factory baked on custom color as selected by Architect.

11. Furring Nails: Corrosion resistant with cardboard furring spacers.

C. Galvanize metal fastening devices such as staples, nails, screws, and wire ties.

D. Bonding Agent: Provide Plaster-Weld, or other approved, to allow proper bond of plaster to substrate.

2.03 ELASTOMERIC COATING

A. Where indicated on the drawings, provide 100% acrylic elastomeric exterior finish coating, including prime coats for adhesion or base coat as required for to level finish on existing walls or soffits. Architect to select from manufacturer's standard finishes. Color shall be a custom color selected by the Architect.

B. Acceptable Manufacturers and Products:
   1. Weatherlastic by Dryvit (Basis of Design)
   2. Thorolastic by Thoro / BASF Chemical Co.

PART 3 - EXECUTION

3.01 PREPARATION

A. Properly prepare surfaces, substrates, and previously installed assemblies to receive of plaster finish.

B. Ensure that existing surfaces are clean and free of loose and foreign material. Apply necessary surface treatments such as bonding agents when required or recommended.

C. Lightly sandblast or acid wash existing surfaces where such treatment is recommended by the Plastering Institute, and where such treatment will not harm other surfaces or assemblies.

D. Inspect framing systems in place to see that they are rigidly and permanently fastened; ready to receive lath, and provide written acceptance of substrate.

3.02 FIELD QUALITY CONTROL

A. Comply with the requirements of California Building Code Chapter 25 for support of lath:

"2507.3 Lath attachment to horizontal wood supports. [DSA-SS, DSA-SS/CC and OSHPD 1 & 4]

Where interior or exterior lath is attached to horizontal wood supports, either of the following attachments shall be used in addition to the methods of attachment described in referenced standards listed in Table 2507.2.

1. Secure lath to alternate supports with ties consisting of a double strand of No. 18 W & M gage galvanized annealed wire at one edge of each sheet of lath. Wire ties shall be installed not less than 3 inches (76 mm) back from the edge of each sheet and shall be looped around stripping, or attached to an 8d common wire nail driven into each side of the joist 2 inches (51 mm) above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches (51 mm) above the bottom of the joist and the ends of the wire secured together with three twists of the wire.

2. Secure lath to each support with 1/2-inch-wide (12.7 mm), 11/2-inch-long (38 mm) No. 9 W & M gage, ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath not more than 3 inches (76 mm) from edge of each sheet. Such staples may be placed over ribs of 3/8-inch (9.5 mm) rib lath or over back wire of welded wire fabric or other approved lath, omitting the 10d nails."

END OF COMMENT

1. Interiors: Application of Metal Plaster Bases shall comply with the requirements of CBC section 2507.

2. Vertical and Horizontal Assemblies shall comply with CBC section 2507.

3.03 INSTALLATION

A. Install lath with long dimension at right angles to supports. Lath over solid backing shall have at least 1/4-inch clearance from backing.

B. Stagger ends of lath to avoid continuous joints. Lap joints at least 2 inches. Butt lath into internal corners and reinforce angles with Cornerite reinforcement, secured along edges at no more than 10 inch intervals.

C. Attach lath to supports and side laps at 6 inches on centers maximum.

D. Fasteners for lath and metal accessories (reveals, expansion joints, screeds, etc.) must be into wood framing members (on plywood only), and lengths need to consider plywood thickness (verify minimum penetration into wood studs, blocking, plates)

E. Install control joints at maximum 10 foot intervals in each direction. Ensure a waterproof joint. Where recommended by the Plastering Institute or required by Code, install weep screeds.

F. Attach plastering accessories to supports using blocking, provide true grounds for plaster. Wire-tie, nail or staple to supporting substrates. When solid flange moldings are installed the stucco netting shall be cut and wire placed over the flange before the molding is fastened to the substrate. Place additional building paper over the upper flange of horizontal moldings.

G. If wood grounds are not shown, install preformed corner beads.

H. As work progresses, build-in expansion/contraction joints as shown on drawings. If not detailed, place as recommended by Lath and Plastering Manual but gain written approval from Architect on their exact location prior to installation.

3.04 NUMBER OF COATS AND THICKNESS

A. Interior Base Coats for Ceramic Tile: Provide scratch approximately 1/2-inch thick, to receive brown coat by tile installer. Refer to tile section 09 30 00, for additional information.

B. Exterior Veneer Stucco Over C.M.U.: Brown coat and two finish coats approximately 5/8-inch total thickness to cover substrate and provide medium dash finish coat with light knockdown.

C. Exterior Stucco Over Lath and Framing: Scratch, brown and two finish coats approximately 7/8-inch thick. Provide medium dash finish coat, with light knock down.

D. High-Strength Gypsum Plaster Over Metal Lath: Scratch, brown and Keene Cement Finish coats; smooth troweled.

3.05 APPLICATION

A. Scratch and Brown Coats: Apply with sufficient material to completely cover lath and scratch across supports. Patch cracks in brown coat prior to application of finish.

B. Exterior Finish Coats: Apply in two coats with an approved type of plastering machine, each coat covering surface uniformly. Apply first coat to form medium dash coat texture pattern, followed by second coat resulting in uniform color and texture throughout project. All plaster will have an integral color in the finish coat. Smooth finishes will be unacceptable.

1. Apply first coat by making several passes with nozzle to completely cover surface.

2. Apply second coat by doubling back the same day, when first coat is sufficiently dry.

C. Refer to Title 24, Section 2504, Part 2, California Building Code 2022, for horizontal assemblies required for plaster ceilings.

3.06 CURING

A. Moist cure the scratch coat for 48 hours prior to application of brown coat. Cure brown coat 7 days prior to application of finish coat (48 hours moist curing, 5 days additional curing.) For moist cure, keep plaster surface continuously wet by water fog spray, or cover surface with absorptive cover kept continuously wet.

3.07 CUTTING AND PATCHING

A. Cut, patch, point up, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections. Repair or replace work to eliminate blisters, buckles, excessive crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to the substrate has failed.

B. Sand smooth-troweled finishes lightly to remove trowel marks and arises.

3.08 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces that are not to be plastered. Repair floors, walls, and other surfaces that have been stained, marred, or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers, and equipment and clean floors of plaster debris.

B. Provide final protection and maintain conditions, in a manner suitable to ensure that plaster will remain intact without damage or deterioration at time of Substantial Completion.

C. Plaster from beads, screeds, base, and trim. Leave work clean and ready for painting.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

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1.01 SUMMARY

A. Section includes: Framing required for gypsum board ceilings, blocking and furring channels, as required, gypsum board walls and ceilings and taped and sanded joint treatment where required, including adhesives and texturizing as indicated on the Drawings and specified herein.

B. Related Sections:

1. Section 06 10 00 – Rough Carpentry.
3. Division 10
4. Section 09 90 00 – Painting and Coating.

1.02 REFERENCE STANDARDS

A. Work to conform to California Building Code, 2022, Chapter Title 24, Part 2.

B. Perform gypsum board systems work in strict accordance with recommendations of the following reference standards, unless otherwise specified in this section or required by local code. Keep a copy of applicable reference standards in field office for duration of project.

1. ASTM C1396 – Standard Specification for Gypsum Board.

2. ASTM C1177 – Standard Specification for Glass Mat Gypsum Substrate for use as Sheathing.

3. ASTM C475 – Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

4. ASTM C514 – Standard Specification for Nails for the Application of Gypsum Board.

5. ASTM C557 – Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

6. ASTM C1002 – Standard Specification for steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

7. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.

8. ASTM E413 – Classification for Rating Sound Insulation.

9. ASTM C840 – Standard Specification for Application and Finishing of Gypsum Board.

10. ASTM D3273 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

11. Gypsum Association - GA-216 – Recommended Specifications for the Application and Finishing of Gypsum Panel Products.

12. Gypsum Association - GA-254 – Recommended Specifications for the Fire-Resistant Gypsum Sheathing.

13. Underwriters Laboratories, Inc. (UL) - Building Materials Directory.

14. Underwriters Laboratories, Inc. (UL) - Fire Resistance Index.

1.03 SUBMITTALS

A. Submit copies of manufacturer's product information and installation instructions for each item and accessories.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's unopened containers, packages or bundles identified with manufacturer's name, brand, type, and grade clearly marked.

B. Store in dry areas and protect from dampness and deterioration.

C. Protect ready-mixed products from freezing.

D. Protect metal products from rusting.

E. Deliver fire-rated materials bearing testing agency label and required fire classification number.

1.05 PROJECT CONDITIONS

A. Do not install board products unless installation areas comply with minimum temperature and ventilation requirements recommended by manufacturer. As a minimum, provide temperatures above 50 degrees F. during and after installation.

B. Under slow drying conditions, allow additional drying time between coats of joint treatment.

C. Protect installed materials from drafts during hot, dry weather.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide gypsum board materials manufactured by one of the following:

United States Gypsum (USG)
Pabco Gypsum
Georgia Pacific
National Gypsum Company

2.02 GYPSUM BOARD:

A. Standard: ASTM C1396 Type I; 5/8-inch thick, Type X with U.L. designation as required by U.L. listing, tapered edges, ends square cut, maximum permissible lengths

B. Water-resistant: 5/8-inch thick, Type X with U.L. designation as required by U.L. listing, tapered edges, ends square cut, maximum permissible lengths.

1. Water Resistant Board: Use type and thickness as required for U.L. Fire description but not less than 5/8-inch U.L. labeled “WRX” meeting ASTM C1396.

2. Joint Tape: SHEETROCK Joint Tape.

3. Setting Type Joint Compound: Easy Sand or DURABOND by USG.

D. USG FIBEROCK® brand:

1. VHI panel, high-density cellulose wall panels, long edges tapered to form a shallow channel for joint reinforcement. Setting-type joint compound is required.

2. Panels to comply with ASTM D3273, C1629; Thickness: 5/8 inch, unless otherwise indicated.

E. GEORGIA-PACIFIC DENSSHIELD® brand:

1. Water-Resistant treated core covered front and back with acrylic coated high-density fiberglass mats.

2. Panels to comply with ASTM D3273, E96; Thickness: 5/8 inch, unless otherwise indicated.

F. GEORGIA-PACIFIC DENSGLASS®: Exterior Sheathing

1. Mold and Moisture Resistant Fiberglass Mats
2. Panels to comply with ASTM D3273 thickness ½” unless otherwise specified.

G. Impact Resistant Gypsum Board: Interior Sheathing

1. Georgia-Pacific – ToughRock®
2. National Gypsum – Hi-Abuse XP®
3. USG – Fiberock® Abuse-Resistant Panels

2.03 GYPSUM BOARD ACCESSORIES

A. Provide gypsum board accessories in accordance with GA-216, and as shown on drawings and specified.

B. Trims: Provide accessories such as corner beads and edge trim as metal fabrications. Plastic materials will not be acceptable.

1. Cornerbead: Use SHEETROCK paper faced metal outside corner, B1 XW EL.

2. L-Trim: Use SHEETROCK paper faced metal “L” trim, B4.

3. J-Trim: Use SHEETROCK paper faced metal “J” trim, B9.

4. Control Joint: Use No. 93,Amico

5. Bullnose Cornerbead: Use SHEETROCK paper faced metal 3/4-inch, or 1-1/2 inch (as selected by Architect). Bullnose outside corner.

C. Provide suspension system for applications of gypsum board using the components required by Drawings, and in accordance with ASTM C645, and Chapter 25, Title 24, California Building Code.

D. Fasteners: Corrosion resistant conforming to ASTM C1002.

1. Wood Studs: Minimum 1-1/4 inch, Type W, bugle head.
2. Metal Studs: Minimum Type S, bugle head.
3. Ceiling Furring: S-12, bugle head at 12 inches at all edges and supports.

E. Adhesive: Provide type manufactured by US Gypsum or other approved, appropriate for attaching board to dissimilar substrate materials shown on Drawings.

1. Gypsum board to gypsum board- Durabond or Easy Sand.

2. Gypsum board to coreboard, or sound deadening board- Durabond or Easy Sand.

3. Gypsum board to cementitious substrates- Durabond 90.

F. Hanger Wire: Provide No. 9 pre-straightened hanger wires.

G. Furring Channels: Provide 7/8-inch hat or Z-type furring channels fabricated from minimum 22 gage galvanized steel.

H. Joint Treatment:

1. Paper tape conforming to ASTM C475, or USG Heavy Duty.

2. Compound-powdered or ready-mixed conforming to ASTM C475. Taping and topping joint compound or all-purpose joint compound may be used.

I. Texturing:

1. Wall Texturing: Provide materials manufactured by one of the following:

Hamilton Drywall Products
USG
National Gypsum Co.

2. Ceiling Texturing: Provide materials manufactured by one of the following:

   Hamilton Drywall Products
   USG
   National Gypsum Co.

J. Shims: Provide for between studs and gypsum board for level and true wall plane.

K. Drywall Channel Screeds: Provide channel screeds and moldings by Fry Reglet Corp., as shown on the Drawings. Provide custom colors as selected by the Architect.

L. Acoustical Sealant: USG SHEETROCK Acoustical Sealant.

M. Drywall Primer: USG SHEETROCK 1st Coat.

N. Setting Compound: DURABOND or Easy Sand.

2.04 EXTERIOR WALL SHEATHING

A. Product: GEORGIA-PACIFIC DENSGLASS®: Exterior Sheathing

1. Mold and Moisture Resistant Fiberglass Mats.
2. Panels to comply with ASTM D3273 thickness 5/8".

2.05 ACCESS DOORS

A. In partitions and ceilings installed in accordance with this Section, provide doors where shown on the Drawings and where required for access to mechanical installations and electrical installations. Verify quantity, type and location with mechanical and electrical trades.

B. Types:

1. Refer to Specifications Section 22 05 29, and Division 22, Plumbing Sections, for types of access doors. Contractor shall provide appropriate access doors for all plumbing, electrical and mechanical devices which need access for future maintenance purposes.

2. For piercing fire-rated surfaces, provide access doors having the same fire rating as the surface being pierced.

3. For tile surfaces and toilet rooms, provide stainless steel access doors and frames, with satin finish.

4. For other installations, provide prime-coated steel access doors and frames for finish painting to be performed at the job listed under Section 09 90 00 of these Specifications.

2.07 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the acceptance of the Architect.

B. Metal Trim: The Drawings do not show all locations and requirements for metal trim. Carefully study the Drawings and the installation, and provide all metal trim normally recommended by the manufacturer of the gypsum wall board accepted for use in this Work.

2.08 WALL SHEATHING

A. Cementitious Fiber-Mat Reinforced Sheathing: ASTM C1325, ANSI A118.9, Cementitious Backer.

1. Product: Subject to compliance with requirements, provide DUROCK® Brand Cement Board by Untied States Gypsum Company.

2. Type and Thickness: 5/8" inch thick.

3. Size: 48" by 96" inches.

2.09 FASTENERS FOR EXTERIOR WALL SHEATHING

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and application.

1. Wood Screws: 1-5/8” inch bugle headed #6 screw with corrosion-resistant coating. Corrosion resistance to comply with printed submittal literature.

2. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: 1-1/4” bugle headed #6 screws with corrosion resistant coating. Corrosion resistance to comply with printed submittal literature.

3. For Steel Framing less than 0.329 inch thick, attach sheathing to comply with ASTM C1002.

4. For Steel Framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C954.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install gypsum board in accordance with the Drawings and with the separate boards in moderate contact but not forced into place.

B. At internal and external corners, conceal the cut edges of the boards by the overlapping covered edges of the abutting boards.

C. Stagger the boards so that corners of any four boards will not meet at a common point except in vertical corners.

D. Joints between wall and floor shall not exceed 1/8-inch. Where sound-rated drywall construction is indicated, seal construction at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C919 and manufacturer's recommendation for location of edge trim, and close off sound-flanking paths around or through construction, including sealing of partitions above acoustical ceilings.

E. Ceilings: Install the gypsum wallboard to ceilings with the long dimension of the wallboard at right angles to the supporting members.

1. Wall board may be installed with the long dimension parallel to supporting members that are spaced 16 inches on centers when attachment members are provided at end joints.

F. Ceiling Suspension System: Carrying Channels shall be securely hung from the structure above, spaced as shown and noted on the Drawings, but in no case more than 4'-0" on center. Hanging wire shall be securely fastened to the structure above as detailed, as recommended by the manufacturer of the suspension system components and as required to meet all Building Code requirements. Installation shall conform to Division of the State Architect, IR 25-3.13.

1. Hanging wires shall be securely fastened to the carrying channels, saddle-tied by at least three turns around each channel, and shall be spaced as shown and noted on the Drawings, but in no case more than 4'-0" on center.

2. Channels shall be located within 4 inches of parallel walls and shall be cut short of abutting walls 1/2-inch, plus or minus 1/4-inch. Carrying channels shall be leveled with turnbuckles where required.

G. Furring Channels shall be securely fastened to carrying channels and shall be spaced 24 inches on center, unless shown otherwise on the Drawings. Furring channels shall be fastened to carrying channels with furring clips manufactured for this purpose.

H. Walls: Install the gypsum wallboard to studs at right angles to the furring or framing members.

1. Make end joints, where required, over framing or furring members.
2. Install gypsum wallboard over full height of all stud walls.

I. Attaching:

1. Drive the specified screws with clutch-controlled power screwdrivers, spacing the screws 12 inches on centers at ceilings and 16" on center at walls.

2. Where framing members are spaced 24 inches apart on walls, space screws 12" on centers.

3. Attach double layers in accordance with the pertinent codes and the manufacturer's recommendations as accepted by the Architect.

4. Attach to wood as required by governmental agencies having jurisdiction.

J. Access Doors:

1. By careful coordination with the Drawings and with the trades involved, install the specified access doors (Section 10 00 00 and specifications in Division 23, Mechanical) where required.

2. Anchor firmly into position, and align properly to achieve an installation flush with the finished surface.

3.03 JOINT TREATMENT

A. Inspect areas to be joint treated, verifying that the gypsum wall board fits snugly against supporting framework.

B. In areas where joint treatment and compound finishing will be performed, maintain a temperature of not less than 55 degrees for 24 hours prior to commencing the treatment, and maintain temperature until joint finishing compounds have dried.

C. Apply the joint treatment and finishing compound by machine or hand tool.

D. Provide a minimum drying time of 24 hours between coats, with additional drying time in poorly ventilated areas.

E. Embedding Compounds:

1. Apply to gypsum wallboard and fastener heads in a thin uniform layer.

2. Spread the compound not less than 3 inches wide at joints, center the reinforcing tape in the joint, and embed the tape in the compound. Then spread a thin layer of compound over the tape.

3. After this treatment has dried, apply a second coat of embedding compound to joints and fastener heads, spreading in a thin uniform coat to not less than 6 inches wide at joints, and feather edged.

4. Sandpaper between costs as required.

5. When thoroughly dry, sandpaper to eliminate ridges and high points.

F. Finishing Compounds:

1. After embedding compound is thoroughly dry and has been completely sanded, apply a coat of finishing compound to joints and fastener heads.

2. Feather the finishing compound to not less than 12 inches wide.

3. When thoroughly dry, sandpaper to obtain a uniformly smooth surface, taking care not to scuff the paper surface of the wallboard.

4. Texture finish walls and ceilings to be painted. Submit a sample to the Architect for acceptance.

3.04 CORNER TREATMENT

A. Internal Corners: Treat as specified for joints, except fold the reinforcing tape lengthwise through the middle and fit neatly into the corner.

B. External Corners:

1. Install the specified corner bead, fitting neatly over the corner and securing with the same type fasteners used for installing the wallboard.
2. Space the fasteners approximately 6 inches on centers, and drive through the wallboard into the framing or furring member.

3. After the corner bead has been secured into position, treat the corner with joint compound and reinforcing tape as specified for joints, feathering the joint compound out from 8 inches to 10 inches on each side of the corner.

3.05 CLEANUP

A. In addition to other requirements for cleaning, use necessary care to prevent scattering gypsum wallboard scraps and dust, and to prevent tracking gypsum and joint finishing compound onto floor surfaces.

B. At completion of each segment of installation in a room or space, promptly pick-up and remove from the working area all scrap, debris, and surplus material of this Section.

END OF SECTION

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DSA IR 25-2

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

Disciplines: Structural

History: Revised 03/18/22 Under 2019 CBC
Last Revised 11/09/17 Under Prior CBCs
Original Issue 05/18/11

Division of the State Architect (DSA) documents referenced within this publication are available on the DSA Forms or DSA Publications webpages.

PURPOSE

This Interpretation of Regulations (IR) provides guidelines for the design and installation of metal suspension systems for lay-in ceilings on projects under DSA jurisdiction. This IR does not preclude the use of other systems, including proprietary systems as discussed in Section 4 below or custom designed systems, when approved by DSA.

SCOPE

This IR is applicable to the design, material requirements, gravity load support, lateral load resistance, and interface with mechanical and electrical appurtenances for the installation of metal suspension ceilings with lay-in ceiling panels. It covers flat and level ceiling systems whose total weight, including luminaires, services, and other devices, does not exceed 4 pounds per square foot (PSF). Heavier systems, faceted systems, ceilings that support lateral loads from partitions, and free-floating ceilings supported by chains or cables are beyond the minimum requirements of this IR and require project-specific design and details.

This IR provides a library of details illustrating the requirements of this IR (see Appendix A below). The detail library is available in REVIT format for download from the DSA website. The registered design professional (RDP) is responsible to select only the appropriate details that are applicable to the project-specific scope defined on the construction drawings. The registered design professional shall also revise the library details to provide the project-specific information where required as noted in brackets with bold and italicized text, such as "***[RDP TO SPECIFY…]***". It is not permitted to reproduce the body of this IR on the construction documents, except as indicated in Sections 5.9, 5.10, and Appendix A below.

The primary focus of this IR is a typical, flat ceiling with mineral or glass fiber tiles, modular light fixtures, and mechanical registers that drop into the ceiling grid. Other types of installations are also addressed but require additional design and detailing by the design team to produce a set of code compliant details that will be reviewed by DSA. General guidance is provided for sloped ceilings (see Section 2.7 below) and linear luminaires (see Appendix B below).

BACKGROUND

Metal suspension ceiling systems with lay-in tiles are a common type of ceiling construction. Providing guidelines to clarify the design and construction of these systems in compliance with code prescribed requirements promotes consistency in detailing and construction documents, ease of plan review, and quality field installation.

California Building Code (CBC) Section 1617A.1.21 requires the design and installation to comply with American Society for Testing and Materials (ASTM) standard specifications C635, C636, and E580. This section of the CBC modifies American Society of Civil Engineers Standard 7 (ASCE 7), Section 13.5.6.2 by adding an exception to the end of Section 13.5.6.2.2 and adding Section 13.5.6.2.3.

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

1. DESIGN AND INSTALLATION REQUIREMENTS

1.1 Ceiling System Components

1.1.1 Shall comply with ASTM C635 and ASTM E580 Section 5.1.

1.1.2 The ceiling grid system must be rated heavy duty per ASTM E580 Section 5.1.1 as defined by ASTM C635. Cross tees shall have a minimum load carrying capability of 16 pounds per linear foot per ASTM E580 Section 5.3.3.

1.1.3 Main runners, cross runners, splices, expansion devices and intersection connectors shall be designed to carry a mean ultimate test load of not less than 180 pounds in compression and tension per ASTM E580 Section 5.1.2.

1.1.4 Hanger and brace wires shall conform to ASTM A641 and the material properties required by *IR 25-1: Maximum Allowable Load for Ceiling Wires*. Hanger and brace wires shall be #12-gauge (0.106-inch diameter) or larger.

1.2 Suspension System Installation

1.2.1 Shall comply with ASTM C636 and ASTM E580 Section 5.2.

1.2.2 #12-gauge hanger wires may be used for up to and including a 4-foot by 4-foot grid spacing and shall be attached to main runners. Wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops per ASTM E580 Section 5.2.5. Refer to Appendix A Detail 2.35 below for a graphical illustration. Splices in hanger wires shall develop 50 percent of the wire allowable load. Only one splice is permitted in the entire length of a hanger wire. Refer to Appendix A Detail 6.10 below for a graphical illustration.

1.2.3 Provide #12-gauge hanger wires at the ends of all main and cross runners within 8-inches of the support or within one-fourth of the length of the end tee, whichever is least, for the perimeter of the ceiling area. Perimeter hanger wires are not required when the length of the end tee is 8-inches or less. Refer to Appendix A Detail 2.60 below for a graphical illustration.

1.2.4 Ceiling grid members shall be attached to two adjacent walls (attached condition) per ASTM E580 Section 5.2.3 and Figure 4. Ceiling grid members shall be at least 3/4-inch clear of perimeter wall angles on the other walls (free condition) per ASTM E580 Section 5.2.3 and Figure 5. Refer to Appendix A Detail 2.60 below for a graphical illustration.

1.2.5 If a wall or multiple walls are specified in a plan configuration that is not orthogonal to the ceiling grid system, the runner to wall connections shall be as follows. If the following provisions cannot be met, then a project-specific layout of main and cross runners and their connections shall be designed and specified on the construction drawings.

1.2.5.1 At least two adjacent perimeter walls shall be connected to the ceiling grid as attached.

1.2.5.2 Main runners shall be oriented in the direction that facilitates at least one end being connected to a “attached” wall condition.

1.2.5.3 One end of each main runner should be free and clear of wall as required by Section 1.2.4 above.

1.2.5.4 Opposite ends of some cross runner lines may have the same wall connection type (i.e., attached-attached or free-free). This is permitted with non-orthogonal configurations, but the number of cross runner lines with like connections at each end should be minimized.

1.2.6 The width of the perimeter supporting closure angle shall be not less than 2-inches except as allowed by Section 1.2.7 below.

1.2.7 Use of angles with widths less than 2-inches in conjunction with qualified proprietary perimeter clips may be acceptable.

1.2.7.1 Closure angle shall be screwed or otherwise positively attached to the wall studs or other supporting structure (e.g., blocking).

1.2.7.2 Proprietary perimeter clips shall be attached to the supporting closure angle with a minimum of two screws per clip.

1.2.7.3 Proprietary perimeter clips shall be installed around the entire ceiling perimeter except that a steel pop rivet may be used at the attached sides in lieu of clips when permitted by the evaluation report.

1.2.7.4 The proprietary perimeter clip shall be qualified by approved test criteria of ASCE Section 13.5.6.2.2.a. The qualified proprietary perimeter clip shall be in accordance with Section 4 below.

1.2.8 At the unattached walls (free condition) of the ceiling perimeter provide interconnection between the runners to prevent lateral spreading per ASTM E580 Section 5.2.4. A metal stabilizer or a #16-gauge wire with a positive mechanical connection to the runner may be used and placed within 8-inches of the wall. Where the perpendicular distance from the wall to the first parallel runner is 8-inches or less, the stabilizer or #16-gauge wire is not required. Refer to Appendix A Detail 2.60 below for a graphical illustration. The use of proprietary perimeter clips to eliminate the installation of spreader bars is acceptable in accordance with Section 4 below.

1.3 Lateral Force Bracing Assembly Installation

1.3.1 Lateral force bracing assemblies consisting of a compression strut and four #12-gauge splayed bracing wires oriented 90 degrees from each other are required for all ceiling areas. Refer to Appendix A Detail 2.35 below for a graphical illustration.

Exception: Lateral force bracing may be omitted for suspended ceiling systems with an area of 144 square feet or less when lateral restraint is provided at all perimeter walls in accordance with CBC Section 1617A.1.21, Item #4 and ASCE 7 Section 13.5.6, Exception 1.

1.3.2 Lateral force bracing assemblies shall be spaced per Table 1 below for all values of the component importance factor (I_P) of the ceiling. Refer to Appendix A Details 2.10, 2.11 and 2.12 below for graphical illustrations. In cases where the brace assembly spacing changes along the height of the building per Table 1 below, each level of the reflected ceiling plan shall indicate the required spacing.

TABLE 1: LATERAL FORCE BRACE ASSEMBLY SPACING

Design Spectral Acceleration Parameter, (S_{DS})	Brace Assembly Spacing	
	$z/h \le 0.5$[a]	$z/h > 0.5$[a,b]
$S_{DS} \le 1.15$	12’-0” x 12’-0”	12’-0” x 12’-0”
$1.15 < S_{DS} \le 1.73$	12’-0” x 12’-0”	8’-0” x 12’-0”
$S_{DS} > 1.73$	8’-0” x 12’-0”	8’-0” x 8’-0”

Footnotes:
a. Where, as defined in ASCE 7 Section 13.3.1:
z = height in structure of point of attachment of ceiling with respect to the base.
h = average roof height of the structure with respect to the base.
b. It shall be permitted to use the brace assembly spacing for “z/h > 0.5” for the full building height.

1.3.3 There shall be a brace assembly a distance of not more than one-half of the spacing required by Table 1 from each surrounding wall, expansion joint, and ceiling edge at any vertical offset. For example, where the brace spacing is 8-feet by 12-feet, the edge distance shall be 4-feet in the direction of the 8-foot spacing and 6-feet in the direction of the 12-foot spacing.

1.3.4 The slope of bracing wires shall not exceed 45 degrees from the horizontal plane and wires shall be taut. Splices in bracing wires shall develop the wire allowable load. Only one splice is permitted in the entire length of a single brace wire. Refer to Appendix A Detail 6.10 below for a graphical illustration.

1.3.5 Compression struts shall meet the following requirements:

1.3.5.1 The strut shall be sized to adequately resist the vertical component force induced by the ceiling bracing wires and have a maximum kl/r not to exceed 300. The strut sizes and maximum lengths listed in Appendix A Detail 3.21 below meet this requirement for ceilings complying with the general requirements of this IR.

1.3.5.2 The strut shall not be more than one (horizontal) in six (vertical) out of plumb.

1.3.5.3 Separate compression struts at least 6-inches from all unbraced ducts, pipes, conduit, etc.

1.3.6 Changes in the ceiling plane elevation shall have independent positive bracing systems for lateral movement and seismic loads.

1.3.7 Proprietary lateral force bracing assemblies may be acceptable in accordance with Section 4 below. The manufacturer, model number, and evaluation report number of the proprietary lateral force bracing assemblies shall be specified. Details of the attachment of the proprietary assembly to ceiling grid members and floor/roof structure in accordance with the evaluation report shall also be provided.

1.4 Attachment of Hanger and Bracing Wires

1.4.1 Fasten hanger wires with not less than three tight turns in 3-inches. Hanger wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops (see ASTM E580 Section 5.2.7.2). Refer to Appendix A Detail 4.10 below for a graphical illustration.

1.4.2 Fasten bracing wires with not less than four tight turns in 1-1/2-inches. Bracing wire loops shall be tightly wrapped and sharply bent to prevent any vertical movement or rotation of the member within the loops (see ASTM E580, Section 5.2.7.2). Refer to Appendix A Sheet 4.10 for a graphical illustration.

1.4.3 Hanger and bracing wire anchorage to the structure shall be installed in such a manner that the direction of the anchorage aligns closely with the direction of the wire (e.g., bracing wire ceiling clips shall be bent as shown in the details in Appendix A and rotated as required to align closely with the direction of the wire, lag or eye screws in wood shall be installed so they align closely with the direction of the wire, etc.).

1.4.4 Separate all ceiling hanger and bracing wires at least 6-inches from all unbraced ducts, pipes, conduit, etc.

1.4.5 Hanger and bracing wires shall not attach to or bend around obstructions including but not limited to piping, ductwork, conduit and equipment. Provide trapeze or other supplementary support members at obstructions to allow typical hanger spacing. Brace assemblies must be configured and/or located to avoid obstructions while maintaining the required maximum brace assembly spacing.

1.4.6 Provide additional hangers, struts, and brace assemblies as required at all ceiling breaks, soffits, or discontinuous areas.

1.4.7 Hanger wires that are more than one (horizontal) in six (vertical) out of plumb shall have counter-sloping wires. See ASTM C636 Figure 1 and Appendix A Detail 4.40 below for acceptable counter-sloping methods.

1.4.8 Hanger wire connection to the structure above shall be capable of carrying not less than a 90-pound allowable load when tested per Test Method ASTM E3090 (see ASTM E580 Section 5.2.7.2).

1.4.9 Attachment of the bracing wires to the structure above and to the main runners shall be adequate for the load imposed. The weight (W_p) shall be taken as not less than 4 PSF for calculating seismic forces (F_p).

1.4.10 Post-installed anchors (e.g., expansion anchors, screw anchors and power-actuated fasteners) shall have a current evaluation report in accordance with *IR A-5: Acceptance of Products, Materials and Evaluation Reports*. Minimum embedment of post installed anchors per the current evaluation report are permitted to supersede the minimum embedment noted in the Appendix A details below provided the design professional demonstrates the adequacy of the design.

1.4.11 Power-actuated fasteners in concrete are not permitted for bracing wires.

1.4.12 The DSA-approved construction documents shall include a plan for installing post-installed anchors in prestressed concrete when applicable. The plan shall demonstrate how the location of existing prestressing tendons and strands will be field-verified and denoted as necessary to avoid interference.

1.5 Expansion Joint and Seismic Separation Joints

1.5.1 Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors and lobbies or other similar areas. Refer to Appendix A Details 2.30, 2.31, 2.40, and 2.41 below for graphical illustrations.

1.5.2 For ceiling areas exceeding 2,500 square feet, a seismic separation joint shall be provided to divide the ceiling into areas not exceeding 2,500 square feet in accordance with ASTM E580 Section 5.2.9. Refer to Appendix A Detail 2.45 below for a graphical illustration.

1.6 Luminaires, Services and Other Devices

1.6.1 All luminaires, services and other devices shall be mounted in a manner that will not compromise ceiling performance in accordance with Section 13.5.6.2.2 Item 5 of ASCE 7 as amended by CBC Section 1617A.1.21 and ASTM E580 Sections 5.3 and 5.4.

1.6.2 Ceiling panels shall not support any luminaires, services, or other devices.

1.6.3 Penetrations through the ceiling for sprinkler heads and other similar devices that are not integrally tied to the ceiling system in the lateral direction shall comply with one of the following per ASTM E580 Section 5.2.8.5:

1.6.3.1 Provide a 2-inch oversized ring, sleeve, or adapter through the ceiling tile to allow free movement of 1-inch in all horizontal directions.

1.6.3.2 Provide a flexible sprinkler hose fitting that can accommodate 1-inch of ceiling movement.

1.6.4 Slack safety wires shall be considered hanger wires for installation and testing requirements.

1.6.5 Where Section 1.7.5 or 1.8.4 below require independent vertical support, the system, including attachment to the structure above, shall be capable of supporting four times the weight of the luminaire or service.

1.6.6 Where independent vertical support is provided per Section 1.7.5 or 1.8.4 below, additional slack safety wires are not required.

1.7 Luminaires

1.7.1 All luminaires shall be positively attached to the ceiling suspension systems by mechanical means per California Electrical Code (CEC) Article 410.36. A minimum of two screws or approved fasteners capable of resisting a horizontal force equal to the weight of the fixture are required at each light fixture, per ASTM E580 Section 5.3.1. See Section 2.1.1 below for pendant luminaires.

1.7.2 Surface-mounted luminaires shall be attached to the main runner with at least two positive clamping devices on each fixture. The clamping device shall completely surround the supporting ceiling runner and be made of steel with a minimum thickness of #14-gauge. Rotational spring catches do not comply. A #12-gauge slack safety wire shall be connected from each clamping device to the structure above. Provide additional supports when luminaires measure 8-feet or longer or exceed 56 pounds. Maximum spacing between supports shall not exceed 8-feet.

1.7.3 Luminaires weighing less than or equal to 10 pounds may be supported directly on the ceiling runners, but they shall have a minimum of one #12-gauge slack safety wire connected from the luminaire housing to the structure above.

1.7.4 Luminaires weighing greater than 10 pounds but less than or equal to 56 pounds may be supported directly on the ceiling runners, but they shall have a minimum of two #12-gauge slack safety wires connected from the luminaire housing at diagonal corners to the structure above.

Exception: All luminaires greater than 2-feet wide by 4-feet long and no more than 8-feet long weighing less than 56 pounds shall have a #12-gauge slack safety wire at each corner.

1.7.5 All luminaires weighing greater than 56 pounds shall be independently supported by not less than four taut #12-gauge hanger wires (one at each corner) attached from the luminaire housing to the structure above or other approved hangers. ←

1.8 Services within the Ceiling

1.8.1 All flexible sprinkler hose fitting mounting brackets, ceiling-mounted air terminals, solar daylight tubes, or other services shall be positively attached to the ceiling suspension systems by mechanical means to resist a horizontal force equal to the weight of the component. Screws or approved fasteners are required. A minimum of two attachments are required at each component.

1.8.2 Ceiling-mounted air terminals or other services weighing less than or equal to 20 pounds shall have one #12-gauge slack safety wire attached from the terminal or service to the structure above.

1.8.3 Flexible sprinkler hose fittings, ceiling-mounted air terminals or other services weighing more than 20 pounds but less than or equal to 56 pounds shall have two #12-gauge slack safety wires (at diagonal corners) connected from the terminal or service to the structure above.

1.8.4 Flexible sprinkler hose fittings, ceiling-mounted air terminals or other services weighing more than 56 pounds shall be independently supported directly from the structure above by not less than four taut #12-gauge hanger wires attached from the terminal or service to the structure above or other approved hangers. ←

1.9 Other Devices within the Ceiling

Miscellaneous lightweight devices weighing 20 pounds or less, such as strobe lights, occupancy sensors, speakers, exit signs, etc., shall be attached to the ceiling grid per Section 1.8.1 above. In addition, devices weighing more than 10 pounds shall have one #12-gauge slack safety wire anchored to the structure above per Section 1.8.2 above.

2. ADDITIONAL REQUIREMENTS

2.1 Alternate Luminaire Types

2.1.1 Where pendant luminaires are to be installed in areas with a suspended ceiling, the construction documents shall include complete support details complying with this IR and DSA *IR 16-9: Pendant Luminaires*.

2.1.2 Where recessed linear luminaires are to be installed in areas with a suspended ceiling, refer to Appendix B below for design and construction guidelines.

2.2 Fire-Resistance-Rated Ceilings

2.2.1 Provide a detail and tested assembly number for fire-resistance-rated ceiling assemblies from an authorized testing agency. The components and installation details must conform in every respect with the listed detail and number. Details shall clearly depict all components, including insulation materials, framing and attachment of the design so that the assembly can be constructed and inspected accordingly.

2.2.2 Pop rivets, screws or other attachments are not acceptable unless specifically detailed in the listed construction detail(s), or an approved listing by a State Fire Marshal (SFM) recognized laboratory.

2.3 Acoustical Ceiling Tile Panel Clearance

For ceiling installations utilizing acoustical tile panels of mineral or glass fiber, it is not mandatory to provide 3/4-inch clearance between the acoustical tile panels and the wall on the sides of the ceiling which are free to slip. Clearance between the ceiling grid members and the walls as required by Section 1.2.4 above is required regardless of the ceiling tile material.

2.4 Other Panel Types

Panels weighing more than one-half PSF, other than mineral fiber and glass fiber acoustical tile, and all metal and wood panels shall be positively attached to the ceiling suspension runners by mechanical means, such as bolts, cables, carabiners, d-shaped rings, screws, or rivets, and each attachment shall have the allowable design strength to support 100 percent of the weight of the panel acting in any direction. A minimum of two attachments are required for each panel. For ceiling installations utilizing panels other than mineral or glass fiber, 3/4-inch clearance shall be provided between the ceiling panel and the wall on the sides of the ceiling area which are free to slip, unless otherwise justified by seismic qualification indicated below.

The use of other types of attachment, such as clips, snap-in devices, perforated lips, clamping devices or spring-loaded devices or hooks, shall be listed per IR A-5 and identified for use with the type of ceiling framing members and panels. The listing shall be seismically qualified in accordance with ASCE 7 Section 13.2.5 or 13.2.6.

An alternate means of compliance per California Administrative Code (CAC) Section 4-304 may be proposed and reviewed on a project-by-project basis when using unlisted means of attachment. The alternate means of attachment shall have the allowable design strength to support 100 percent of the weight of the panel acting in any direction and shall be capable of maintaining that strength if the ceiling grid is distorted or out of level.

In lieu of direct restraint attachments, it is also permitted to provide a secondary means of connecting the panel to the grid or structure to retain the panel in case of panel dropout, ceiling grid distortion and ceiling grid becoming out-of-level. The secondary attachment shall have the allowable design strength to support two times the weight of the panel acting in any direction, such as a slack wire or cable.

Special attachment details complying with one of the methods outlined above, such as screws or cables, shall be provided at the perimeter of the ceiling, where panels are cut or altered, and where non-standard panel sizes or edge conditions occur.

2.5 Exits

Ceilings over exit paths shall be installed in accordance with ASCE 7 Section 13.5.6.2.2, Item 1 as amended by CBC Section 1617A.1.21. A main or cross runner shall be installed on all sides of each piece of tile, board or panel and each luminaire or grill. Splices or intersection of such runners shall be attached with through connectors such as pop rivets, screws, pins, plates with end tabs, or other approved connectors.

2.6 Free-Floating Ceilings

Free-floating ceilings (ceilings not attached to any walls) supported by wires in accordance with this IR shall be braced in accordance with Section 1.3 above, regardless of the ceiling area, unless it can be demonstrated the anticipated ceiling movement will not cause failure of the ceiling components or failure of mechanical, electrical, plumbing, or fire and life safety components/systems within the ceiling area and the area of anticipated movement. The anticipated movement can be assumed as the hanger supports swinging to a 45-degree angle from vertical in any plan direction.

The perimeter of free-floating ceilings shall be supported by a continuous runner which is spliced in accordance with ASTM E580 Section 5.1.2.

2.7 Sloped Ceilings

Sloped ceilings with acoustical, mineral or glass fiber tiles, surrounded on all sides by partition walls are permitted in accordance with the requirements of this section. Sloped ceilings not meeting the requirements of this section shall be custom designed and detailed.

2.7.1 The slope of the ceiling shall not exceed the manufacturer's published maximum slope recommendation nor 25 degrees from horizontal, whichever is less. The ceiling shall be square or rectangular in plan. The structure above the sloped ceiling may be flat or sloped in a different direction.

2.7.2 The slope shall occur across a single plane. The slope of the ceiling is to be uniform from the intersection of the wall at the lowest end of the ceiling to the intersection of the wall at the uppermost end of the ceiling. A gable or multifaceted ceiling profile can be accomplished within the parameters of these provisions by replacing a full height wall with a soffit at the ridge or each slope transition line. The design must demonstrate the soffit construction provides strength and stiffness in the plane of the ceiling equivalent to a full height wall.

2.7.3 Specific detailing of the sloped ceiling system is required. The requirements for a level ceiling in this IR also apply to sloped ceilings. Library details specific to sloped ceilings are not provided in Appendix A, but the details provided for level ceilings can be modified to meet the requirements of this section. The design professional shall review manufacturer technical guides for recommended installation to assist in the development of site-specific details.

2.7.4 DSA may require structural calculations to demonstrate the adequacy of the lateral bracing system.

2.7.5 Sloped ceilings shall comply with the following detailing requirements:

2.7.5.1 Attachment of proprietary perimeter clips to the walls shall comply with Section 1.2.7 above.

2.7.5.2 Main runners are to be installed parallel (up/down) to the direction of the ceiling slope.

2.7.5.3 Runners at the bottom/lower end of the slope shall be installed as the attached side.

2.7.5.4 Runners at the top/higher end of the slope shall be installed as the free side.

2.7.5.5 Perimeter wall angles at the top and bottom of the slope are to be shimmed or installed with adjustable wall mounting brackets such that the bottom leg of the angle aligns with the plane of the ceiling. This is to ensure the 90-degree angle of the wall trim in relation to the runner is maintained. Bending the leg(s) of the wall trim to match the slope of the ceiling is prohibited.

2.7.5.6 Hanger wires, including slack wires, are to be installed vertical and plumb.

2.7.5.7 Compression struts are to be installed vertical and plumb in compliance with Section 1.3.5.2 above.

2.7.5.8 Brace wires are to be installed a maximum of 45 degrees from the horizontal plane.

2.7.5.9 Shims between the tiles and the grid are required to ensure panels are centered to resist sliding out.

2.7.5.10 Panel edge hold down clips are to be installed along the top of the grid to the ceiling tiles as follows:

2.7.5.10.1 For ceiling slope less than or equal to 15 degrees from horizontal: Clips are to be installed at each main runner and cross runner around the perimeter of the ceiling in the first bay adjacent to the walls. See Appendix A Detail 2.90 below.

2.7.5.10.2 For ceiling slope greater than 15 degrees but less than or equal to 25 degrees from horizontal: Clips are to be installed per the illustration in Appendix A Detail 2.90.

2.7.5.11 Maintain minimum 3/4" clearance of the runners to the wall angle at the free sides.

2.7.5.12 Seismic clips to attach 7/8-inch wall angle to the ceiling grid are required. The seismic clip shall be attached to the wall angle with two screws.

2.7.6 Sloped free floating ceilings are beyond the scope of this IR. The design professional is responsible to provide project-specific design (including supporting calculations) and details.

3. CEILING SYSTEM ALTERATION

3.1 Existing Grid Cut or Altered

The entire ceiling in the affected space shall be evaluated and upgraded as required to meet the requirements of the current CBC and this IR when any portion of the grid system is cut or altered, and Section 3.1.1 or 3.1.2 below applies:

3.1.1 The existing ceiling has lateral bracing assemblies (4-way brace wires and compression post) with spacing greater than 12-feet on center in either principal axis and the area cut or altered is equal to or less than 10 percent of the entire ceiling area. Ceilings without lateral bracing assemblies are included in this case.

3.1.2 The area cut or altered exceeds 10 percent of the entire ceiling area.

3.1.3 The following apply to the requirements for cut or altered grid systems:

3.1.3.1 The “entire” ceiling in the affected space is defined as the area of ceiling bounded by

four walls or a combination of walls and expansion joints or seismic separation joints.

3.1.3.2 With DSA concurrence, other existing lateral bracing systems may be deemed equivalent to a 4-way brace wire and compression post lateral force bracing system.

3.2 Existing Grid NOT Cut or Altered

Evaluation and associated upgrade to the ceiling grid, suspension system, and lateral force brace assemblies is not required when the ceiling grid is not cut or altered, and the scope of work includes only the following:

3.2.1 Replacement of existing ceiling panels with like panels of equal or lesser weight.

3.2.2 Replacement of luminaires and/or terminals with like units (i.e., equal size and equal or lesser weight) placed in the same locations.

3.2.3 Replacement of only the existing lighting components (e.g., lens, ballast, and/or lamps) within the existing outer light fixture enclosure and the attachment of the outer enclosure to existing grid is not altered.

3.3 Reuse of Existing Ceiling Wires

Existing ceiling hanger and bracing wires may be reused provided they comply with the following:

3.3.1 The gauge and spacing of the wires must comply with the current applicable codes and this IR.

3.3.2 If a new wire is to be spliced to an existing wire, the DSA-approved construction drawings shall include a detail specifying how the splice is to be made. Acceptable wire splice details are provided in Appendix A Detail 6.10 below.

3.3.3 See Section 6 below for testing requirements for the re-use of existing hanger and bracing wire assemblies.

4. DSA ACCEPTANCE OF EVALUATION REPORTS

Ceiling grid systems and components with valid evaluation reports issued by qualified evaluation agencies, in accordance with IR A-5 are accepted by DSA, provided the system or component meets the requirements of CBC Section 1617A.1.21, ASTM C635, ASTM C636, and ASTM E580 Section 5. Where a qualified evaluation report is utilized, the installation shall comply with all the requirements specified in the evaluation report (e.g., connections, member sizes, perimeter details, special clips to wall angles, rigid braces, etc.).

In accordance with IR A-5, DSA will accept HCAI Preapproved Details (OPD) “2013 CBC Standard Suspended Ceiling Details for Acoustical Tile or Lay-in Panel Ceilings” and HCAI Preapproval of Manufacturer Certification (OPM).

Note: The Office of Statewide Health Planning and Development (OSHPD) is now the Department of Health Care Access and Information (HCAI).

5. CONSTRUCTION DOCUMENTS

The construction documents shall clearly identify all suspended ceiling systems, support details and lateral bracing.

5.1 General Requirements

The items listed in this section are required to be provided in the construction documents where applicable to the project scope. This list includes items common to most projects but may not include all information required for all projects. Additional information and/or details may be

required on the construction documents for project-specific specialty conditions, configurations, products, etc.

Except as indicated in both Sections 5.9 and 5.10 below and Appendix A of this IR, it is not permitted to reproduce this IR on the construction documents as a means to meet these requirements.

5.2 Ceiling Systems

A list of acceptable ceiling grid systems must be shown on the construction documents. Each system specified must be classified as heavy duty and shall have a valid evaluation report in accordance with IR A-5. The construction documents shall specify the following for each acceptable grid system:

5.2.1 Manufacturer.

5.2.2 Product name.

5.2.3 Evaluation report number.

5.2.4 Main runner part, model, or catalog number.

5.2.5 Cross runner part, model, or catalog number.

5.2.6 Seismic wall clip (if used).

When manufacturer specific information (e.g., proprietary seismic wall clips, adjustable wall molding brackets, panel hold downs clips, etc.) is provided in the specifications, details on the construction drawings shall be provided and/or coordinated to reflect the same manufacturer specific information.

5.3 Ceiling Suspension System

The ceiling suspension system and its anchorage to the structure shall be fully detailed.

Where accepted proprietary devices, clips, wall angles, brackets, etc. are utilized, the details on the construction documents shall clearly indicate the installation details necessary to show compliance with all evaluation report requirements.

5.4 Ceiling Lateral Force Bracing

The ceiling lateral force bracing system, including bracing wires and compression struts, and the bracing system anchorage to the structure shall be fully detailed on the construction documents. The bracing assembly spacing at each floor and roof level must be clearly indicated.

When a proprietary lateral force bracing system with a valid approval per IR A-5 (e.g., HCAI OPM), the manufacturer's system-specific information and details (e.g., ceiling grid clip, bracing members, connectors, permitted grid manufacturers, etc.) shall be provided on the construction drawings and in the specifications.

5.5 Expansion Joints and Seismic Separations Joints

Expansion joints and seismic separation joints shall be fully detailed, and the location shall be shown on the ceiling plans.

5.6 Luminaires, Services and Other Devices

Details specifying the construction of bracing and anchorage of all luminaires, services and other devices shall be provided as required to comply with this IR. Where pendant luminaires are to be installed in areas with a suspended ceiling, the construction documents shall include complete support details complying with this IR and IR 16-9.

5.7 Supplementary Support Members

Details of trapeze or other supplementary support members necessary to maintain typical hanger spacing while avoiding obstructions shall be shown on the construction documents.

5.8 Partition Bracing

Partition bracing shall be shown on the construction documents and be independent of the ceiling system.

5.9 Ceiling Notes and Details in Appendix A

The ceiling notes and details provided in Appendix A below are deemed to meet the general requirements of this IR. These notes and details shall not be used for construction or inspection except when incorporated in DSA-approved construction documents.

Use of the notes and details is not mandated by DSA; they are provided only as a convenience to the registered design professional for incorporation into the construction documents.

Use of other notes and details created by the registered design professional is always acceptable provided they comply with the CBC and this IR. While these notes and details do not cover every condition that may occur on every project, they are intended to cover conditions common to many projects. It is anticipated their use will facilitate the design, plan review and construction process.

Electronic drawing files of the Appendix A details in Revit LT™ 2020 format are available for download. DSA is providing these electronic drawing files to the registered design professional for convenience only, and DSA is not responsible for issues of compatibility with particular computer systems or conversion to other file formats. The requirements of this IR are in no way changed or modified by providing the registered design professional with the electronic drawing files. The files may not be currently up to date or in conformance with the published IR, and the registered design professional shall verify and coordinate the information with the latest published IR. Information contained in the files may be changed or updated by DSA, and DSA shall have no responsibility to notify or supply the registered design professional with these changes.

5.10 Ceiling Notes and Details: Conditions of Use

The conditions and requirements for use of the ceiling notes and details in Appendix A below are as follows:

5.10.1 The details give no consideration to suitability for use in a specific application, compatibility with other building systems, appropriate use of materials or design, appearances, etc. The registered design professionals listed on the plan review application shall review all such qualities, features and/or properties to ensure code compliance, appropriate integration with other building systems, and proper design for the project-specific conditions and installation.

5.10.2 When the details in the Appendix below are used, they shall be incorporated into the construction drawings submitted for DSA approval. Incorporation by reference alone is not permitted. Only the notes and details applicable to the scope of the project shall be incorporated in the construction documents (e.g., do not incorporate wood connection details in the construction drawings for a concrete structure, do not include essential services building details in the construction documents for a school project, etc.).

5.10.3 Provided the content of the details is not changed, it is left to the discretion of the registered design professional to reconfigure (i.e., renumber, resize, etc.) the details for

integration into the construction drawings.

Exception: The registered design professional (RDP) is required to provide additional information on a detail where indicated in brackets with bold and italicized text, such as "***[RDP TO SPECIFY…]***". These brackets and notes to the registered design professional shall be removed from the details and replaced with the applicable information.

5.10.4 These details submitted as part of the construction documents during the plan review process will be subject to plan review as follows:

5.10.4.1 It is expected no DSA plan review comment will be made on a detail incorporated into the construction documents that is unaltered and found applicable to the project for which it is submitted.

5.10.4.2 Where a detail requires the designer to provide additional information to complete the detail before applying it to the drawings, plan review will be limited to the following:

5.10.4.2.1 A review of only the additional information provided.

5.10.4.2.2 A review to determine if the detail, with the additional information, is applicable to project for which it is submitted.

5.10.4.3 Where a detail incorporated into the construction documents has been altered beyond that described above, it will be subject to a full review for both detail content and applicability to the project for which it is submitted.

5.10.5 Where conditions not covered by the details in Appendix A below occur, project-specific design and details will be required. This includes, but is not limited to, pendant luminaires, projector supports, projector screens, ceiling fans, free-floating ceilings, etc.

6. TESTING

All field testing must be performed in the presence of the project inspector or a special inspector.

6.1 New Installations

Post-installed anchors in concrete used to support hanger wires shall be tested at a frequency of 10 percent. Power-actuated fasteners in concrete shall be field tested for 200 pounds in tension. All other post-installed anchors in concrete shall be tested in accordance with CBC Section 1910A.5.

Post-installed anchors in concrete used to attach bracing wires shall be tested at a frequency of 50 percent in accordance with CBC Section 1910A.5.

6.2 Reuse of Existing Ceiling Hanger Wires and Bracing Wires

6.2.1 All existing ceiling hanger wire/anchor assemblies must be field tested to 200 pounds. If existing hanger wires are spaced no more than 4'-0" on center each way and the first 20 tests pass, the testing frequency can be reduced to 50 percent.

6.2.2 All existing bracing wire/anchor assemblies must be field tested to 440 pounds at a 45-degree angle from horizontal and in the plan direction the wire will be reused. If the first 20 tests pass, the testing frequency can be reduced to 50 percent.

6.2.3 Where a new wire is spliced to an existing wire, each spliced wire/anchor assembly must be field tested to the loads given for existing assemblies above.

6.2.4 The testing frequency reductions given in Section 6.2.1 and 6.2.2 above are not permitted for existing nonconforming buildings subject to rehabilitation in accordance with CAC Section 4-307.

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

REFERENCES:

2019 California Code of Regulations (CCR) Title 24
Part 2: California Building Code (CBC), Section 1617A.1.21
Part 3: California Electrical Code (CEC), Article 410.36
ASCE 7-16 Minimum Design Loads for Building and Other Structures
ASTM C635, C636 and E580

This IR is intended for use by DSA staff and by design professionals to promote statewide consistency for review and approval of plans and specifications as well as construction oversight of projects within the jurisdiction of DSA, which includes State of California public schools (K–12), community colleges and state-owned or state-leased essential services buildings. This IR indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered by DSA.

This IR is subject to revision at any time. Please check DSA's website for currently effective IRs. Only IRs listed on the webpage at www.dgs.ca.gov/dsa/publications at the time of project application submittal to DSA are considered applicable.

APPENDIX A: CONSTRUCTION DOCUMENTS CEILING NOTES AND DETAILS

See Sections 5.9 and 5.10 above for instruction and guidance on the proper use of these notes and details in the construction documents by the responsible design professional (RDP).

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4.20	Hanger Wire Connection to Metal Deck	03/2022
4.21	Hanger Wire Connection to Concrete Over Metal Deck	03/2022
4.22	Hanger Wire Connection to Concrete Slab, Beam, or Joist	03/2022
4.23	Hanger Wire Connection to Structural Steel	03/2022
4.24	Hanger Wire Connection to Metal Stud Wall	03/2022
4.25	Hanger Wire Connection to Sawn Timber	03/2022
4.26	Hanger Wire Connection to Wood I-Joist	03/2022

Detail Title:	REV: 09/21/2015	Detail No.
SHEET INDEX	REV: 03/2022	0.01

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

Sheet Index		
Number	**Title**	**Revision Date**
4.27	Hanger Wire Connection to Wood Chord Truss	03/2022
4.28	Hanger Wire Connection to Open Web Steel Joist	03/2022
4.29	Typical Saddle Tie Detail	03/2022
4.30	Brace Wire Connection at Metal Deck	03/2022
4.31	Brace Wire Connection to Concrete Over Metal Deck	03/2022
4.32	Brace Wire Connection to Concrete Slab, Beam, or Joist	03/2022
4.33	Brace Wire Connection to Structural Steel	03/2022
4.34	Brace Wire Connection to Metal Stud Wall	03/2022
4.35	Brace Wire Connection to Sawn Timber	03/2022
4.36	Brace Wire Connection to Wood I-Joist	03/2022
4.37	Brace Wire Connection to Wood I-Joist	09/21/2015
4.38	Brace Wire Connection to Wood Chord Truss	03/2022
4.39	Brace Wire Connection to Open Web Steel Joist	03/2022
4.40	Hanger Wire Countersloping Methods (Ref. ASTM C363)	03/2022
5.10	Compression Strut Connection Table	03/2022
5.20	Strut Connection to Bare Metal Deck	03/2022
5.21	Strut Connection to Concrete Over Metal Deck	03/2022
5.30	Strut Connection to Concrete Slab, Beam, or Joist	03/2022
5.40	Strut Connection to Structural Steel	03/2022
5.50	Strut Connection to Sawn Timber with Gypsum Board	03/2022
5.51	Strut Connection to Sawn Timber without Gypsum Board	03/2022
5.52	Strut Connection to I-Joist	03/2022
6.10	Ceiling Wire Splices	03/2022

Detail Title:	REV: 09/21/2015 REV: 03/2022	Detail No.
SHEET INDEX		0.01

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

1. CEILING SYSTEM GENERAL NOTES

1.01 Ceiling system components shall comply with ASTM C635 and Section 5.1 of ASTM E580.

1.02 The ceiling grid system must be rated heavy duty as defined by ASTM C635.

1.03 Ceiling systems. The following ceiling system(s) is/are part of the scope of this project:

Manufacturer:	***[RDP to specify]***
Product Name:	***[RDP to specify]***
Evaluation Report Type and Number:	***[RDP to specify]***
Main Runner Part, Model, or Catalog Number:	***[RDP to specify]***
Cross Runner Part, Model, Catalog Number:	***[RDP to specify]***

1.04 Seismic Wall Clip:

Manufacturer's Model:	***[RDP to specify if used]***

1.05 Ceiling panels shall not support any luminaires, air terminals or devices.

1.06 For ceiling installations utilizing acoustical tile panels of mineral or glass fiber, it is not mandatory to provide ¾" clearance between the acoustical tile panels and the wall on the sides of the ceiling which are free to slip. For all other ceiling panel types, provide ¾" clearance between the ceiling panel and the wall on the sides of the ceiling free to slip. Clearance between ceiling grid runners/members and walls shall comply with the details on these drawings regardless of ceiling tile material.

2. MATERIALS

2.01 Ceiling wire shall be Class 1 zinc coated (galvanized) carbon steel conforming to ASTM A641. Wire shall be #12 gauge (0.106" diameter) with soft temper and minimum ultimate tensile strength = 70 ksi.

2.02 Galvanized sheet steel (including that used for metal stud and track compression struts/post) shall conform to ASTM A653, or other equivalent sheet steel listed in Section A3.1 of the North American Specification for the Design of Cold-Formed Steel Structural Members, (AISI S100). Material 43 mil (18 gauge) and lighter shall have minimum yield strength of 33 ksi. Material 54 mil (16 gauge) and heavier shall have a minimum yield strength of 50 ksi. ←

2.03 Electrical metallic tube (EMT) shall be ANSI C80.3/UL 797 carbon steel with G90 galvanizing. EMT shall have minimum yield strength (F_Y) of 30 ksi and minimum ultimate strength (F_U) of 48 ksi.

3. ATTACHMENT OF HANGER AND BRACING WIRES

3.01 Separate all ceiling hanger and bracing wires at least 6 inches from all unbraced ducts, pipes, conduit, etc.

3.02 Hanger and bracing wires shall not attach to or bend around obstructions including but not limited to piping, ductwork, conduit and equipment.

Detail Title:	REV: 09/21/2015	Detail No.
CEILING NOTES	REV: 03/2022	1.00

3.03 Hanger wires that are more than one (horizontal) in six (vertical) out of plumb shall have counter-sloping wires.

3.04 Slack safety wires shall be considered hanger wires for installation and testing requirements.

3.05 Hanger and bracing wire anchorage to the structure shall be installed in such a manner that the direction of the anchorage aligns closely with the direction of the wire (e.g., bracing wire ceiling clips must be bent as shown in the details and rotated as required to align closely with the direction of the wire, screw eyes in wood must be installed so they align closely with the direction of the wire, etc.).

4. FASTENERS AND WELDING

4.01 Sheet metal screws shall comply with ASTM C1513 and ASME B18.6.3. Penetration of screws through joined material shall not be less than three exposed threads.

4.02 Expansion anchors shall be: ***[RDP to indicate manufacturer, product, evaluation report number and test load for each size specified per CBC 1910A.5.4.]***

4.03 Power-Actuated Fasteners shall be: ***[RDP to indicate manufacturer, product, evaluation report number.]***

4.04 If not otherwise specified in the evaluation report, power-actuated fasteners installed in steel shall be installed so the entire pointed end of the fastener is driven through the steel member

4.05 Power-actuated fasteners in concrete or masonry are not permitted for bracing wires.

4.06 Concrete reinforcement and prestressing tendons shall be located by non-destructive means prior to installing post-installed anchors.

4.07 Welding shall be in accordance with AWS D1.3 using E60XX series electrodes.

5. TESTING

5.01 All field testing must be performed in the presence of the project inspector.

5.02 Post-installed anchors in concrete used to support hanger wires shall be tested at a frequency of 10 percent. Power-actuated fasteners in concrete shall be field tested for 200 pounds in tension. All other post-installed anchors in concrete shall be tested in accordance with CBC Section 1910A.5.

5.03 Post-installed anchors in concrete used to attach bracing wires shall be tested at a frequency of 50 percent in accordance with CBC Section 1910A.5.

6. LUMINAIRES

6.01 All luminaires shall be positively attached to the ceiling suspension systems by mechanical means to resist a horizontal force equal to the weight of the luminaire. A minimum of two screws or approved fasteners are required at each luminaire, per ASTM E580 Section 5.3.1.

6.02 Surface-mounted luminaires shall be attached to the main runner with at least two positive clamping devices. The clamping device shall completely surround the supporting

ceiling runner and be made of steel with a minimum thickness of #14 gauge. Rotational spring catches do not comply. A #12 gauge slack safety wire shall be connected from each clamping device to the structure above. Provide additional supports when a luminaire is 8 feet or longer or exceeds 56 pounds. Maximum spacing between supports shall not exceed 8 feet.

6.03 Luminaires weighing less than or equal to 10 pounds may be supported directly on the ceiling runners, shall have a minimum of one #12 gauge slack safety wire connected from the fixture housing to the structure above.

6.04 Luminaires weighing greater than 10 pounds but less than or equal to 56 pounds may be supported directly on the ceiling runners, but they shall have a minimum of two #12 gauge slack safety wires connected from the fixture housing at diagonal corners to the structure above.

Exception: All luminaires greater than two by four feet weighing less than 56 pounds shall have a #12 gauge slack safety wire at each corner.

6.05 All luminaires weighing greater than 56 pounds shall be independently supported by not less than four taut #12 gauge hanger wires (one at each corner) attached from the fixture housing to the structure above or other approved hangers. The four taut #12 gauge wires or other approved hangers, including their attachment to the structure above, shall be capable of supporting four times the weight of the fixture.

7. SERVICES WITHIN THE CEILING

7.01 All flexible sprinkler hose fitting mounting brackets, ceiling-mounted air terminals or other services shall be positively attached to the ceiling suspension systems by mechanical means. Screws or approved fasteners are required. A minimum of two attachments are required at each component.

7.02 Ceiling-mounted air terminals or other services weighing less than or equal to 20 pounds shall have one #12 gauge slack safety wire attached from the terminal or service to the structure above.

7.03 Flexible sprinkler hose fittings, ceiling-mounted air terminals or other services weighing more than 20 pounds but less than or equal to 56 pounds shall have two #12 gauge slack safety wires (at diagonal corners) connected from the terminal or service to the structure above.

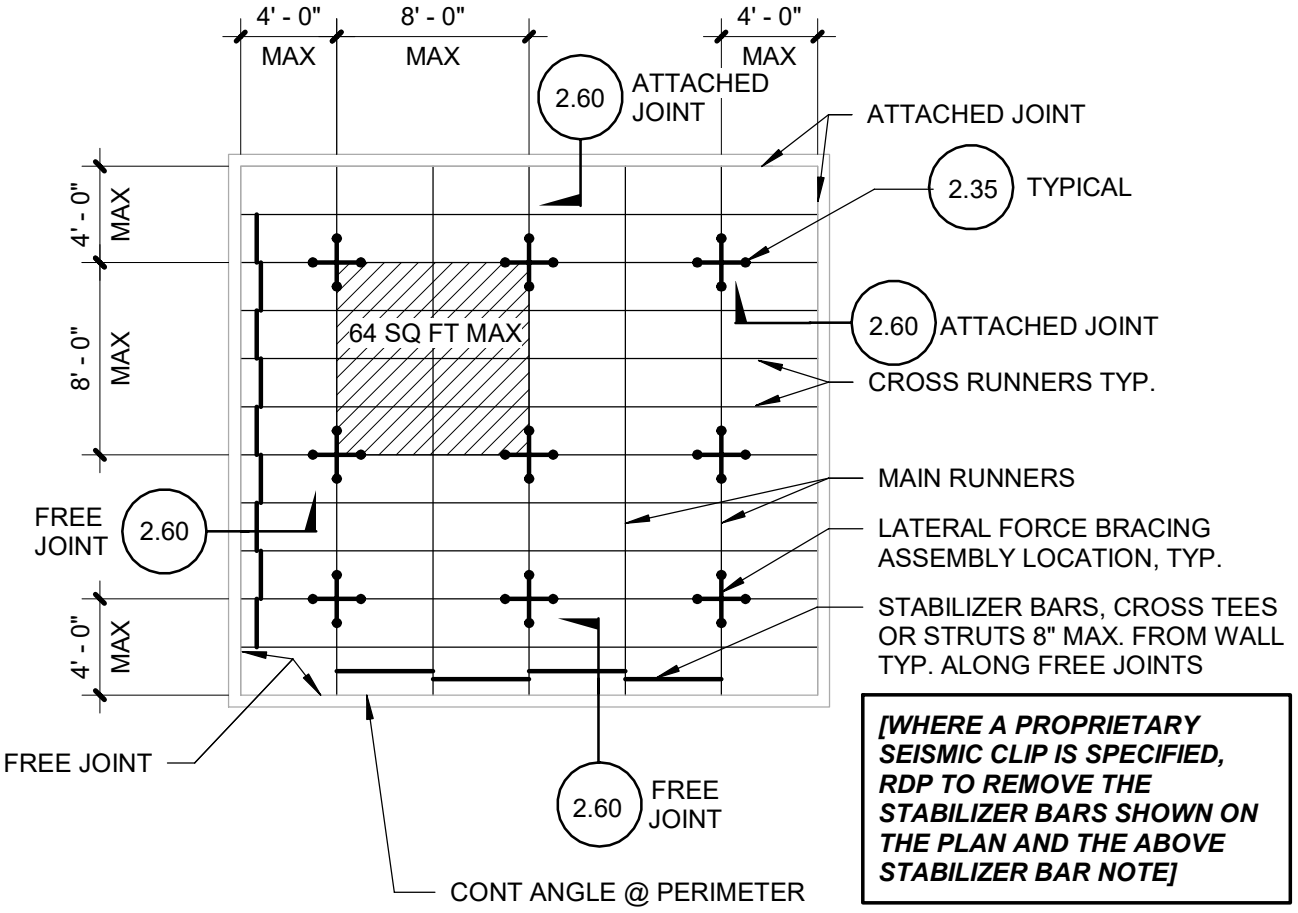
7.04 Flexible sprinkler hose fittings, ceiling-mounted air terminals or other services weighing more than 56 pounds shall be supported directly from the structure above by not less than four taut #12 gauge hanger wires attached from the terminal or service to the structure above or other approved hangers.

8. OTHER DEVICES WITHIN THE CEILING

8.01 All lightweight miscellaneous devices, such as strobe lights, occupancy sensors, speakers, exit signs, etc., shall be attached to the ceiling grid. In addition, devices weighing more than 10 pounds shall have a #12 gauge slack safety wire anchored to the structure above. Devices weighing more than 20 pounds shall be supported independently from the structure above.

Detail Title:	REV: 09/21/2015	Detail No.
CEILING NOTES	REV: 03/2022	1.00

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



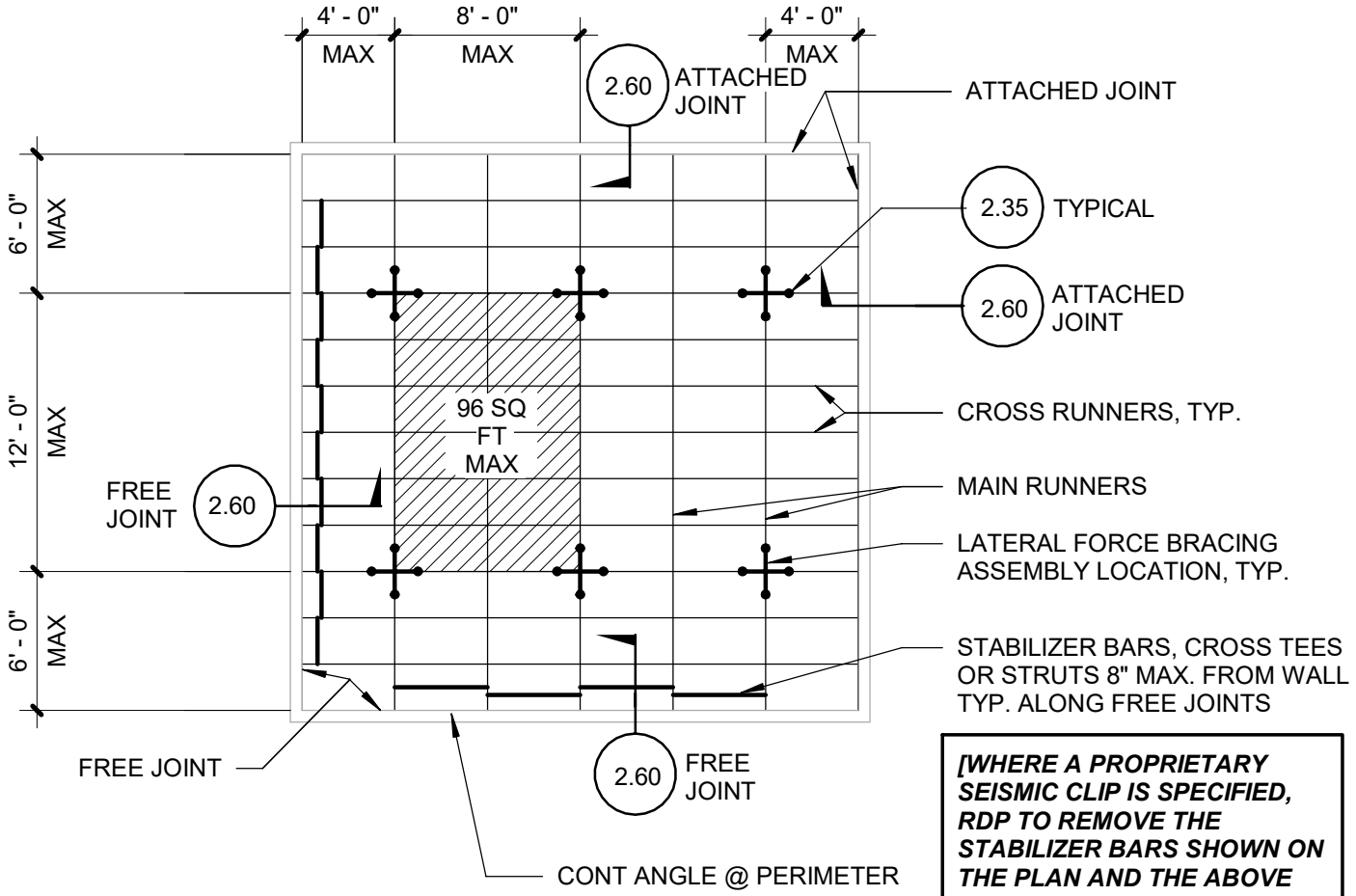
[WHERE A PROPRIETARY SEISMIC CLIP IS SPECIFIED, RDP TO REMOVE THE STABILIZER BARS SHOWN ON THE PLAN AND THE ABOVE STABILIZER BAR NOTE]

NOTE:
BRACING WIRES AND COMP. STRUT SHALL OCCUR AT EVERY 64 SQ. FT. MAX. IN ROOMS OVER 144 SQ. FT.

[WHERE BRACING ASSEMBLY SPACING CHANGES OVER THE HEIGHT OF THE BUILDING, RDP SHALL INDICATE THE REQUIRED SPACING AT EACH LEVEL ON THE REFLECTED CEILING PLANS.]

Detail Title :	REV: 09/21/2015	Detail No.
TYP. CEILING PLAN FOR 8'-0"x8'-0" BRACE ASSEMBLY SPACING	REV: 03/2022	2.10

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



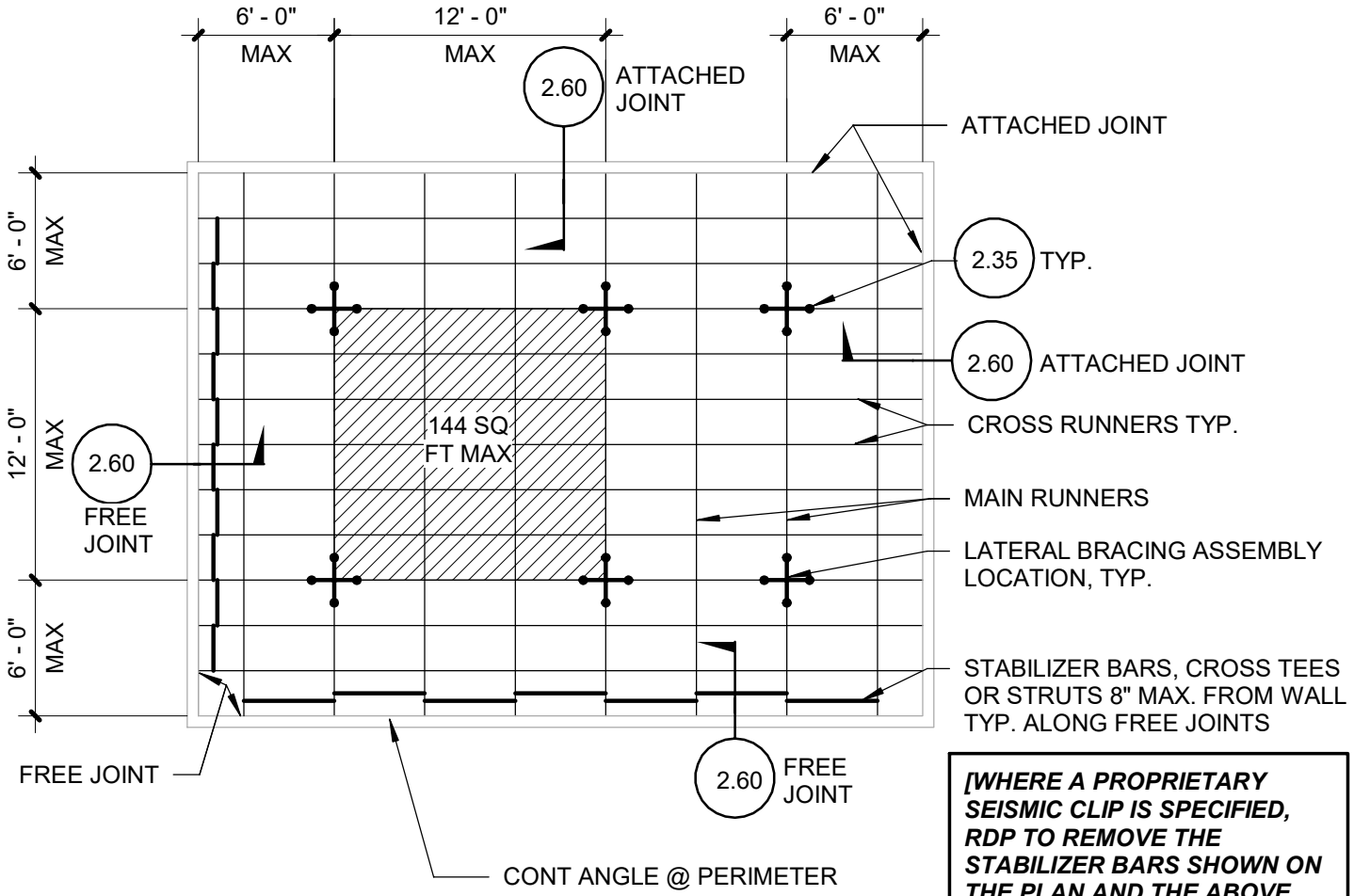
NOTE:
BRACING WIRES AND COMP. STRUT SHALL OCCUR AT EVERY 96 SQ. FT. MAX. IN ROOMS OVER 144 SQ. FT.

[WHERE A PROPRIETARY SEISMIC CLIP IS SPECIFIED, RDP TO REMOVE THE STABILIZER BARS SHOWN ON THE PLAN AND THE ABOVE STABILIZER BAR NOTE]

[WHERE BRACING ASSEMBLY SPACING CHANGES OVER THE HEIGHT OF THE BUILDING, RDP SHALL INDICATE THE REQUIRED SPACING AT EACH LEVEL ON THE REFLECTED CEILING PLANS.]

Detail Title :	REV: 09/21/2015	Detail No.
TYP. CEILING PLAN FOR 8'-0"x12'-0" BRACE ASSEMBLY SPACING	REV: 03/2022	2.11

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



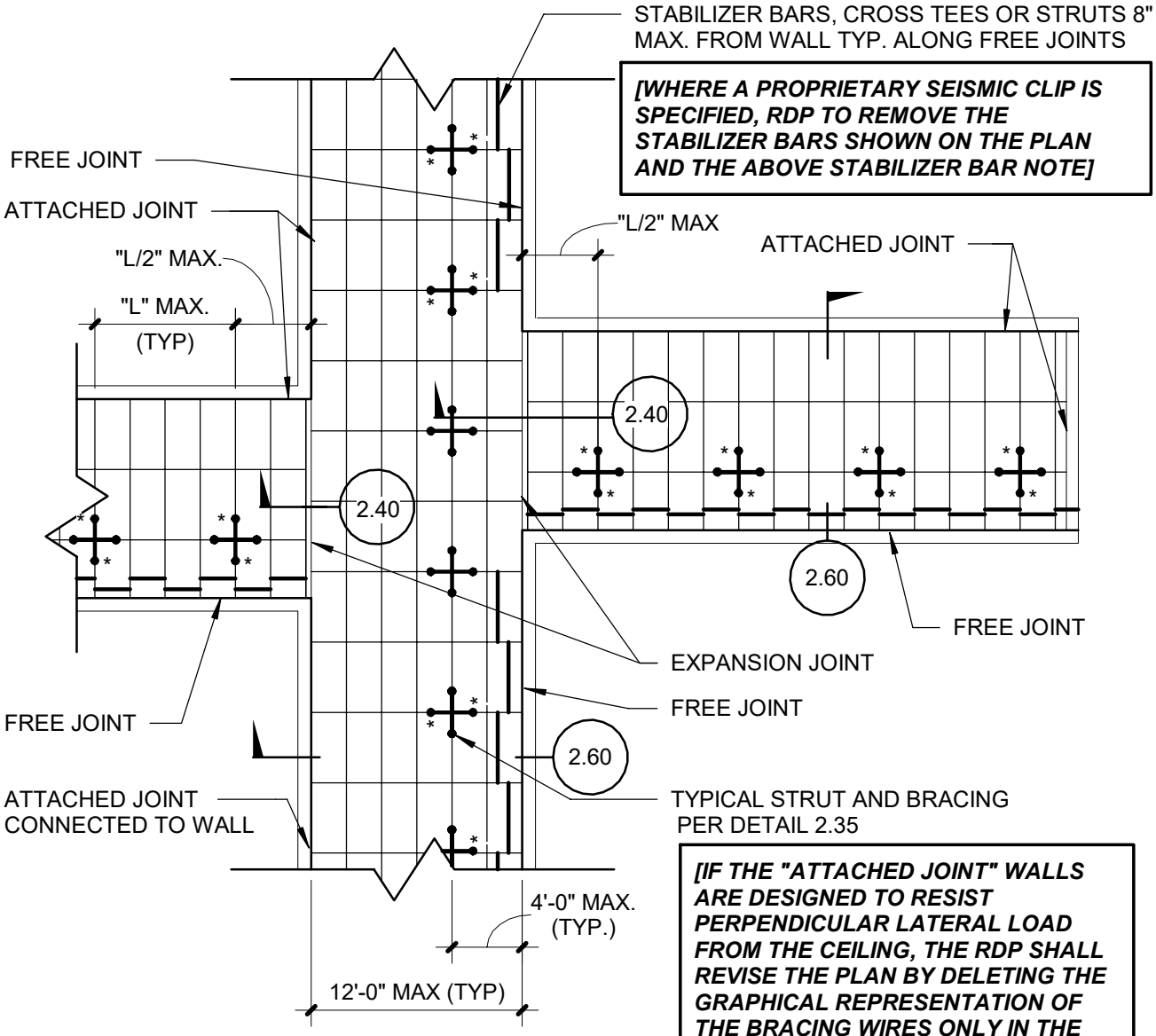
NOTE:
BRACING WIRES AND COMP. STRUT SHALL OCCUR AT EVERY 144 SQ. FT. MAX. IN ROOMS OVER 144 SQ. FT.

[WHERE A PROPRIETARY SEISMIC CLIP IS SPECIFIED, RDP TO REMOVE THE STABILIZER BARS SHOWN ON THE PLAN AND THE ABOVE STABILIZER BAR NOTE]

[WHERE BRACING ASSEMBLY SPACING CHANGES OVER THE HEIGHT OF THE BUILDING, RDP SHALL INDICATE THE REQUIRED SPACING AT EACH LEVEL ON THE REFLECTED CEILING PLANS.]

Detail Title :	REV: 09/21/2015	Detail No.
TYP. CEILING PLAN FOR 12'-0"x12'-0" BRACE ASSEMBLY SPACING	REV: 03/2022	2.12

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



NOTES:

1. "L" IS MAX. BRACE ASSEMBLY SPACING PER CEILING PLAN DETAIL, FOR EXAMPLE, WHERE 8' x 12' SPACING IS SPECIFIED, USE "L" = 8'.

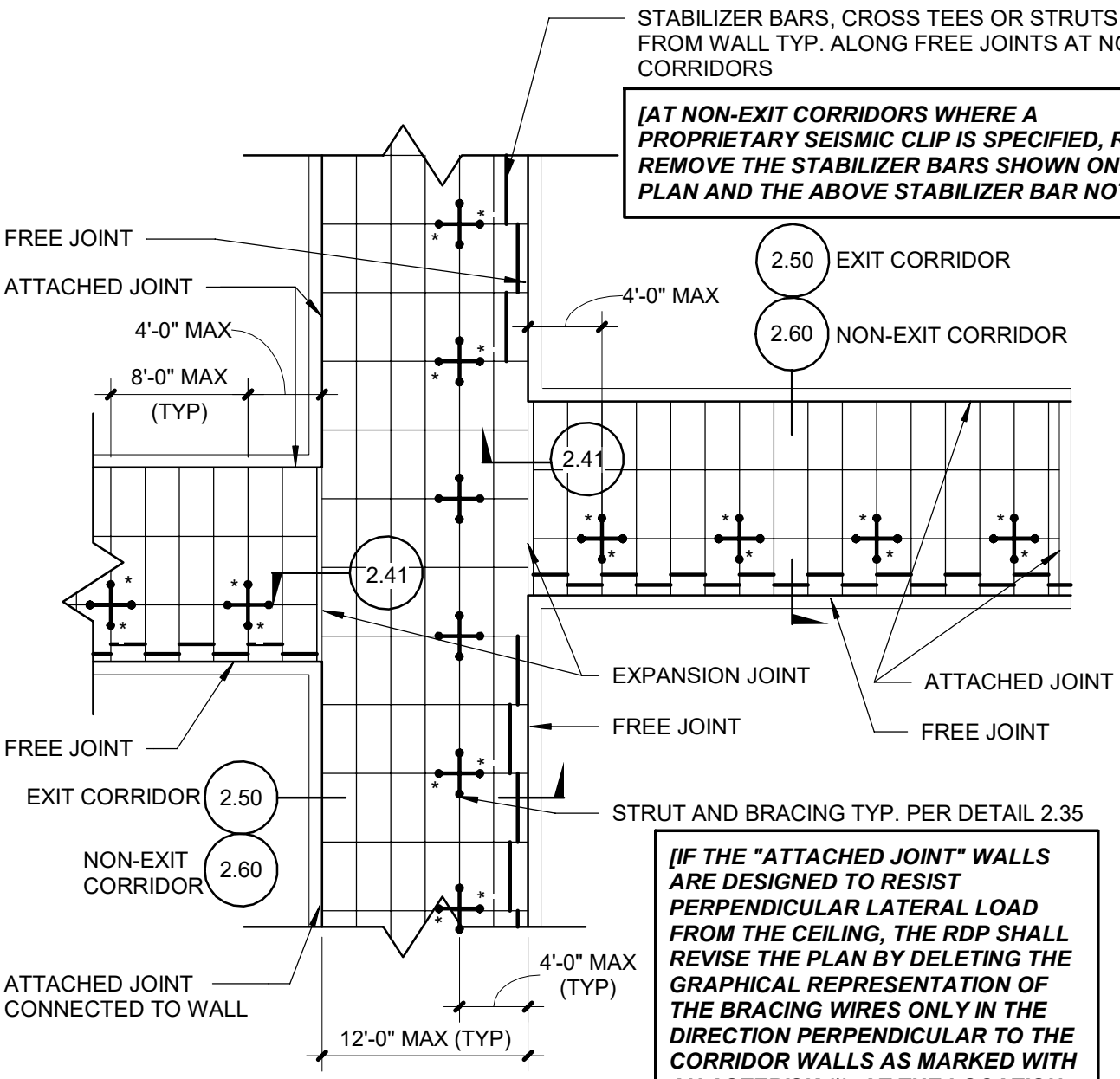
[IF THE "ATTACHED JOINT" WALLS ARE DESIGNED TO RESIST PERPENDICULAR LATERAL LOAD FROM THE CEILING, THE RDP SHALL REVISE THE PLAN BY DELETING THE GRAPHICAL REPRESENTATION OF THE BRACING WIRES ONLY IN THE DIRECTION PERPENDICULAR TO THE CORRIDOR WALLS AS MARKED WITH AN ASTERISK (*). AT THE LOCATION NOTES HERE THE RESULTING SYMBOL WOULD APPEAR THUS:]

[RDP SHALL SHOW EXPANSION JOINT LOCATIONS ON THE PROJECT-SPECIFIC REFLECTED CEILING PLANS.]

[IN ALL CASES THE RDP SHALL REVISE THIS PLAN BY DELETING THE ASTERISK (*).]

Detail Title :	REV: 09/21/2015	Detail No.
CORRIDOR CEILING PLAN (SCHOOL BUILDING)	REV: 03/2022	2.30

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



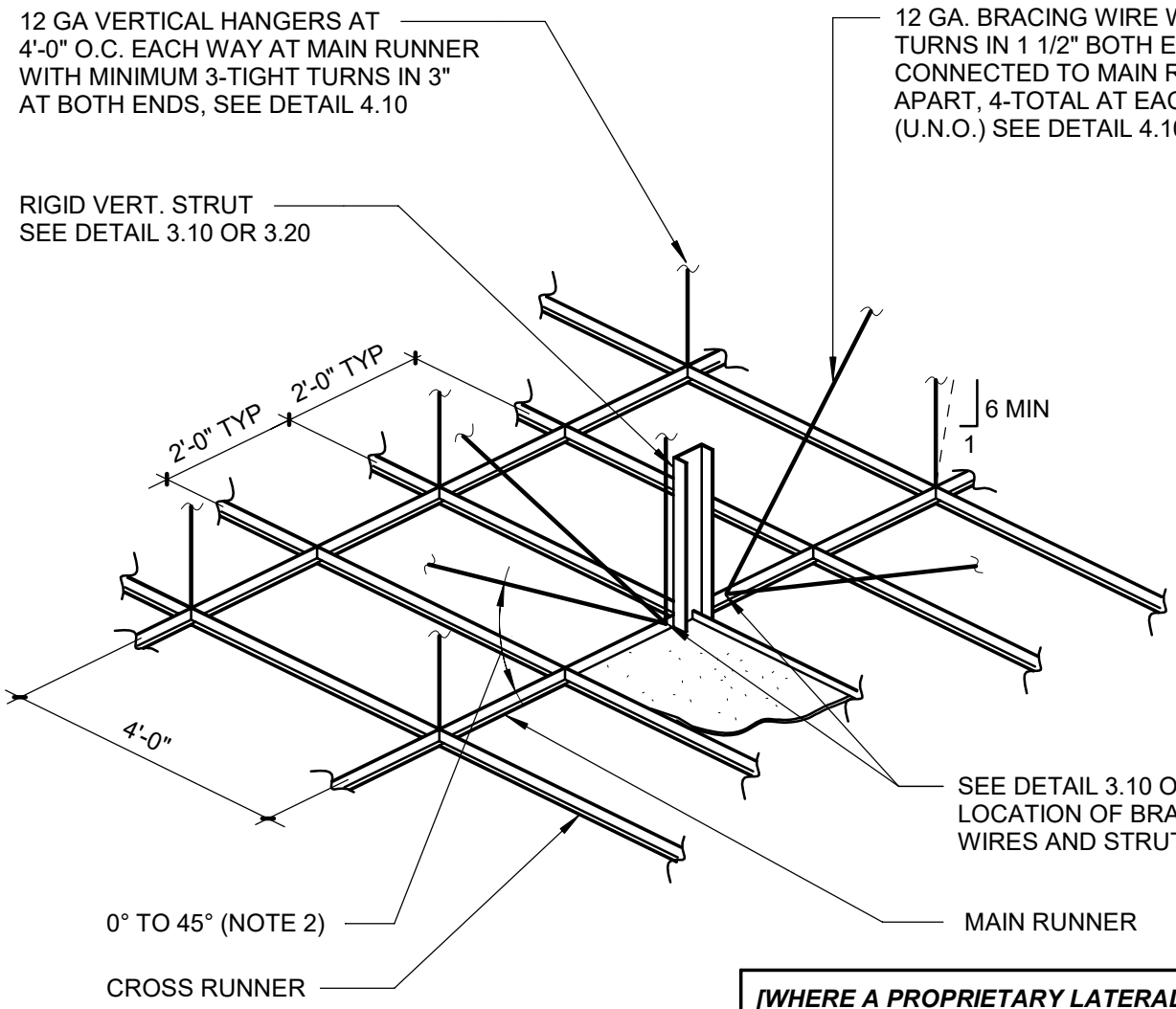
[IF THE "ATTACHED JOINT" WALLS ARE DESIGNED TO RESIST PERPENDICULAR LATERAL LOAD FROM THE CEILING, THE RDP SHALL REVISE THE PLAN BY DELETING THE GRAPHICAL REPRESENTATION OF THE BRACING WIRES ONLY IN THE DIRECTION PERPENDICULAR TO THE CORRIDOR WALLS AS MARKED WITH AN ASTERISK (*). AT THE LOCATION NOTES HERE THE RESULTING SYMBOL WOULD APPEAR THUS:] |

[RDP SHALL SHOW EXPANSION JOINT LOCATIONS ON THE PROJECT-SPECIFIC REFLECTED CEILING PLANS.]

[IN ALL CASES THE RDP SHALL REVISE THIS PLAN BY DELETING THE ASTERISK (*).]

Detail Title :	REV: 09/21/2015	Detail No.
CORRIDOR CEILING PLAN (ESSENTIAL SERVICE BUILDING)	REV: 03/2022	2.31

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



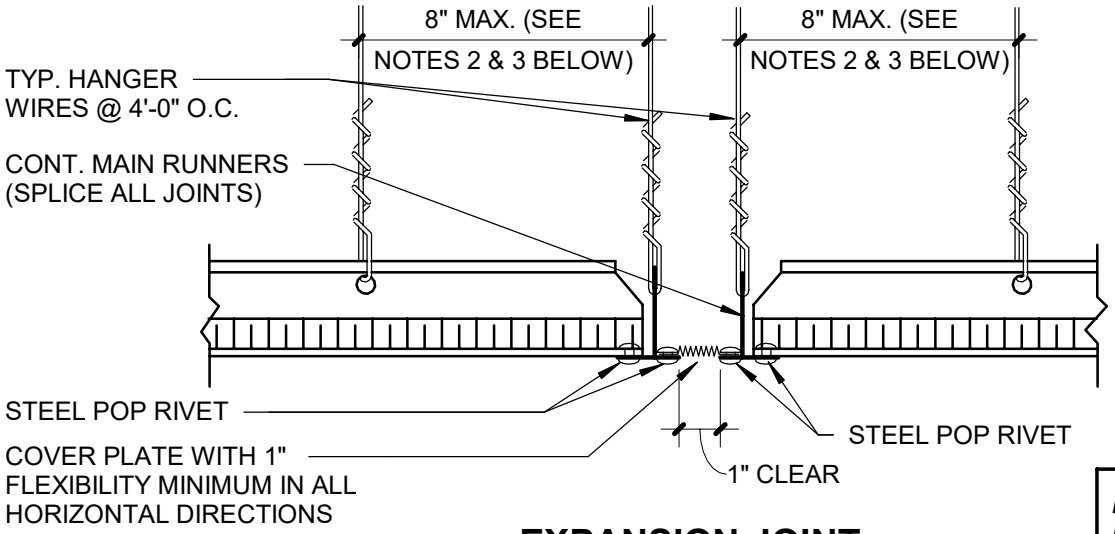
NOTES:

1. STRUTS SHALL NOT REPLACE HANGER WIRES.
2. THE MINIMUM ACCEPTABLE ANGLE IS DETERMINED SUCH THAT THE WIRES DO NOT INTERFERE WITH THE RUNNERS, LIGHT FIXTURES, ETC. AND REMAIN STRAIGHT AND UNOBSTRUCTED.

[WHERE A PROPRIETARY LATERAL BRACING ASSEMBLY IS SPECIFIED, RDP SHALL PROVIDE DETAILS AND SPECIFICATIONS FOR THE INSTALLATION OF THE ENTIRE ASSEMBLY INCLUDING SPACING, APPROVED GRID MANUFACTURER(S), ATTACHMENT TO THE CEILING GRID, BRACING MEMBER SIZES, ATTACHMENT TO THE FLOOR AND ROOF STRUCTURE, ETC.]

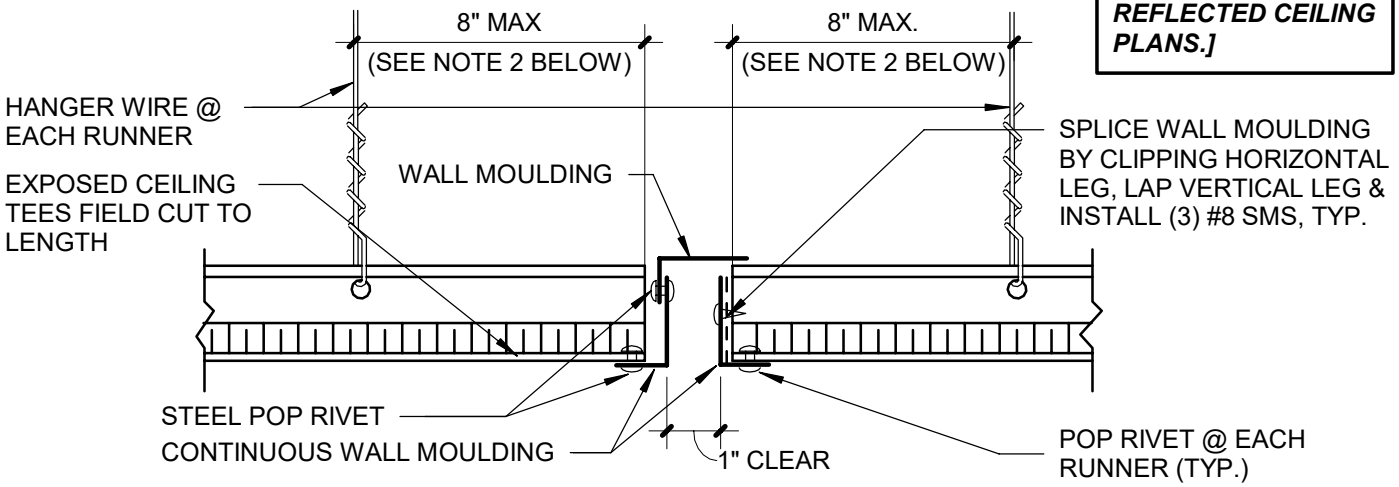
Detail Title :	REV: 09/21/2015	Detail No.
SUSPENSION AND LATERAL BRACING ASSEMBLY	REV: 03/10/2017	2.35
	REV: 03/2022	

SUPSENDED LAY-IN PANEL CEILING: 2019 CBC



EXPANSION JOINT

[RDP SHALL SHOW EXPANSION JOINT LOCATIONS ON THE PROJECT-SPECIFIC REFLECTED CEILING PLANS.]



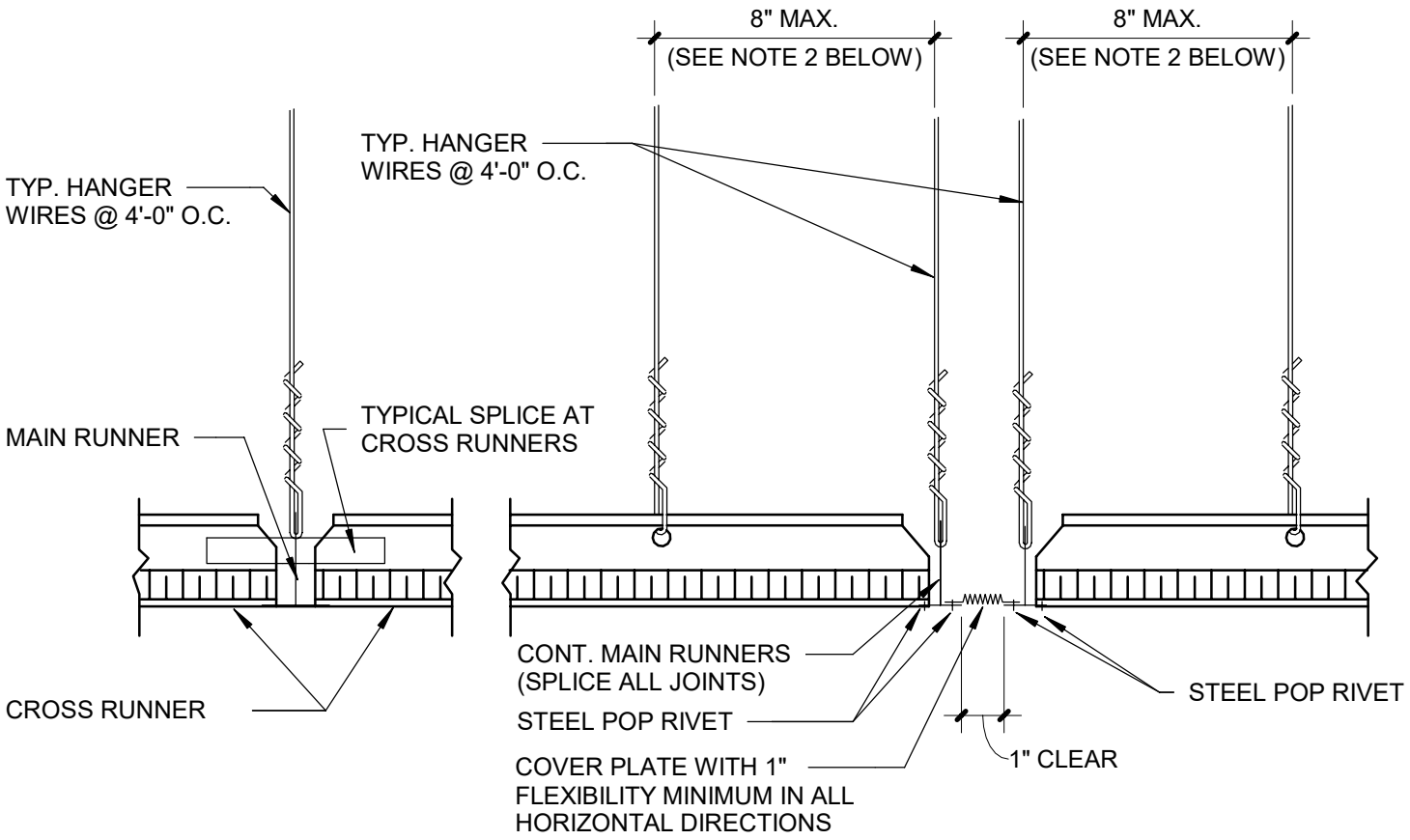
EXPANSION JOINT ALTERNATE

NOTES:

1. DETAIL APPLIES TO EXPANSION JOINTS AT THE INTERSECTION OF CORRIDORS AND AT THE JUNCTIONS OF CORRIDORS AT LOBBIES AND OTHER SIMILAR AREAS.
2. PROVIDE #12 GAGE HANGER WIRES AT THE ENDS OF ALL MAIN AND CROSS RUNNERS WITHIN EIGHT (8) INCHES OF THE SUPPORT OR WITHIN ONE-FOURTH (1/4) OF THE LENGTH OF THE END TEE, WHICHEVER IS LESS, FOR THE PERIMETER OF THE CEILING AREA.
3. PERIMETER WIRES ARE NOT REQUIRED WHEN THE LENGTH OF THE END TEE IS EIGHT (8) INCHES OR LESS.

Detail Title :	REV: 09/21/2015	Detail No.
EXPANSION JOINT (SCHOOL BUILDING)	REV: 03/2022	2.40

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



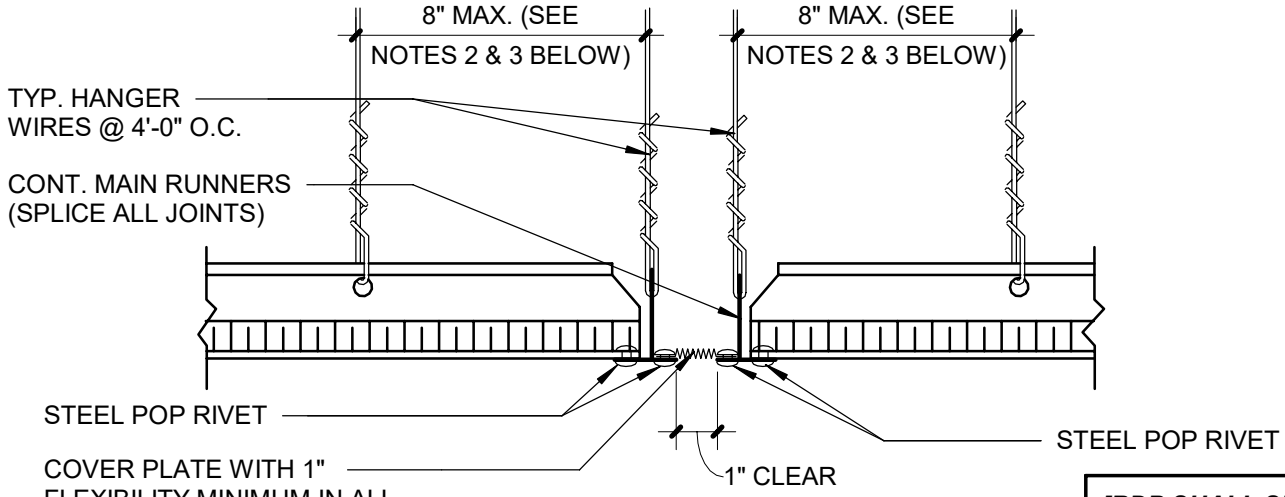
RUNNER SPLICE **EXPANSION JOINT**

NOTES:

1. DETAIL APPLIES TO EXPANSION JOINTS AT THE INTERSECTION OF CORRIDORS AND AT THE JUNCTIONS OF CORRIDORS AT LOBBIES AND OTHER SIMILAR AREAS.
2. PROVIDE #12 GAGE HANGER WIRES AT THE ENDS OF ALL MAIN AND CROSS RUNNERS WITHIN EIGHT (8) INCHES OF THE SUPPORT OR WITHIN ONE-FOURTH (1/4) OF THE LENGTH OF THE END TEE, WHICHEVER IS LESS, FOR THE PERIMETER OF THE CEILING AREA. PERIMETER WIRES ARE NOT REQUIRED WHEN THE LENGTH OF THE END TEE IS EIGHT (8) INCHES OR LESS.

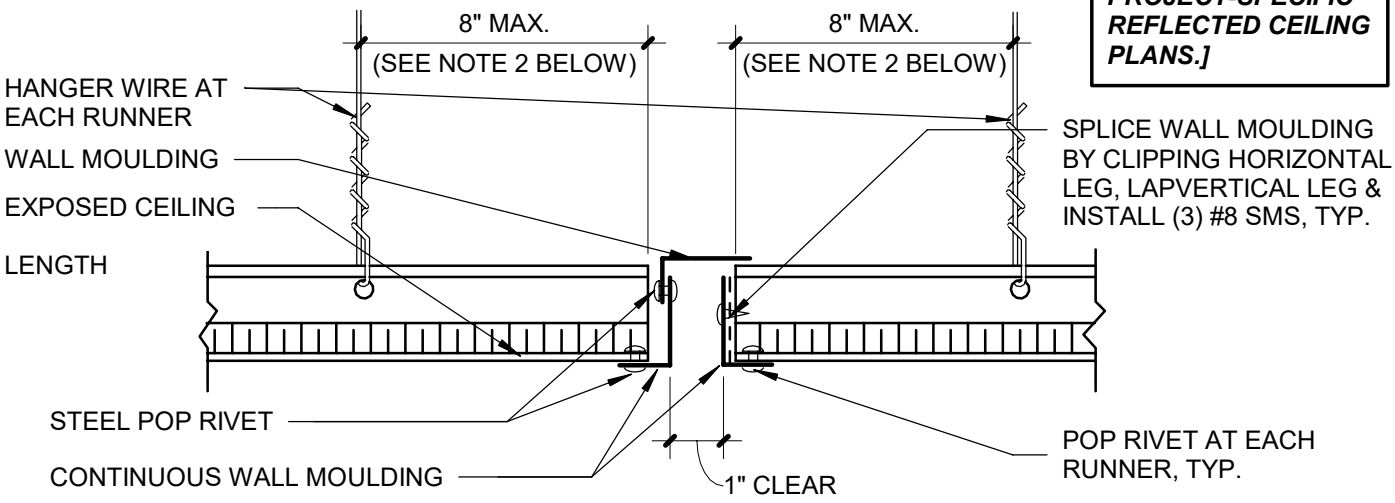
[RDP SHALL SHOW EXPANSION JOINT LOCATIONS ON THE PROJECT-SPECIFIC REFLECTED CEILING PLANS.]

Detail Title :	REV: 09/21/2015	Detail No.
EXPANSION JOINT (ESSENTIAL SERVICE BUILDING)	REV: 03/2022	2.41



SEISMIC SEPARATION JOINT

[RDP SHALL SHOW EXPANSION JOINT LOCATIONS ON THE PROJECT-SPECIFIC REFLECTED CEILING PLANS.]



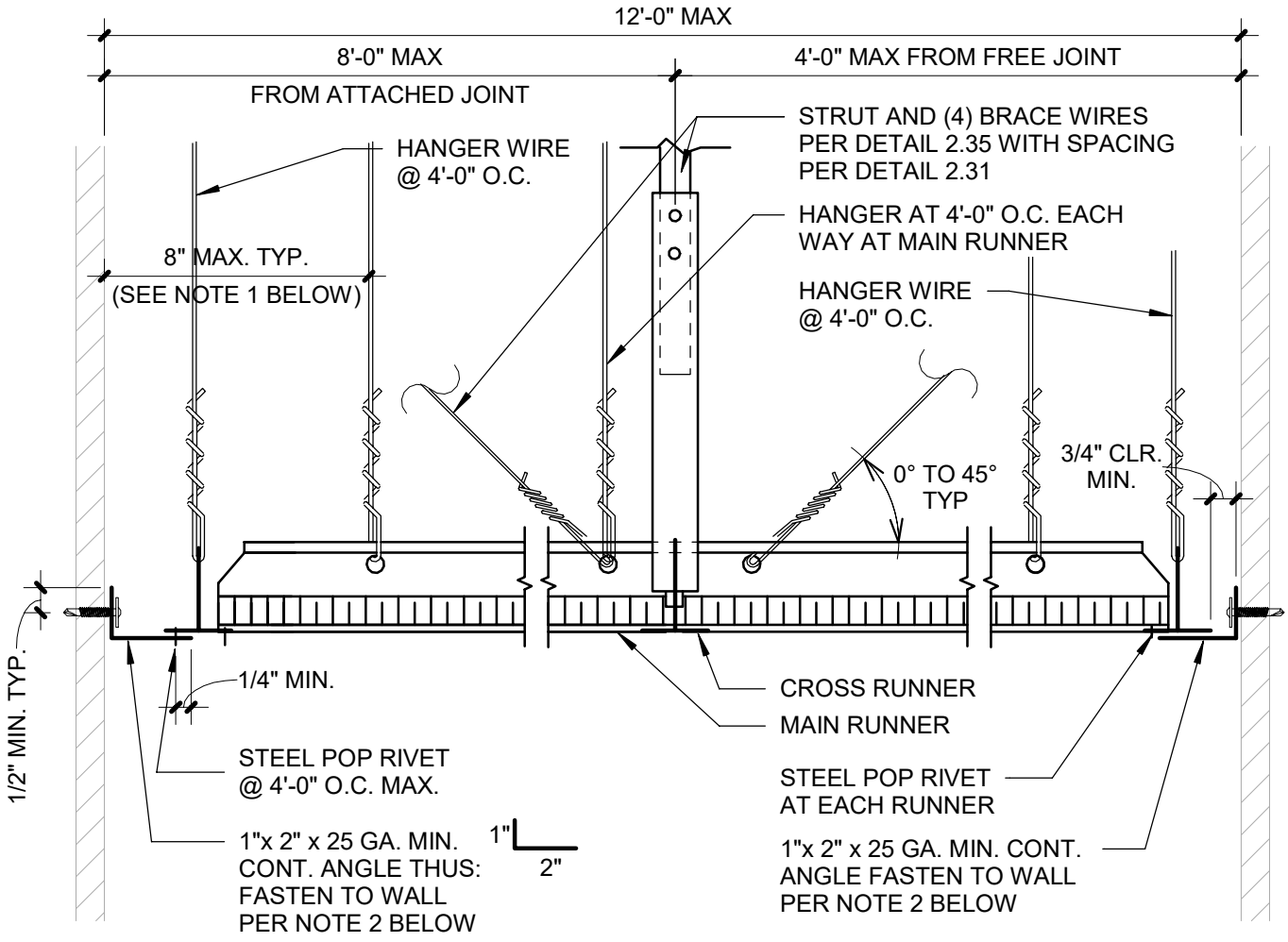
ALTERNATE SEISMIC SEPARATION JOINT

NOTES:

1. DETAILS APPLIES TO SEISMIC SEPARATION JOINT AT CONTINUOUS CEILING AREAS EXCEEDING 2500 SQ. FT. SEE CEILING PLANS FOR LOCATION.
2. PROVIDE #12 GAGE HANGER WIRES AT THE ENDS OF ALL MAIN AND CROSS RUNNERS WITHIN EIGHT (8) INCHES OF THE SUPPORT OR WITHIN ONE-FOURTH (1/4) OF THE LENGTH OF THE END TEE, WHICHEVER IS LESS, FOR THE PERIMETER OF THE CEILING AREA.
3. PERIMETER WIRES ARE NOT REQUIRED WHEN THE LENGTH OF THE END TEE IS EIGHT (8) INCHES OR LESS.

Detail Title :	REV: 09/21/2015	Detail No.
SEISMIC SEPARATION JOINT	REV: 03/2022	2.45

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



ATTACHED JOINT **FREE JOINT**

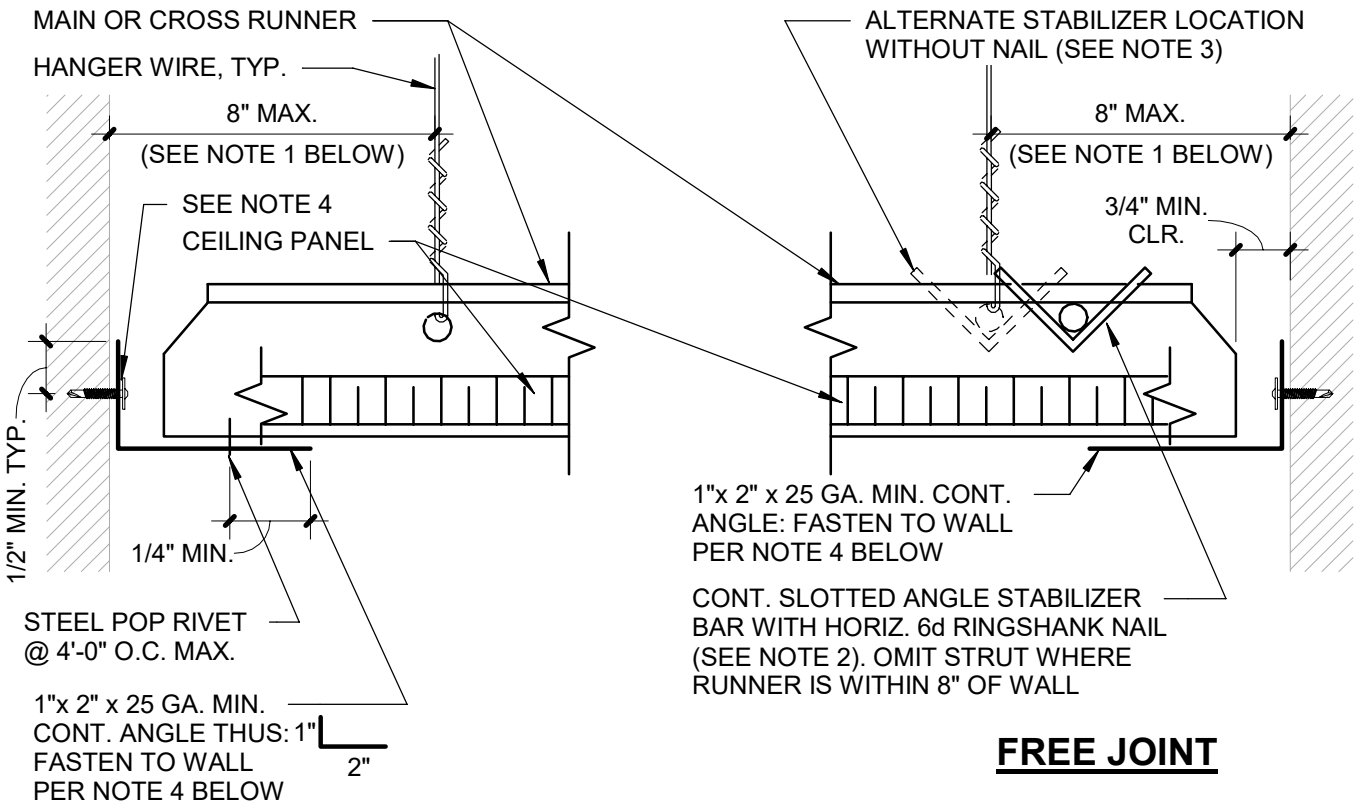
NOTES:

1. PROVIDE #12 GAGE HANGER WIRES AT THE ENDS OF ALL MAIN AND CROSS RUNNERS WITHIN EIGHT (8) INCHES OF THE SUPPORT OR WITHIN ONE-FOURTH (1/4) OF THE LENGTH OF THE END TEE, WHICHEVER IS LESS, FOR THE PERIMETER OF THE CEILING AREA. PERIMETER WIRES ARE NOT REQUIRED WHEN THE LENGTH OF THE END TEE IS EIGHT (8) INCHES OR LESS.
2. FASTEN ANGLE TO WALL FRAMING AS FOLLOWS:
   A. METAL STUD (20 GA. MIN.) WALL: (1) #10 SMS AT 24" O.C. MAX.
   B. WOOD STUD WALL: #10x2" LONG WOOD SCREW AT 16" O.C. MAX.

[WHERE A PROPRIETARY LATERAL BRACING ASSEMBLY IS SPECIFIED, RDP SHALL PROVIDE DETAILS AND SPECIFICATIONS FOR THE INSTALLATION OF THE ENTIRE ASSEMBLY INCLUDING SPACING, APPROVED GRID MANUFACTURER(S), ATTACHMENT TO THE CEILING GRID, BRACING MEMBER SIZES, ATTACHMENT TO THE FLOOR AND ROOF STRUCTURE, ETC.]

Detail Title :	REV: 09/21/2015	Detail No.
TYP. SECTION AT EXIT CORRIDOR (ESSENTIAL SERVICE BUILDING)	REV: 03/2022	2.50

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

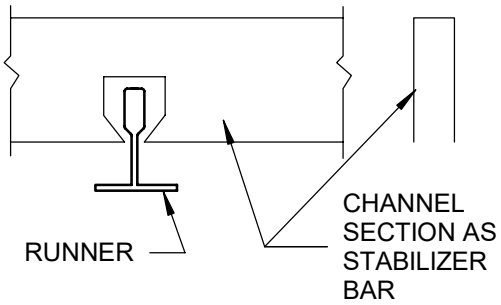


ATTACHED JOINT

NOTES:

1. PROVIDE #12 GAGE HANGER WIRES AT THE ENDS OF ALL MAIN AND CROSS RUNNERS WITHIN EIGHT (8) INCHES OF THE SUPPORT OR WITHIN ONE-FOURTH (1/4) OF THE LENGTH OF THE END TEE, WHICHEVER IS LESS, FOR THE PERIMETER OF THE CEILING AREA. PERIMETER WIRES ARE NOT REQUIRED WHEN THE LENGTH OF THE END TEE IS EIGHT (8) INCHES OR LESS.
2. NAILS AT ENDS OF HORIZONTAL STABILIZERS ARE TO BE PLACED WITH NAIL HEAD TOWARD CENTER LINE OF SPAN OF STRUT.
3. STABILIZER BAR MAY BE SLOTTED APPROVED ANGLES OR CHANNELS WITH "DIAMOND POINTS" OF SPRING STEEL WHICH SNAP TIGHT TO PREVENT MOVEMENT OF STRUT.
4. FASTEN ANGLE TO WALL STUD OR BLOCKING AS FOLLOWS:
   A. METAL STUD (20 GA. MIN.) WALL: (1) #10 SMS AT 24" O.C. MAX.
   B. WOOD STUD WALL: #10x2" LONG WOOD SCREW AT 16" O.C. MAX.

FREE JOINT

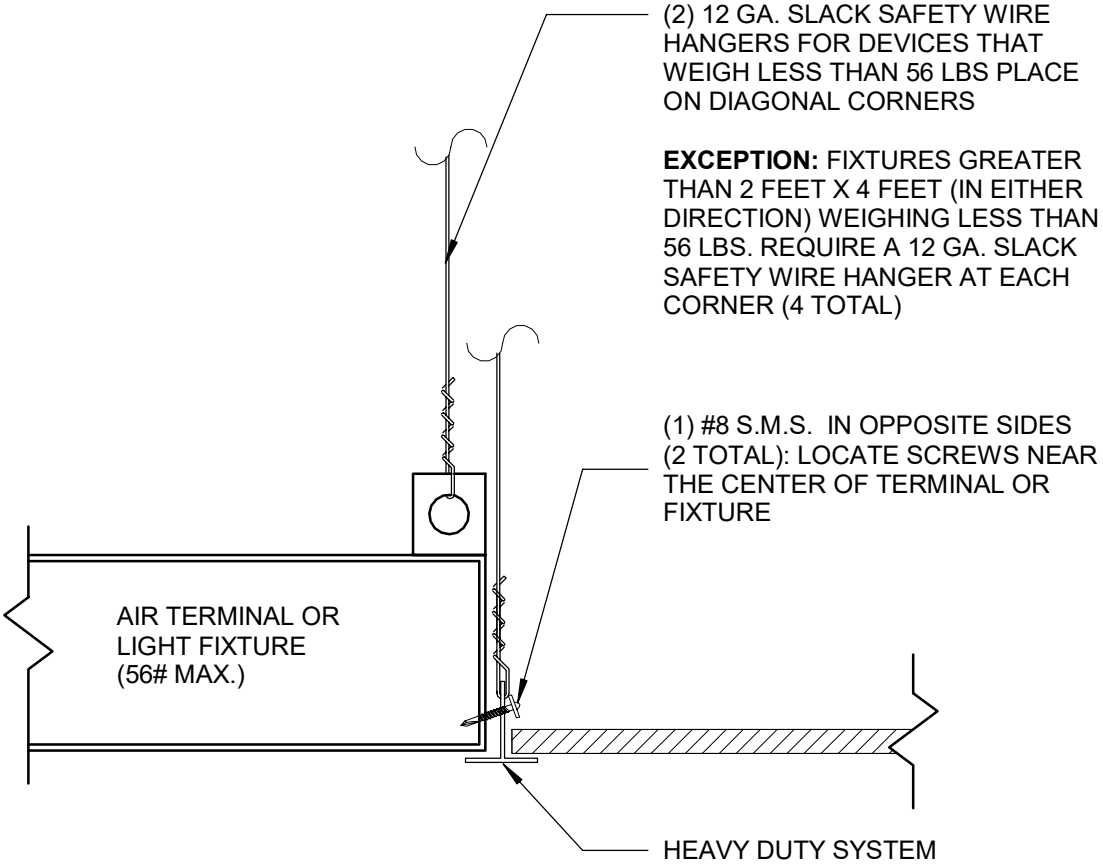


STABILIZER (SEE NOTE 3)

[WHERE PROPRIETARY CLIPS ARE SPECIFIED, RDP SHALL REVISE THIS DETAIL ACCORDINGLY , WHICH INCLUDES REMOVING ALL REFERENCES TO STABILIZERS. RDP SHALL PROVIDE PRODUCT SPECIFIC INFORMATION INCLUDING SMALLER WALL ANGLE (IF APPLICABLE), ATTACHMENT OF THE CLIP TO THE RUNNERS AT THE ATTACHED AND FREE JOINTS, ATTACHMENT OF THE CLIP TO THE WALL ANGLE, AND CLEARANCE OF THE RUNNER TO WALL ANGLE AT THE FREE END.]

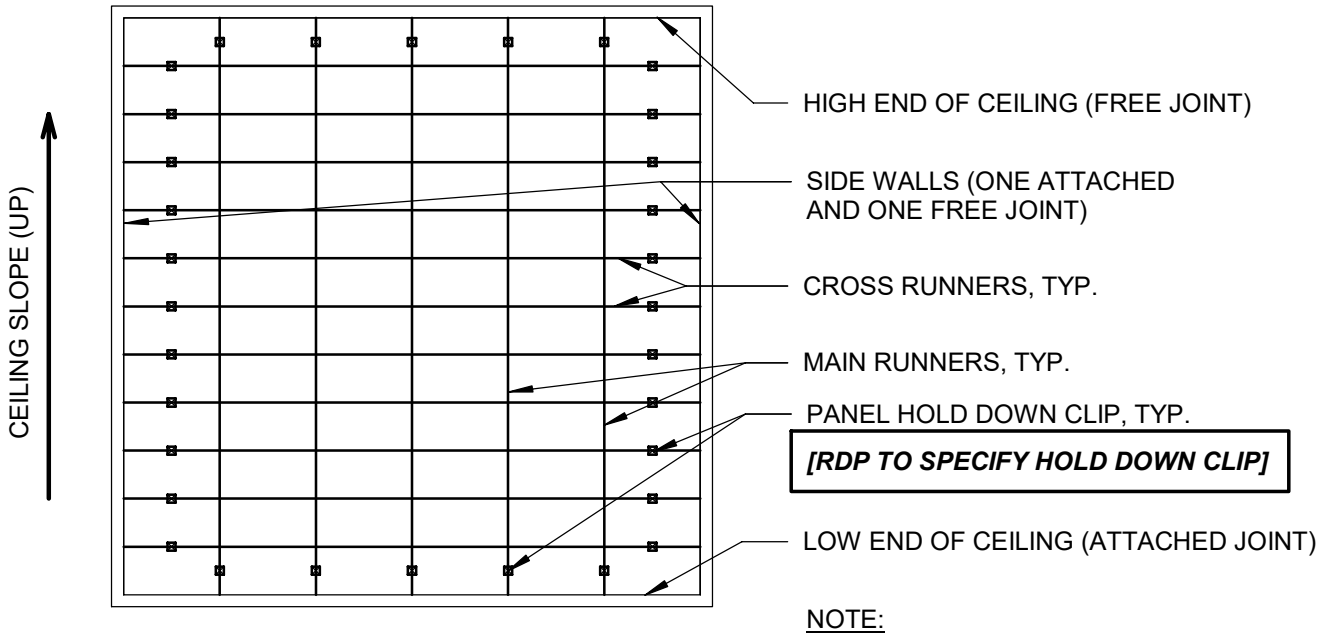
Detail Title :	REV: 09/21/2015	Detail No.
CEILING PERIMETER	REV: 03/10/2017	2.60
	REV: 03/2022	

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



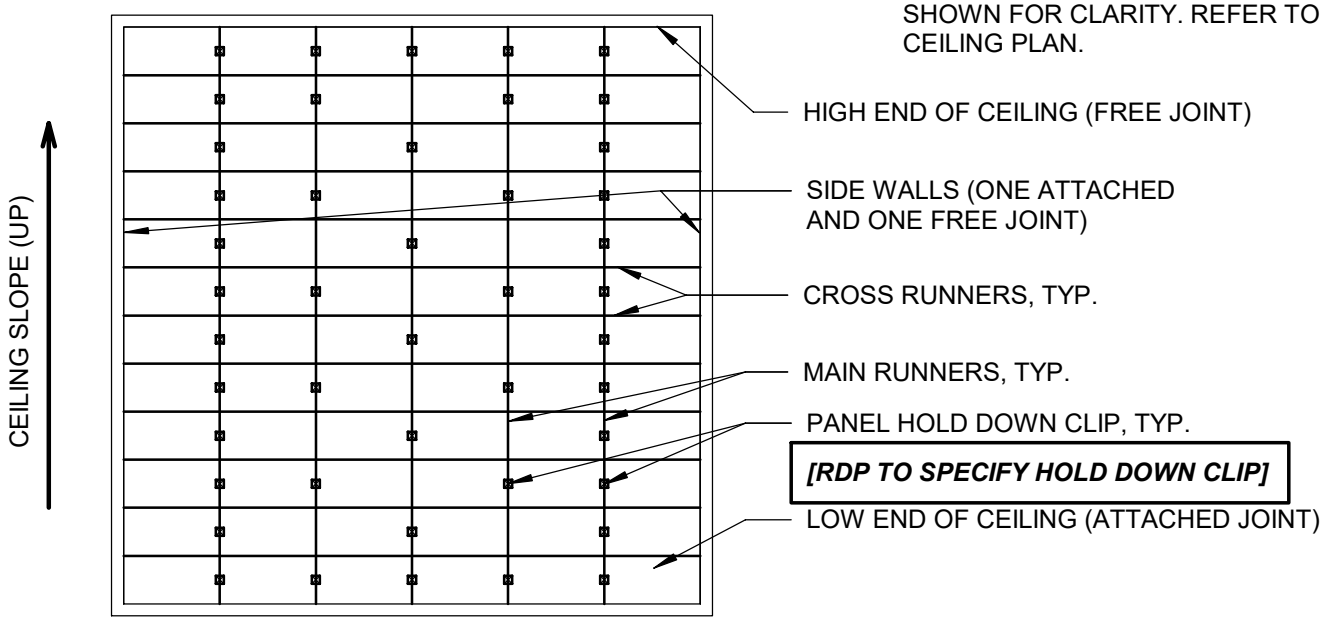
Detail Title :	REV: 09/21/2015	Detail No.
LUMINAIRE / AIR TERMINAL SUPPORT	REV: 02/10/2016	2.80
	REV: 03/2022	

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



CEILING PLAN: SLOPE ≤ 15°

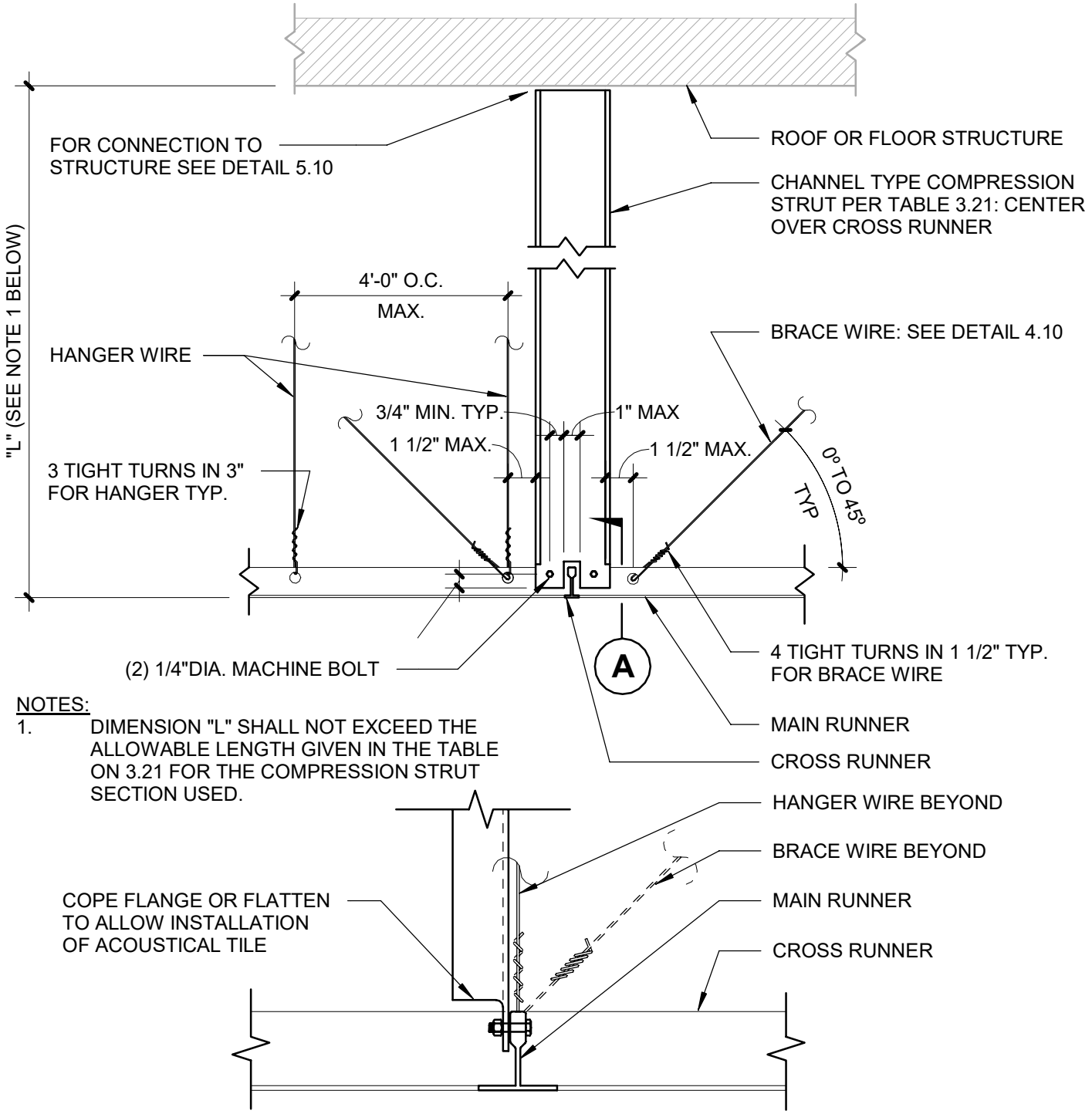
NOTE:
1. LATERAL FORCE BRACING ASSEMBLIES NOT SHOWN FOR CLARITY. REFER TO TYP. CEILING PLAN.
2. STABILIZER BARS, PERIMETER ANGLES, AND PROPRIETARY SEISMIC CLIPS NOT SHOWN FOR CLARITY. REFER TO TYP. CEILING PLAN.



CEILING PLAN: 15° < SLOPE ≤ 25°

Detail Title :	REV: 03/2022	Detail No.
PANEL HOLD DOWN CLIPS AT SLOPED CEILING		2.90

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



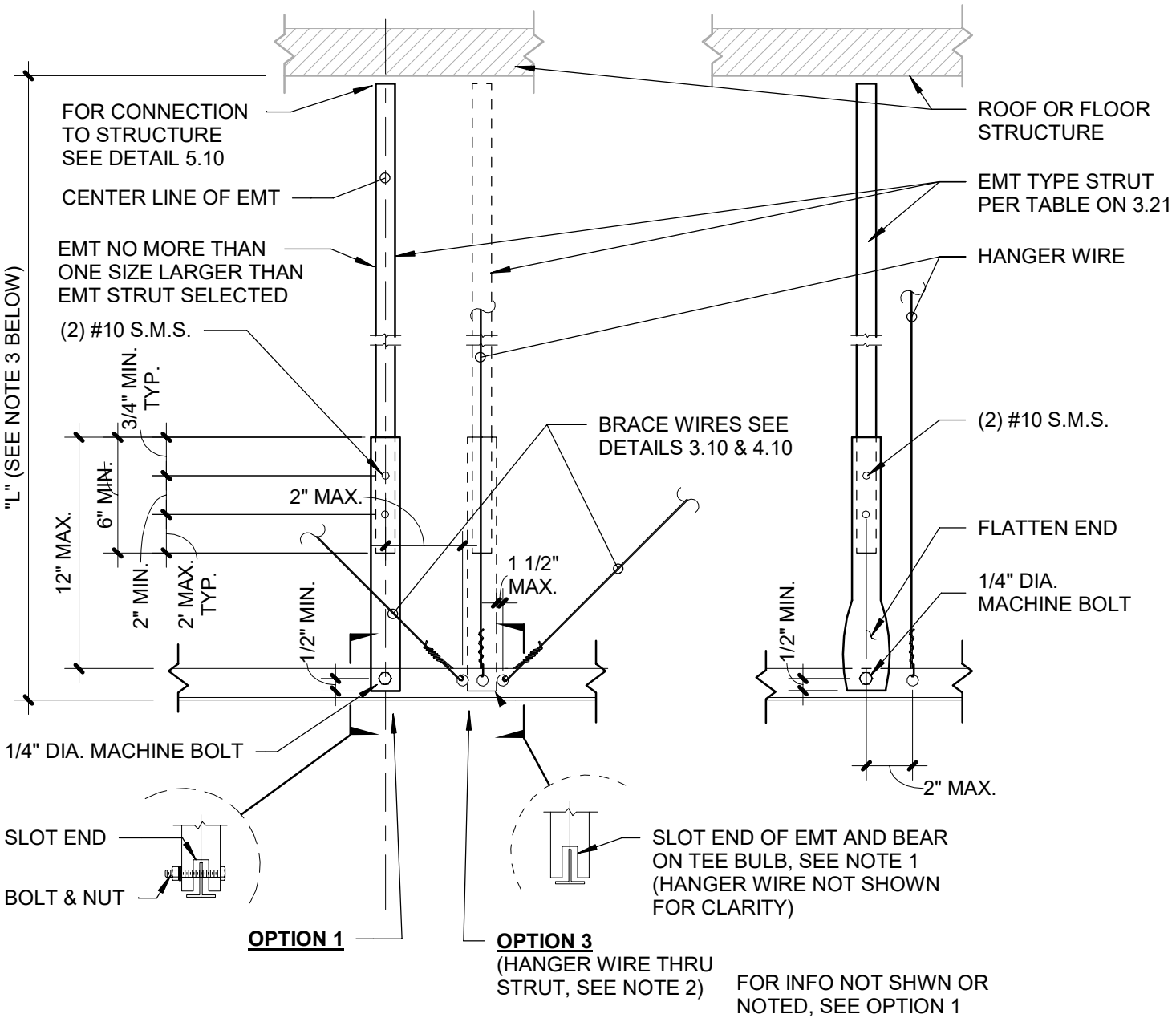
NOTES:

1. DIMENSION "L" SHALL NOT EXCEED THE ALLOWABLE LENGTH GIVEN IN THE TABLE ON 3.21 FOR THE COMPRESSION STRUT SECTION USED.

(A) SECTION
3" = 1'-0"

Detail Title :	REV: 09/21/2015	Detail No.
COMPRESSION STRUT - CHANNEL TYPE	REV: 03/2022	3.10

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



OPTION 1 & 3 **OPTION 2**

NOTES:

1. MACHINE BOLT IS NOT REQUIRED ON OPTION 3.
2. OPTION 3 IS PERMITTED ONLY WHERE THE ROOF OR FLOOR STRUCTURE IS SAWN TIMBER WITHOUT GYPSUM BOARD.
3. DIMENSION "L" SHALL NOT TO EXCEED THE ALLOWABLE LENGTH GIVEN IN THE TABLE ON 3.21 FOR THE COMPRESSION STRUT USED

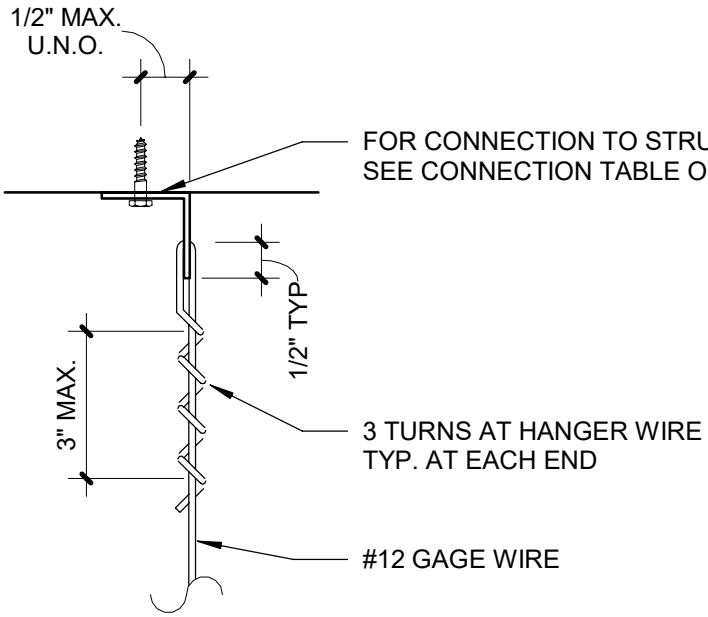
Detail Title :	REV: 09/21/2015	Detail No.
COMPRESSION STRUT - EMT TYPE	REV: 03/2022	3.20

COMPRESSION STRUT EMT SECTION	MAXIMUM LENGTH
1/2" DIAMETER EMT (0.042" WALL THICKNESS)	3' - 11"
3/4" DIAMETER EMT (0.049" WALL THICKNESS)	6' - 4"
1" DIAMETER EMT (0.057" WALL THICKNESS)	9' - 9"
1 1/4" DIAMETER EMT (0.065" WALL THICKNESS)	12' - 9"
1 1/2" DIAMETER EMT (0.065" WALL THICKNESS)	14' - 9"
2" DIAMETER EMT (0.065" WALL THICKNESS)	18' - 10"

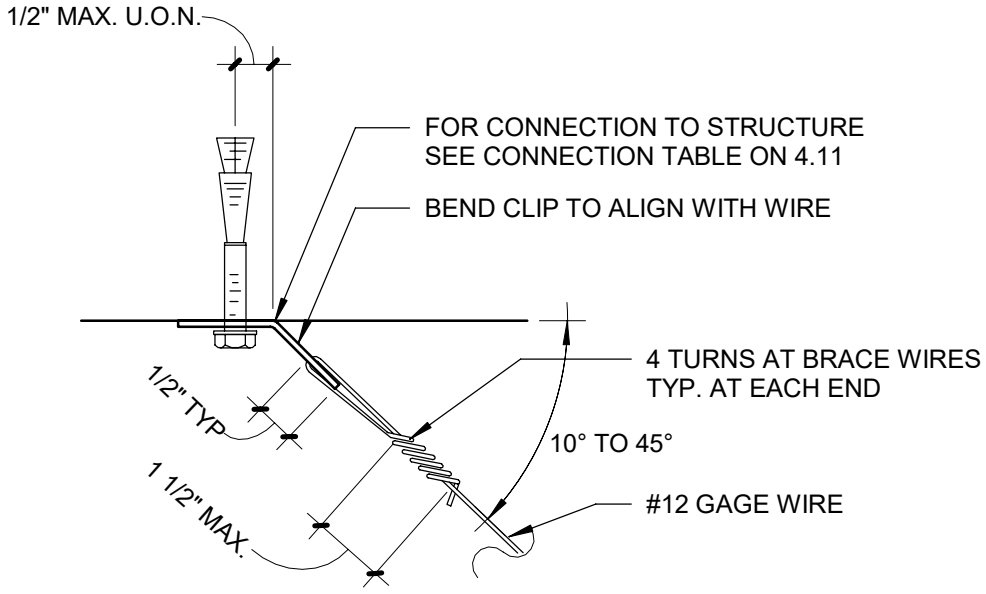
COMPRESSION STRUT CHANNEL SECTION	MAXIMUM LENGTH
250S125-33	5' - 10"
250S137-33	6' - 10"
362S137-33	8' - 0"
250S137-43	8' - 10"
400S137-43	10' - 10"

Detail Title :	REV: 09/21/2015	Detail No.
COMPRESSION STRUT TABLE	REV: 03/10/2017	3.21
	REV: 03/2022	

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



HANGER WIRE



BRACE WIRE

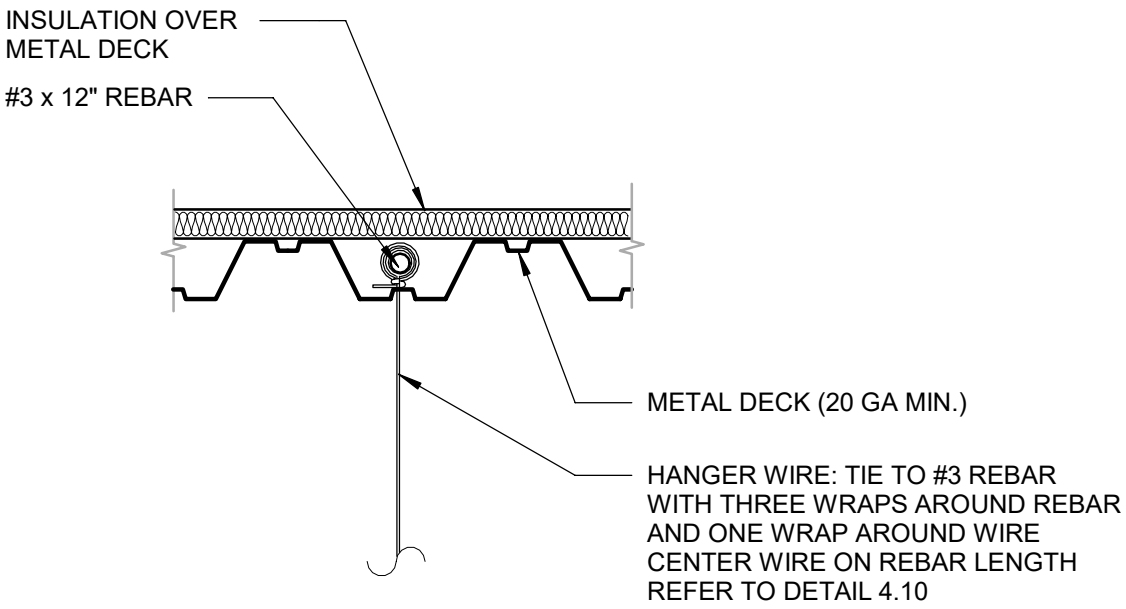
Detail Title :	REV: 09/21/2015	Detail No.
HANGER AND BRACE WIRE CONNECTION - TYP. WIRE TURNS	REV: 03/2022	4.10

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

STRUCTURAL SYSTEM OF FLOOR/ ROOF ABOVE SUSPENDED CEILING	APPLICABLE HANGER WIRE DETAIL	APPLICABLE BRACE WIRE DETAIL
BARE METAL DECK	4.20	4.30
CONCRETE OVER METAL DECK	4.21	4.30 & 4.31
CONCRETE SLAB, BEAM, OR JOIST	4.22	4.32
STRUCTURAL STEEL	4.23	4.33
METAL STUD WALL	4.24	4.34
SAWN TIMBER	4.25 & 4.29	4.35
WOOD I-JOIST	4.26	4.36 & 4.37
WOOD CHORD TRUSS	4.27 & 4.29	4.38 & 4.29
OPEN WEB STEEL JOIST	4.28 & 4.29	4.39 & 4.29

Detail Title :	REV: 09/21/2015	Detail No.
HANGER AND BRACE WIRE CONNECTION TABLE	REV: 03/2022	4.11

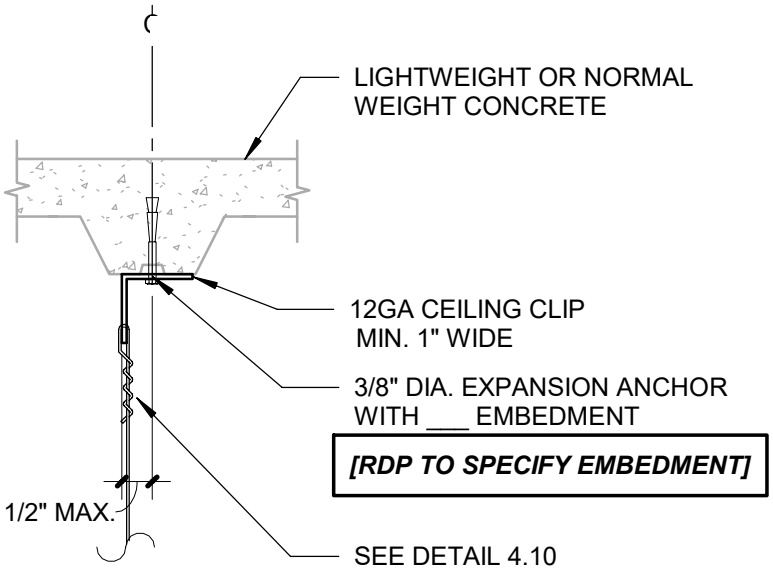
SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



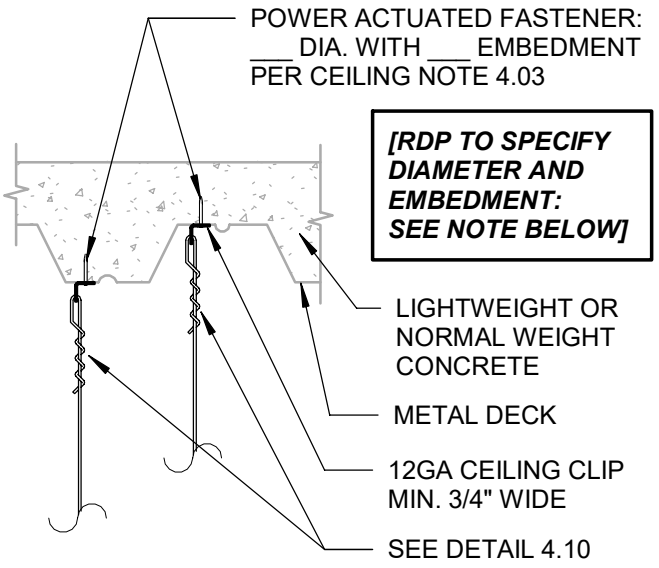
NOTES:
1. REFER TO DETAIL 4.10 FOR ADDITIONAL INFORMATION.

Detail Title :	REV: 09/21/2015	Detail No.
HANGER WIRE CONNECTION TO METAL DECK	REV: 03/2022	4.20

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



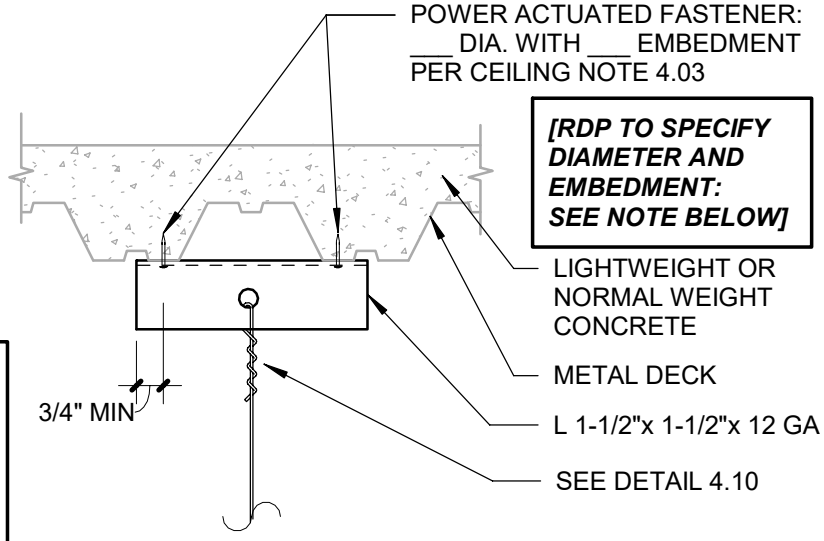
OPTION 1



OPTION 2

NOTES:
1. REFER TO DETAILS4.10 FOR ADDITIONAL INFORMATION.
2. POST INSTALLED ANCHORS TO BE PLACED NO MORE THAN 1" OFFSET FROM CENTERLINE OF DECK LOW FLUTE.
3. TEST POST-INSTALLED ANCHORS IN ACCORDANCE WITH CEILING NOTE 5.01.

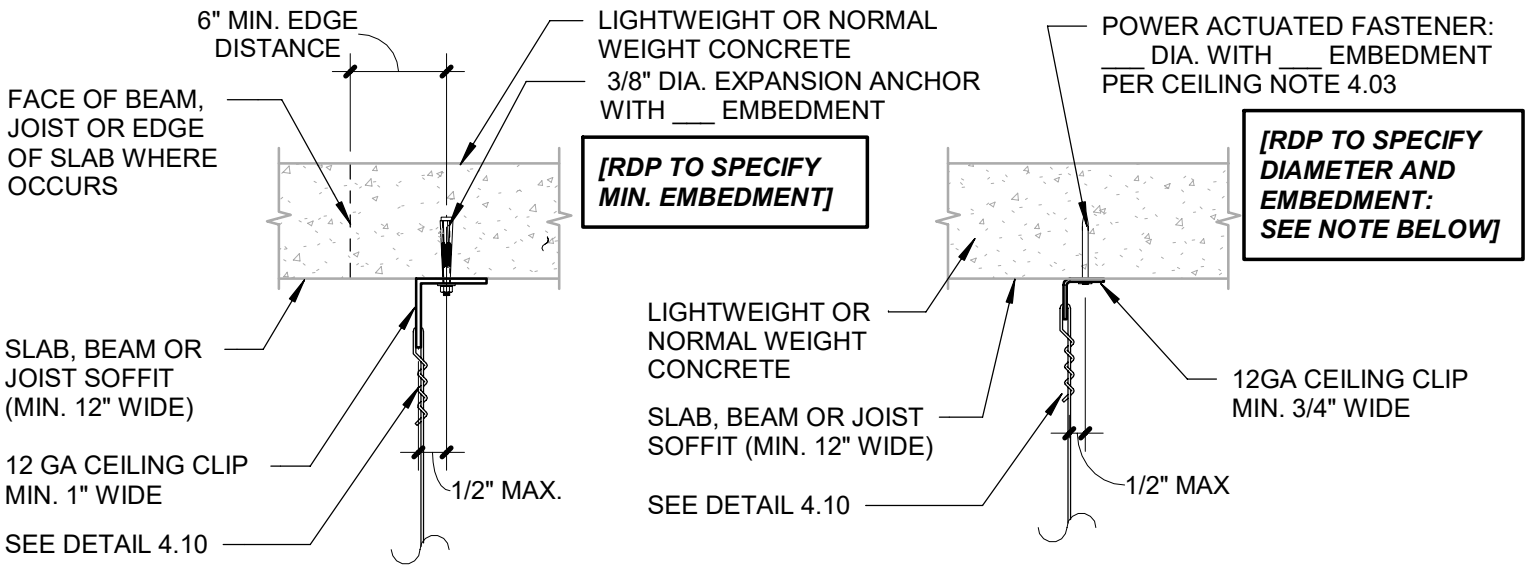
[RDP TO SPECIFY ALL OF THE FOLLOWING FOR POWER ACTUATED FASTENERS:
- DIAMETER (0.145" MINIMUM)
- EMBEDMENT (1 1/4" MINIMUM)
AN EMBEDMENT DEPTH LESS THAN 1-1/4" CAN BE PERMITTED IF BOTH OF THE FOLLOWING ARE MET:
1. LESSER EMBEDMENT APPROVED BY THE EVALUATION REPORT.
2. ANCHOR IS CAPABLE OF RESISTING A 90 LB ALLOWABLE LOAD WHEN TESTED PER ASTM E3090 AS REQUIRED BY ASTM E380 SECTION 5.2.7.2]



OPTION 3

Detail Title :	REV: 09/21/2015	Detail No.
HANGER WIRE CONNECTION TO CONCRETE OVER METAL DECK	REV: 03/2022	4.21

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



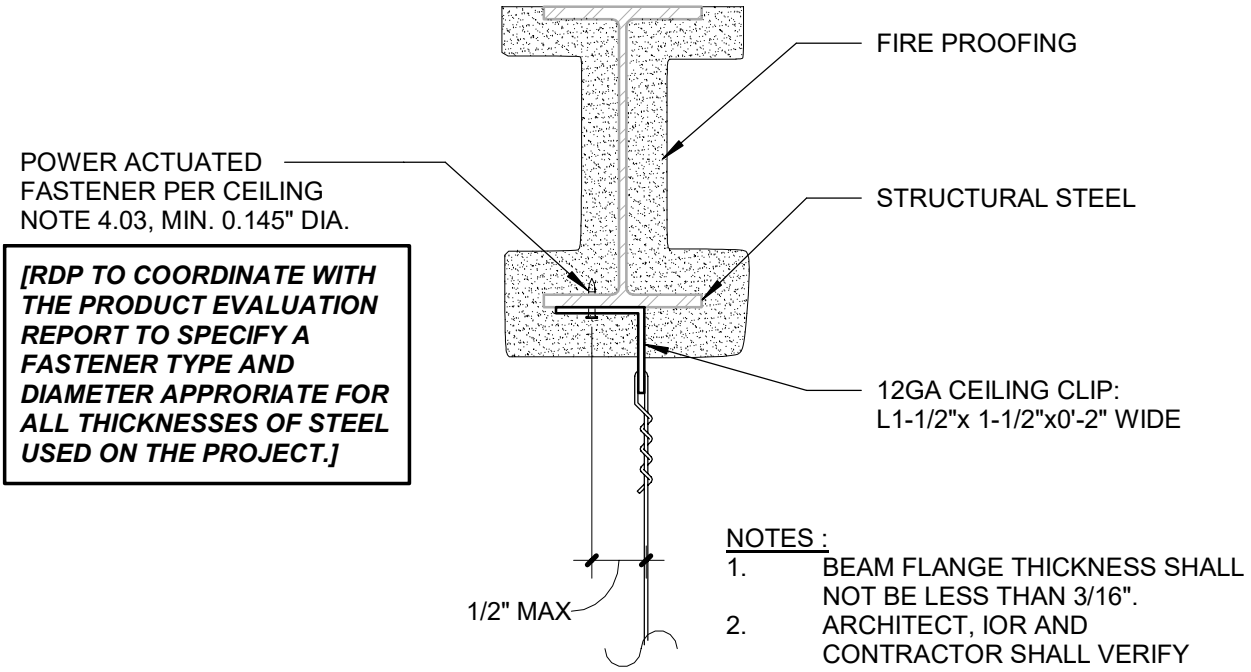
OPTION 1 **OPTION 2**

NOTES:
1. REFER TO 4.10 FOR ADDITIONAL DETAILS.
2. TEST POST INSTALLED ANCHORS IN ACCORDANCE WITH CEILING NOTE 5.01.
3. DSA APPROVAL OF A CONSTRUCTION PLAN IS REQUIRED PRIOR TO INSTALLING POST-INSTALLED ANCHORS IN PRESTRESSED CONCRETE. THE CONSTRUCTION PLAN SHALL DEMONSTRATE HOW THE LOCATION OF PRESTRESSING TENDONS AND STRANDS WILL BE LOCATED AND DENOTED AS NECESSARY TO AVOID INTERFERENCE.

[RDP TO SPECIFY ALL OF THE FOLLOWING FOR POWER ACTUATED FASTENERS:
- DIAMETER (0.145" MINIMUM)
- EMBEDMENT (1 1/4" MINIMUM)
AN EMBEDMENT DEPTH LESS THAN 1-1/4" CAN BE PERMITTED IF BOTH OF THE FOLLOWING ARE MET:
1. LESSER EMBEDMENT APPROVED BY THE EVALUATION REPORT.
2. ANCHOR IS CAPABLE OF RESISTING A 90 LB ALLOWABLE LOAD WHEN TESTED PER ASTM E3090 AS REQUIRED BY ASTM E380 SECTION 5.2.7.2.]

Detail Title :	REV: 09/21/2015	Detail No.
HANGER WIRE CONNECTION TO CONCRETE SLAB, BEAM, OR JOIST	REV: 03/2022	4.22

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



[RDP TO COORDINATE WITH THE PRODUCT EVALUATION REPORT TO SPECIFY A FASTENER TYPE AND DIAMETER APPRORIATE FOR ALL THICKNESSES OF STEEL USED ON THE PROJECT.]

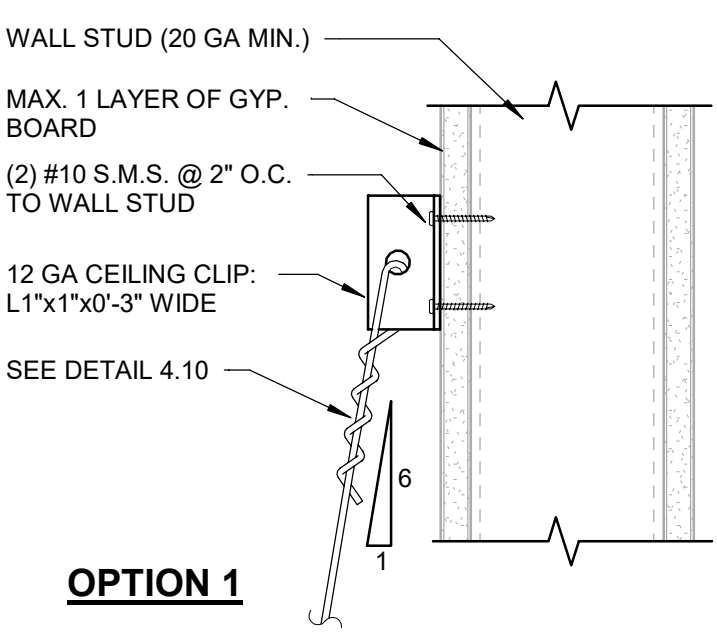
NOTES :

1. BEAM FLANGE THICKNESS SHALL NOT BE LESS THAN 3/16".
2. ARCHITECT, IOR AND CONTRACTOR SHALL VERIFY THAT NO PAF IS INSTALLED IN THE PROTECTED ZONE OF ANY STEEL MEMBER. SEE AISC 341.
3. REFER TO DETAIL 4.10 FOR ADDITIONAL INFORMATION.

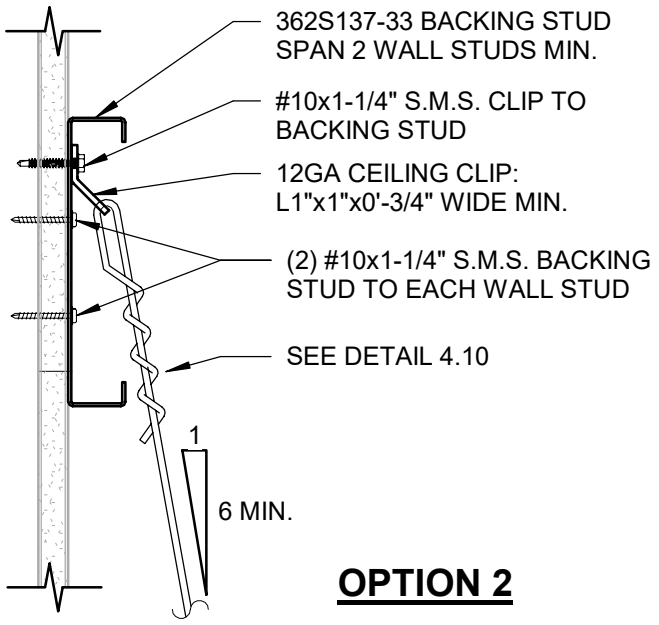
HANGER WIRE

Detail Title :	REV: 09/21/2015	Detail No.
HANGER WIRE CONNECTION TO STRUCTURAL STEEL	REV: 03/2022	4.23

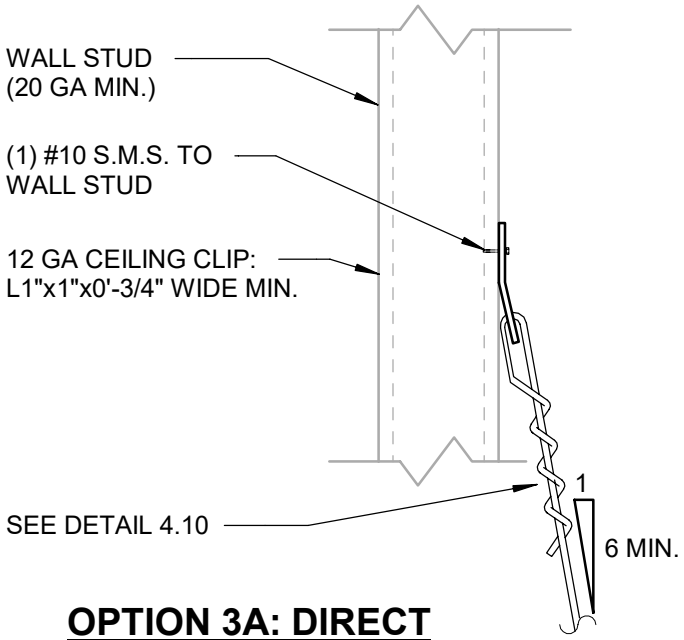
SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



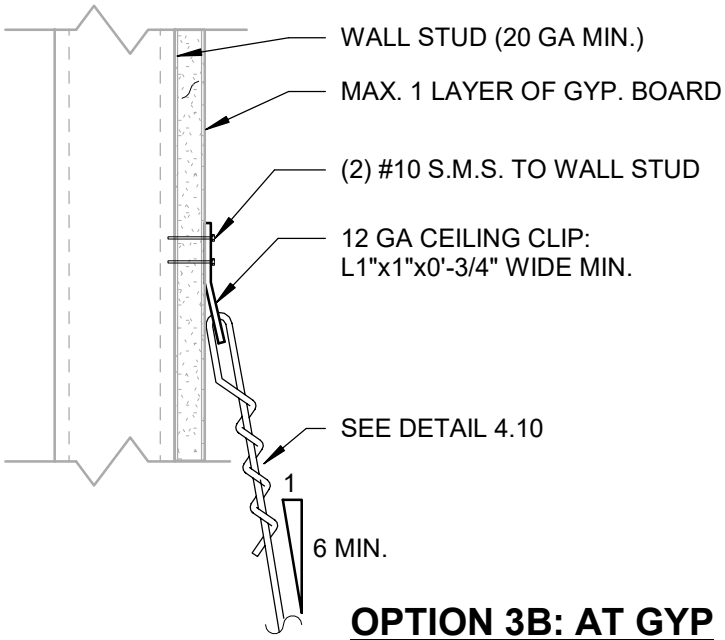
OPTION 1



OPTION 2



OPTION 3A: DIRECT



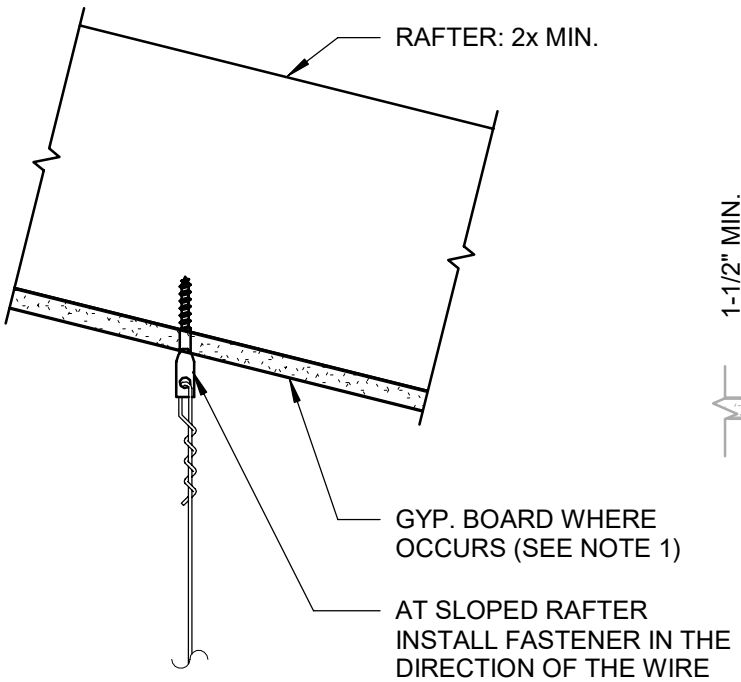
OPTION 3B: AT GYP

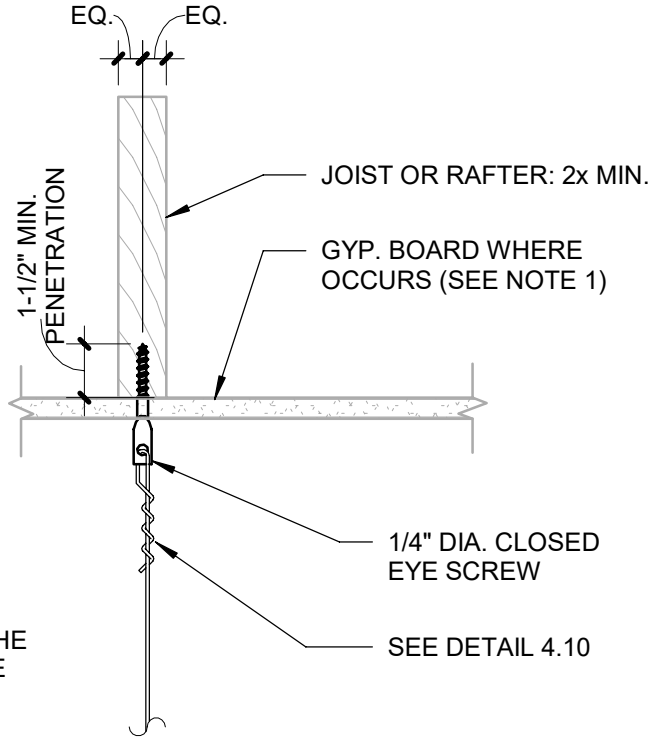
NOTES:

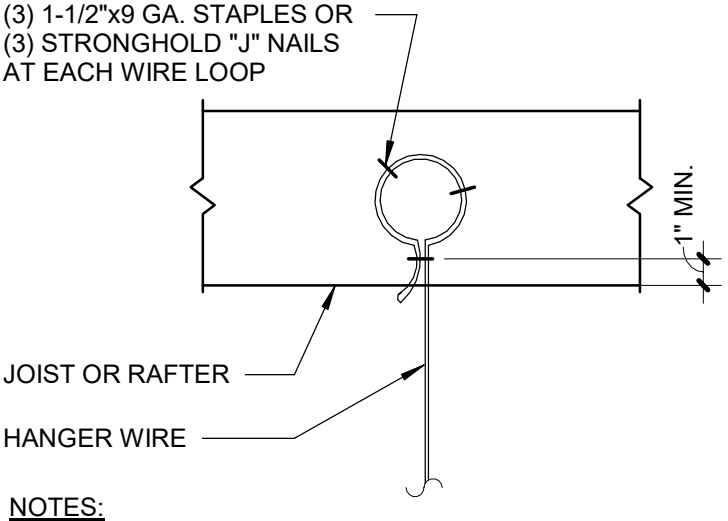
1. THIS DETAIL APPLIES AT PERIMETER WIRE ATTACHEMENT OR WHERE OBSTRUCTION PREVENTS ATTACHMENT TO THE STRUCTURE ABOVE.

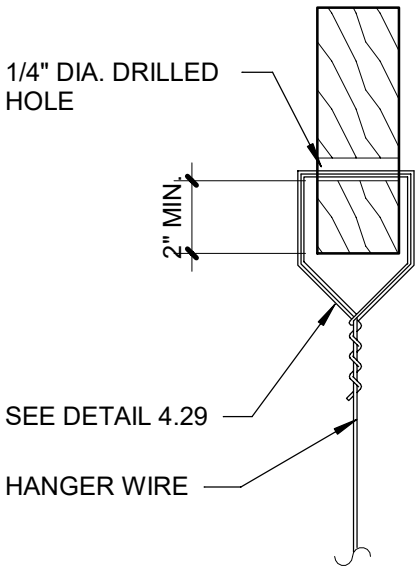
Detail Title :	REV: 09/21/2015	Detail No.
HANGER WIRE CONNECTION TO METAL STUD WALL	REV: 03/2022	4.24

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC







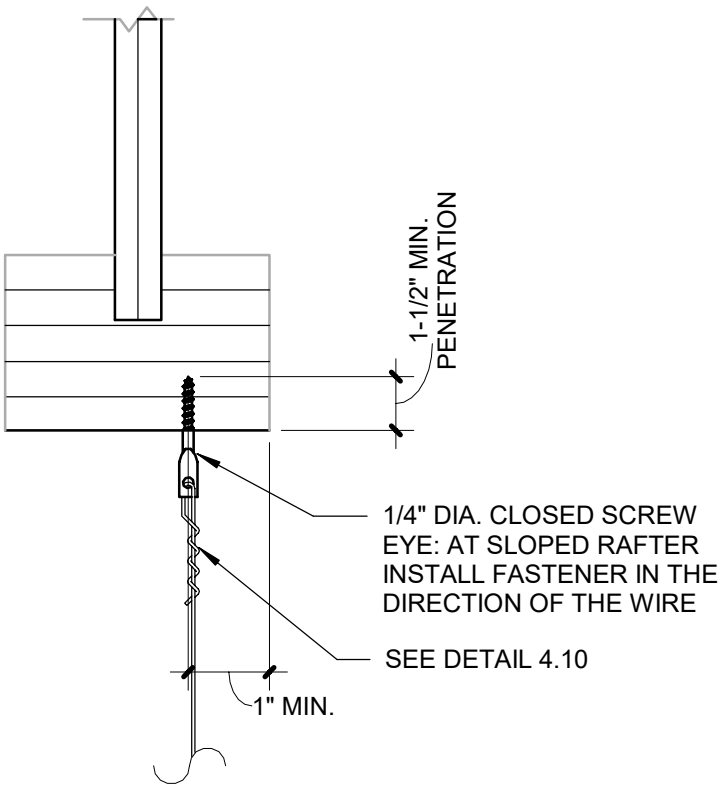


NOTES:

1. WHEN FIRE RATED GYP. BOARD IS INSTALLED ON THE BOTTOM FLANGES, USE SCREW EYES W/ SUFFICIENT LENGTH TO AVOID DAMAGING THE FIRE RATED GYP. BOARD AND MEET MIN. PENETRATION.

Detail Title :	REV: 09/21/2015	Detail No.
HANGER WIRE CONNECTION TO SAWN TIMBER	REV: 03/2022	4.25

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

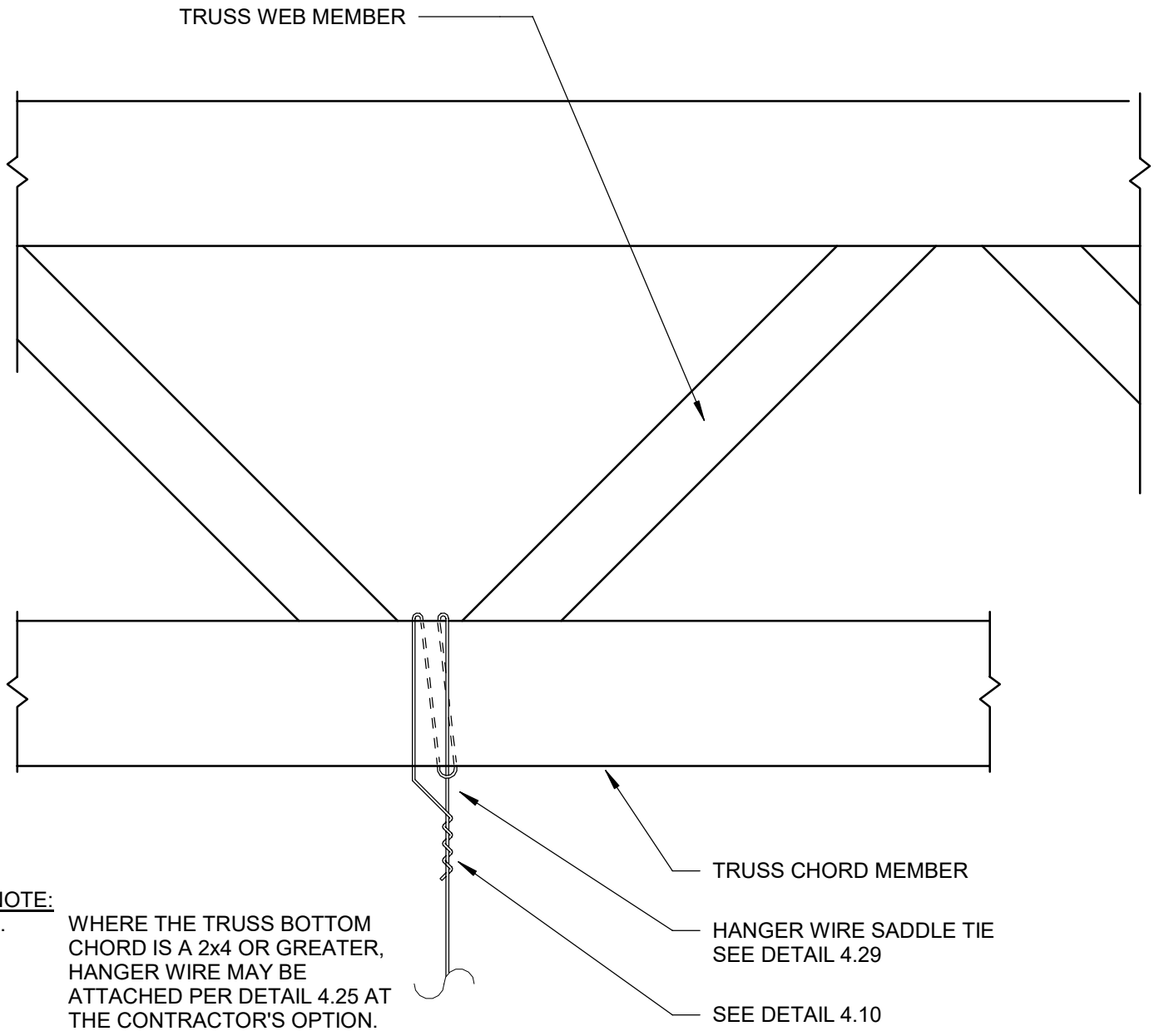


NOTES:

1. WHEN FIRE RATED GYP. BOARD IS INSTALLED ON THE BOTTOM FLANGES, USE SCREW EYES W/ SUFFICIENT LENGTH TO AVOID DAMAGING THE FIRE RATED GYP. BOARD AND MEET MIN. PENETRATION.

Detail Title :	REV: 09/21/2015	Detail No.
HANGER WIRE CONNECTION TO WOOD I-JOIST	REV: 03/2022	4.26

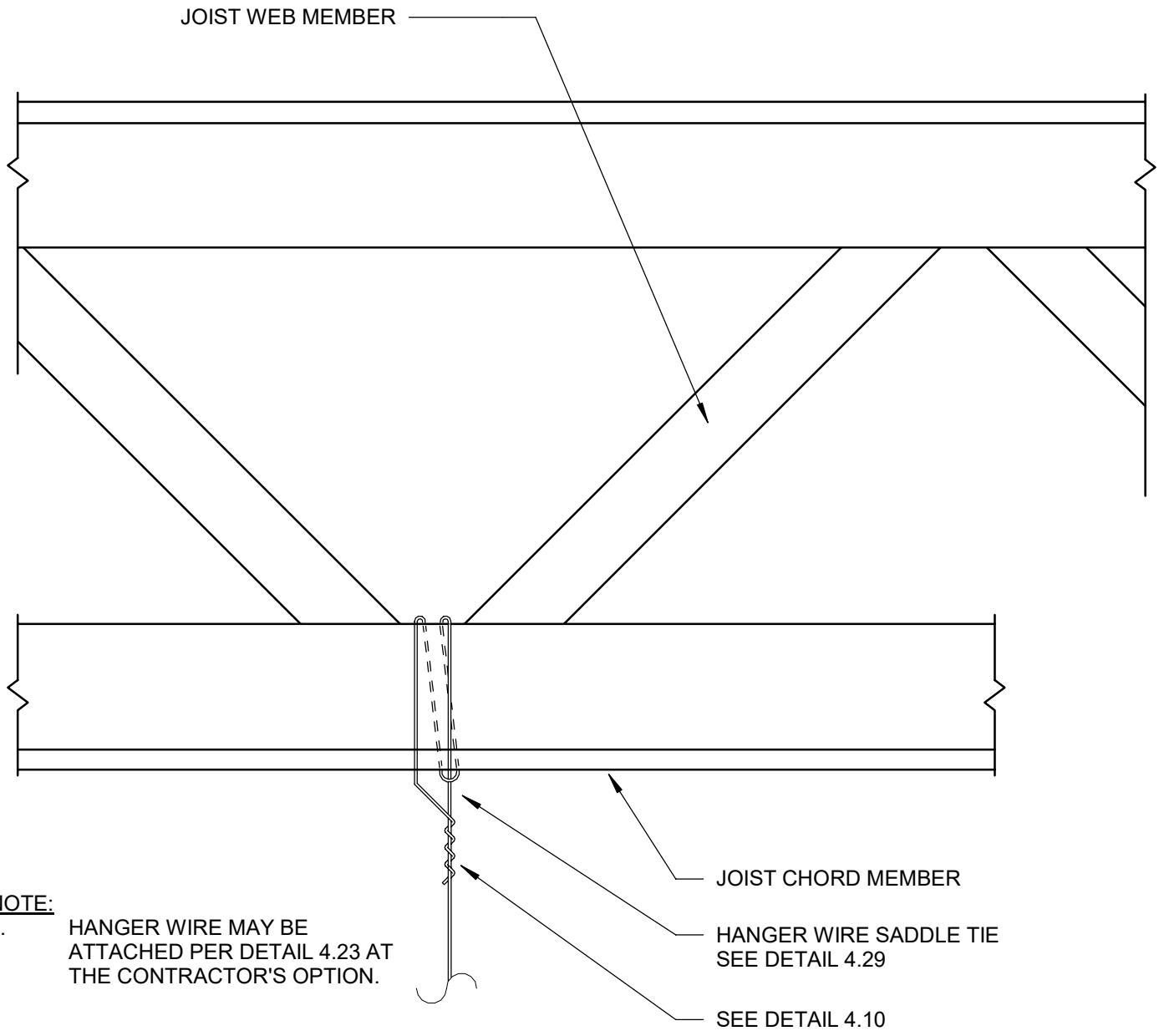
SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



NOTE:
1. WHERE THE TRUSS BOTTOM CHORD IS A 2x4 OR GREATER, HANGER WIRE MAY BE ATTACHED PER DETAIL 4.25 AT THE CONTRACTOR'S OPTION.

Detail Title :	REV: 09/21/2015	Detail No.
HANGER WIRE CONNECTION TO WOOD CHORD TRUSS	REV: 03/2022	4.27

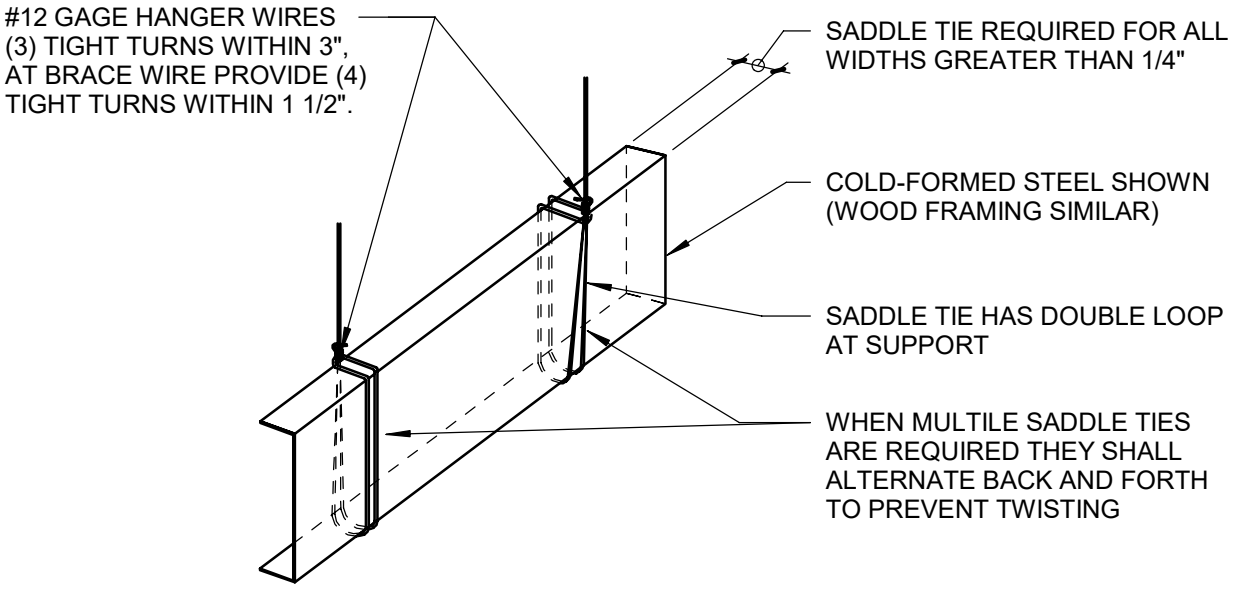
SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



NOTE:
1. HANGER WIRE MAY BE ATTACHED PER DETAIL 4.23 AT THE CONTRACTOR'S OPTION.

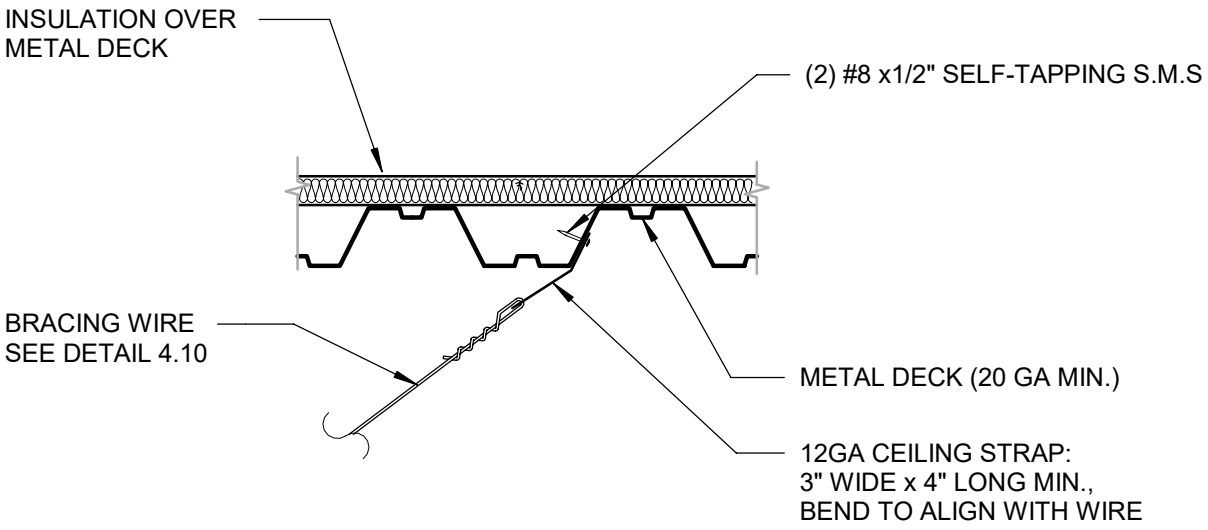
Detail Title :	REV: 09/21/2015	Detail No.
HANGER WIRE CONNECTION TO OPEN WEB STEEL JOIST	REV: 03/2022	4.28

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



Detail Title :	REV: 09/21/2015	Detail No.
TYPICAL SADDLE TIE DETAIL	REV: 03/2022	4.29

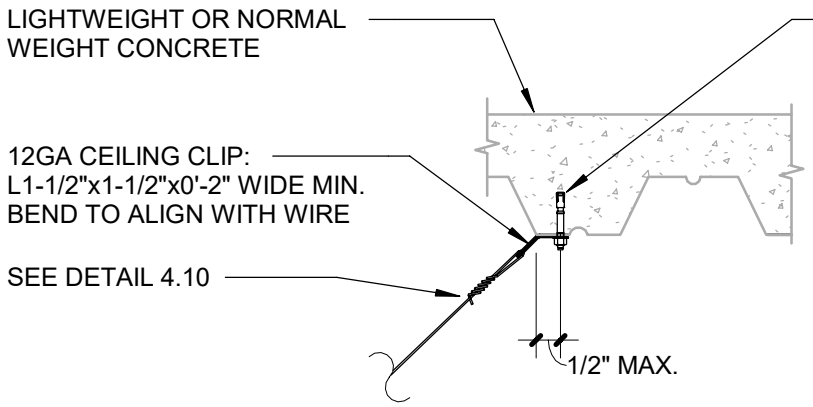
SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



NOTES:
1. IF SELF-TAPPING SCREWS ARE USED WITH CONCRETE FILL, SET SCREWS BEFORE PLACING CONCRETE.

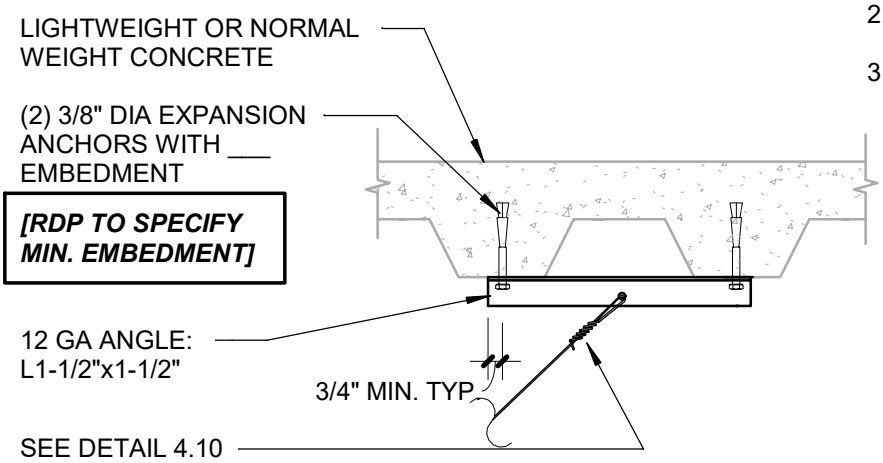
Detail Title :	REV: 09/21/2015	Detail No.
BRACE WIRE CONNECTION AT METAL DECK	REV: 03/2022	4.30

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



[RDP TO SPECIFY EMBEDMENT. AT RDP DISCRETION THE SPECIFIED ANCHOR MAY BE REVISED TO THAT REQUIRED BY THE SCHEDULE IN DETAIL CL4.31 OF HCAI PREAPPROVED DETAILS OPD-0002-13.]

OPTION 1



[RDP TO SPECIFY MIN. EMBEDMENT]

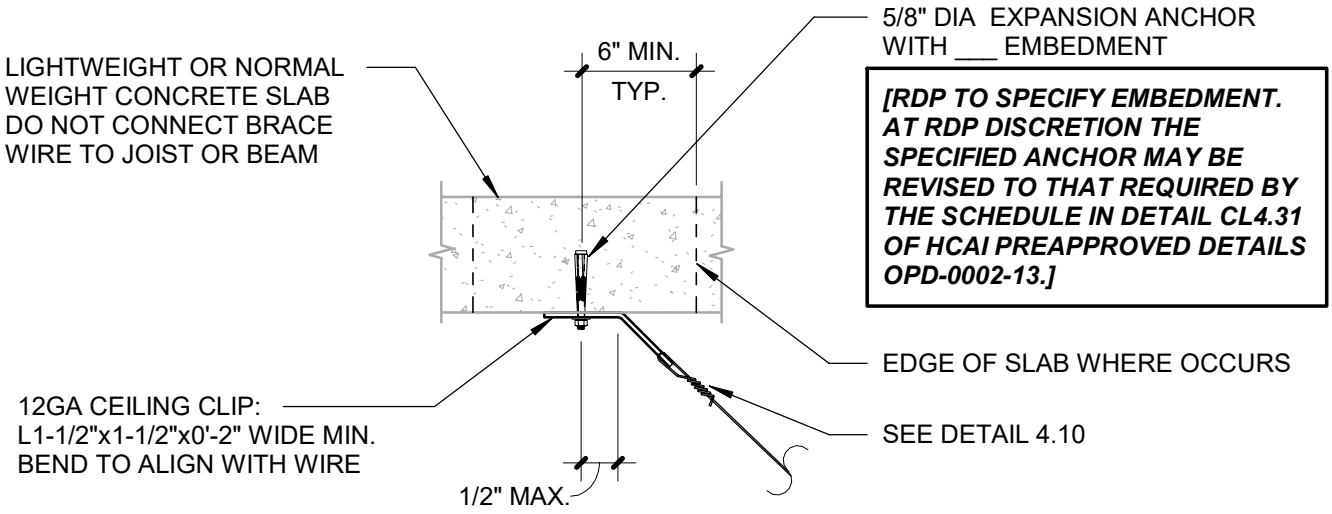
OPTION 2

NOTES:

1. TEST POST INSTALLED ANCHORS IN ACCORDANCE WITH CEILING NOTE 5.02.
2. REFER TO DETAIL 4.10 FOR ADDITIONAL INFORMATION.
3. POST-INSTALLED ANCHORS TO BE PLACED NO MORE THAN 1" OFFSET FROM CENTERLINE OF DECK LOW FLUTE.

Detail Title :	REV: 09/21/2015	Detail No.
BRACE WIRE CONNECTION TO CONCRETE OVER METAL DECK	REV: 03/2022	4.31

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

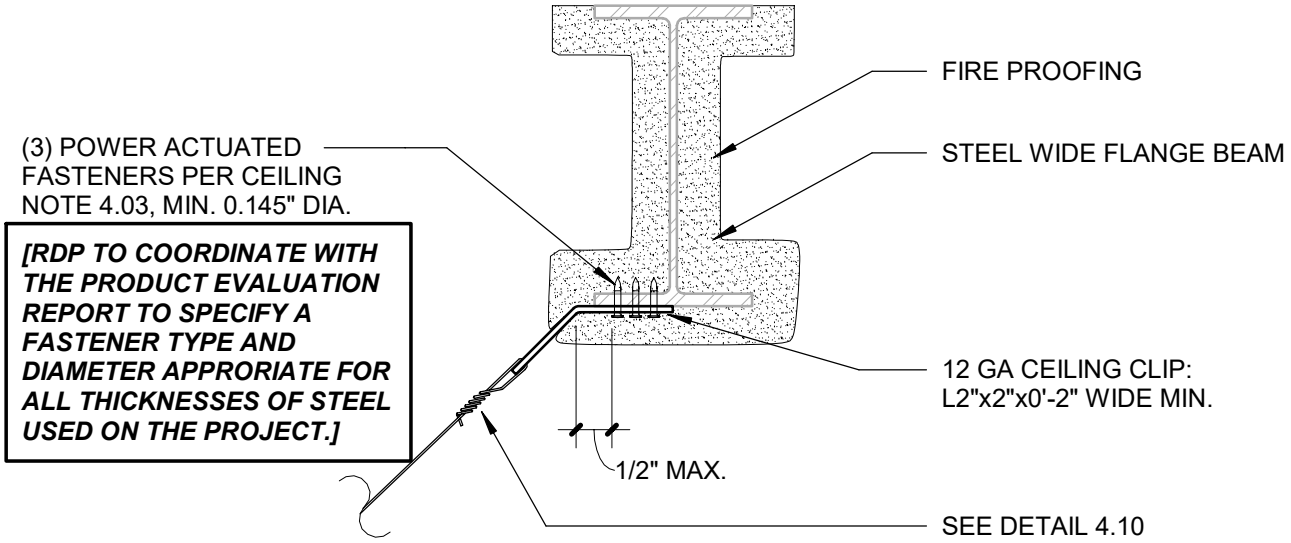


NOTES:

1. TEST POST-INSTALLED ANCHORS IN ACCORDANCE WITH CEILING NOTE 5.02.
2. REFER TO DETAIL 4.10 FOR ADDITIONAL INFORMATION.
3. DSA APPROVAL OF A CONSTRUCTION PLAN IS REQUIRED PRIOR TO INSTALLING POST-INSTALLED ANCHORS IN PRESTRESSED CONCRETE. THE CONSTRUCTIN PLAN SHALL DEMONSTRATE HOW THE LOCATION OF PRESTRESSING TENDONS AND STRANDS WILL BE LOCATED AND DENOTED AS NECESSARY TO AVOID INTERFERENCE.

Detail Title :	REV: 09/21/2015	Detail No.
BRACE WIRE CONNECTION TO CONCRETE SLAB, BEAM, OR JOIST	REV: 03/2022	4.32

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

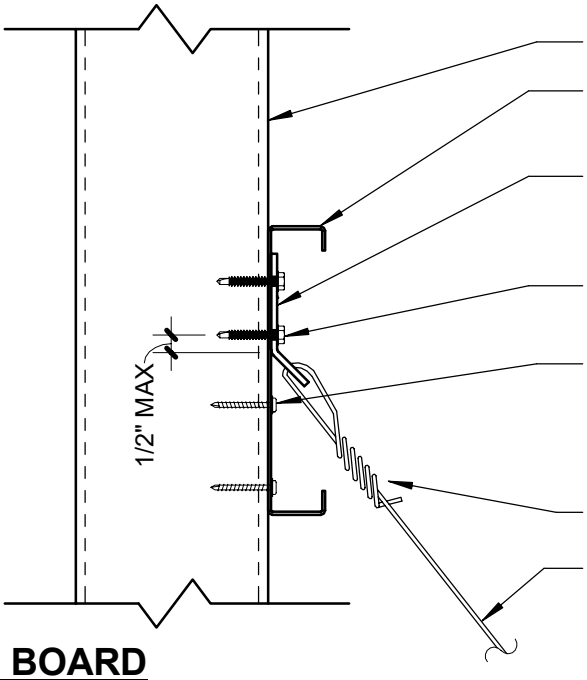


BRACING WIRE

NOTES :

1. BEAM FLANGE THICKNESS SHALL NOT BE LESS THAN 3/16".
2. ARCHITECT, IOR, AND CONTRACTOR SHALL VERIFY THAT NO POWER ACTUATED FASTENER IS INSTALLED IN THE PROTECTED ZONE OF ANY STEEL MEMBER. SEE AISC 341.
3. REFER TO DETAIL 4.10 FOR ADDITIONAL INFORMATION.

Detail Title :	REV: 09/21/2015	Detail No.
BRACE WIRE CONNECTION TO STRUCTURAL STEEL	REV: 03/2022	4.33



METAL STUD (20 GA MIN.)

600S137-54 BACKING
SPAN 2 WALL STUDS MIN.

12GA CEILING CLIP: L1-1/2"x
1-1/2"x0'-1" WIDE MIN.
BEND TO ALIGN WITH WIRE

(2) #10x1-1/4" S.M.S. CEILING
CLIP TO BACKING

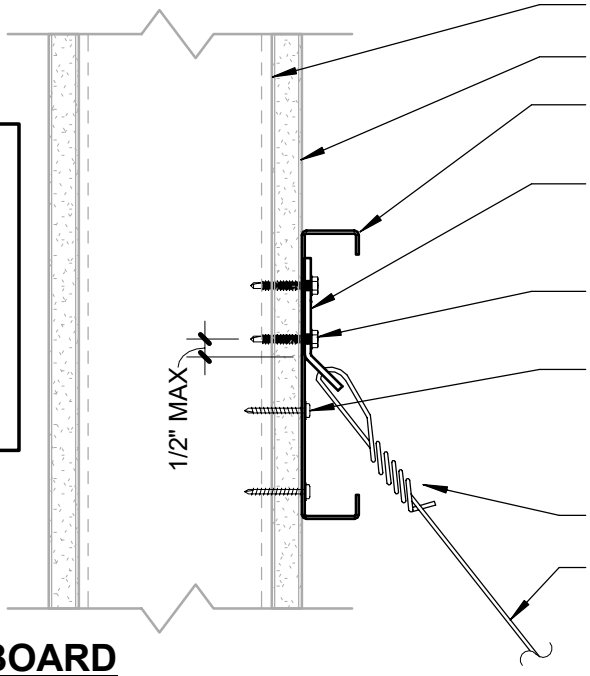
#10x1-1/4" S.M.S. BACKING TO
EACH STUD, QTY THUS:
(3) AT 20 GA STUD
(2) AT 18 GA STUD & HEAVIER

SEE DETAIL 4.10

BRACE WIRE: ORIENTATION
IN PLAN SHALL BE
PERPENDICULAR WITH WALL

WALL WITHOUT GYP. BOARD

[RDP MAY WISH TO PERMIT THE CEILING CLIP TO BE ATTACHED DIRECTLY TO THE WALL STUD FLANGE. IN THIS CASE THE RDP SHALL PROVIDE 18 GA OR HEAVIER STUDS AND DEMONSTRATE THAT THE WALL STUD IS CAPABLE OF SUPPORTING THE BRACE FORCE.]



METAL STUD (20 GA MIN.)

MAX. 1 LAYER OF GYP. BOARD

600S137-54 BACKING
SPAN 2 WALL STUDS MIN.

12GA CEILING CLIP: L2-1/2"x
1-1/2"x0'-1" WIDE MIN. (LLV)
BEND TO ALIGN WITH WIRE

(4) #10x1-1/4" S.M.S. CEILING
CLIP TO BACKING

#10x1-1/4" S.M.S. BACKING TO
EACH STUD, QTY THUS:
(5) AT 20 GA STUD
(4) AT 18 GA STUD & HEAVIER

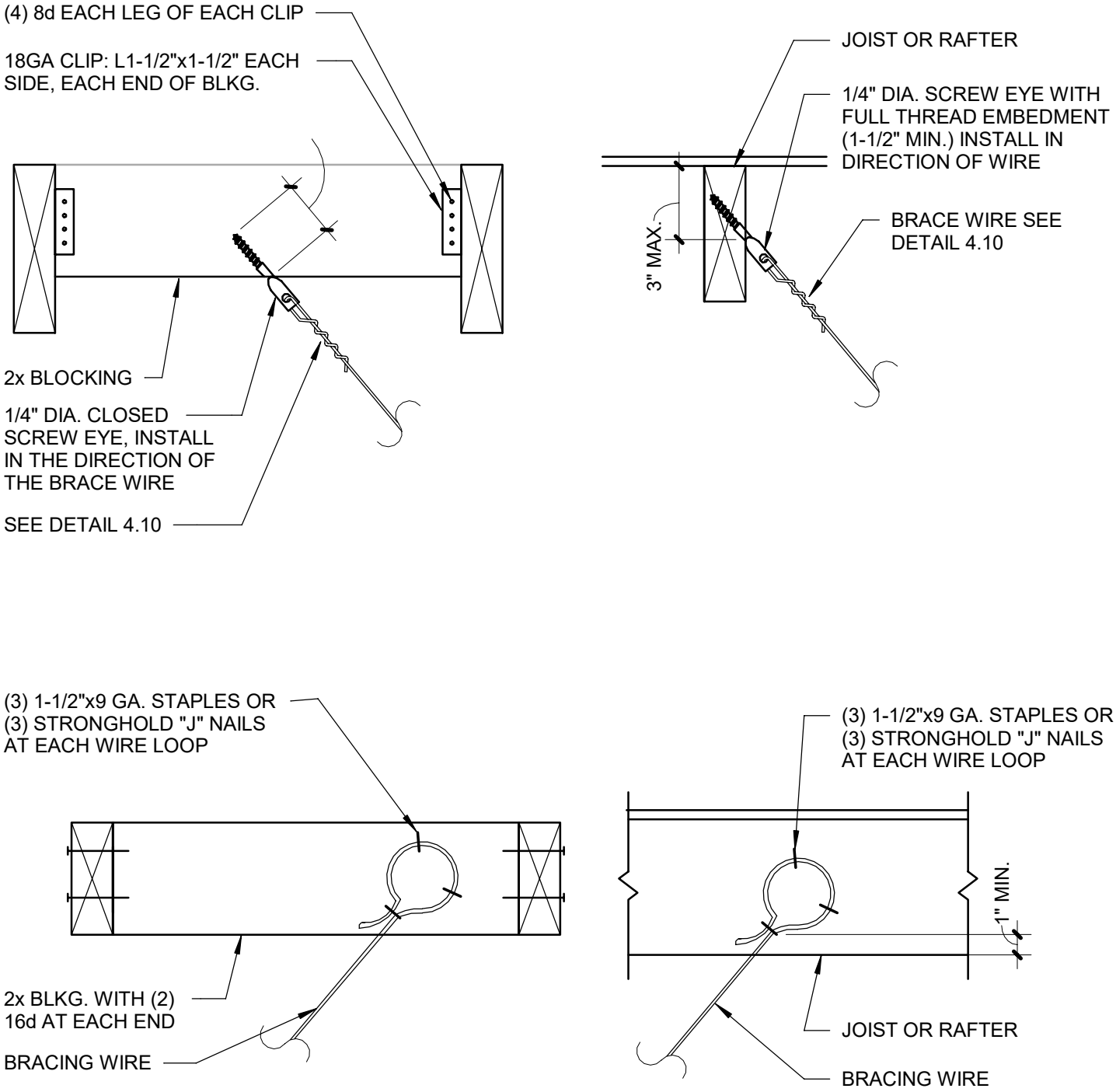
SEE DETAIL 4.10

BRACE WIRE: ORIENTATION
IN PLAN SHALL BE NO LESS
THAN 80 DEGREES WITH WALL

WALL WITH GYP. BOARD

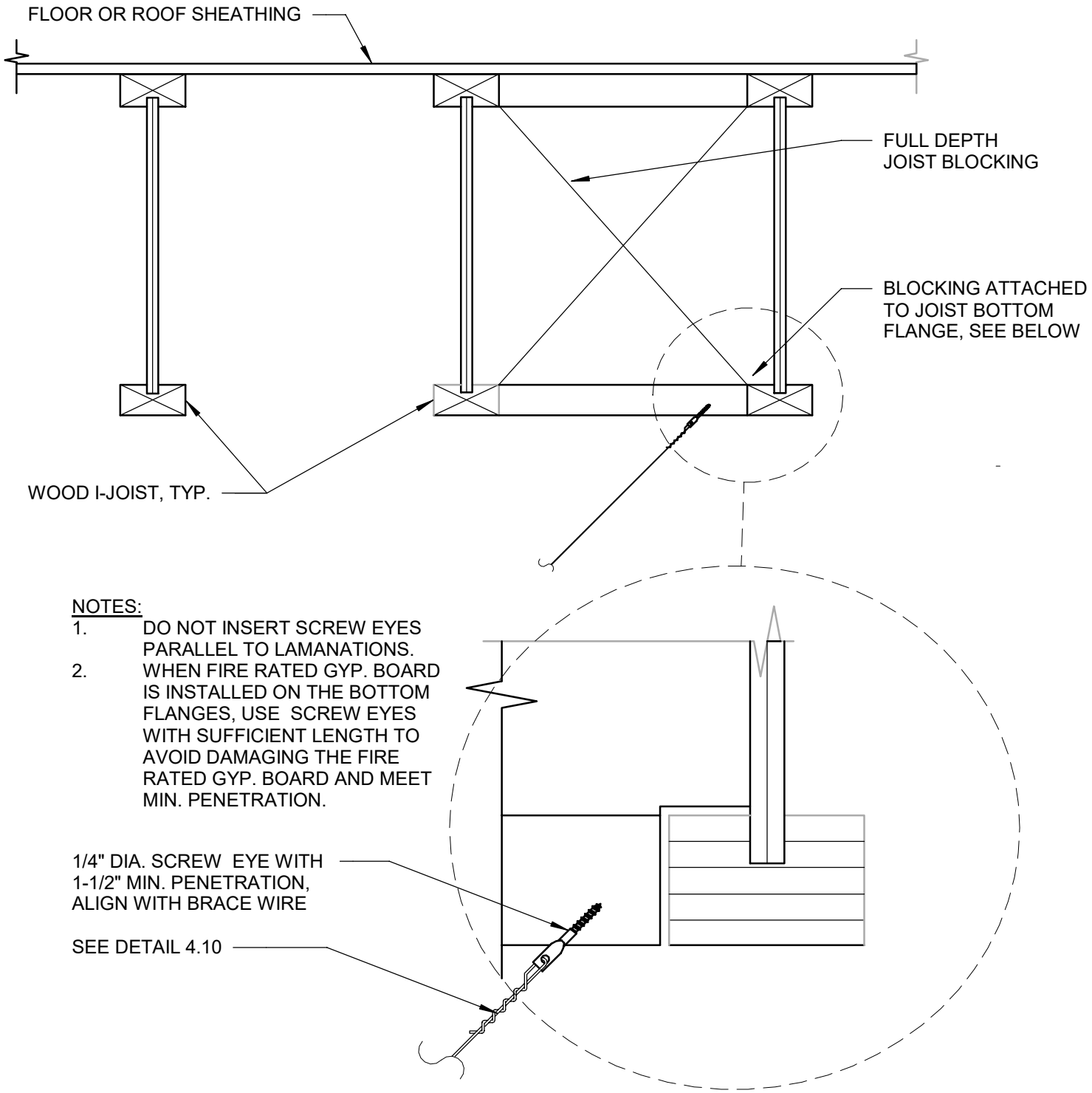
Detail Title :	REV: 09/21/2015	Detail No.
BRACE WIRE CONNECTION TO METAL STUD WALL	REV: 03/10/2017	4.34
	REV: 03/2022	

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



Detail Title :	REV: 09/21/2015	Detail No.
BRACE WIRE CONNECTION TO SAWN TIMBER	REV: 03/2022	4.35

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

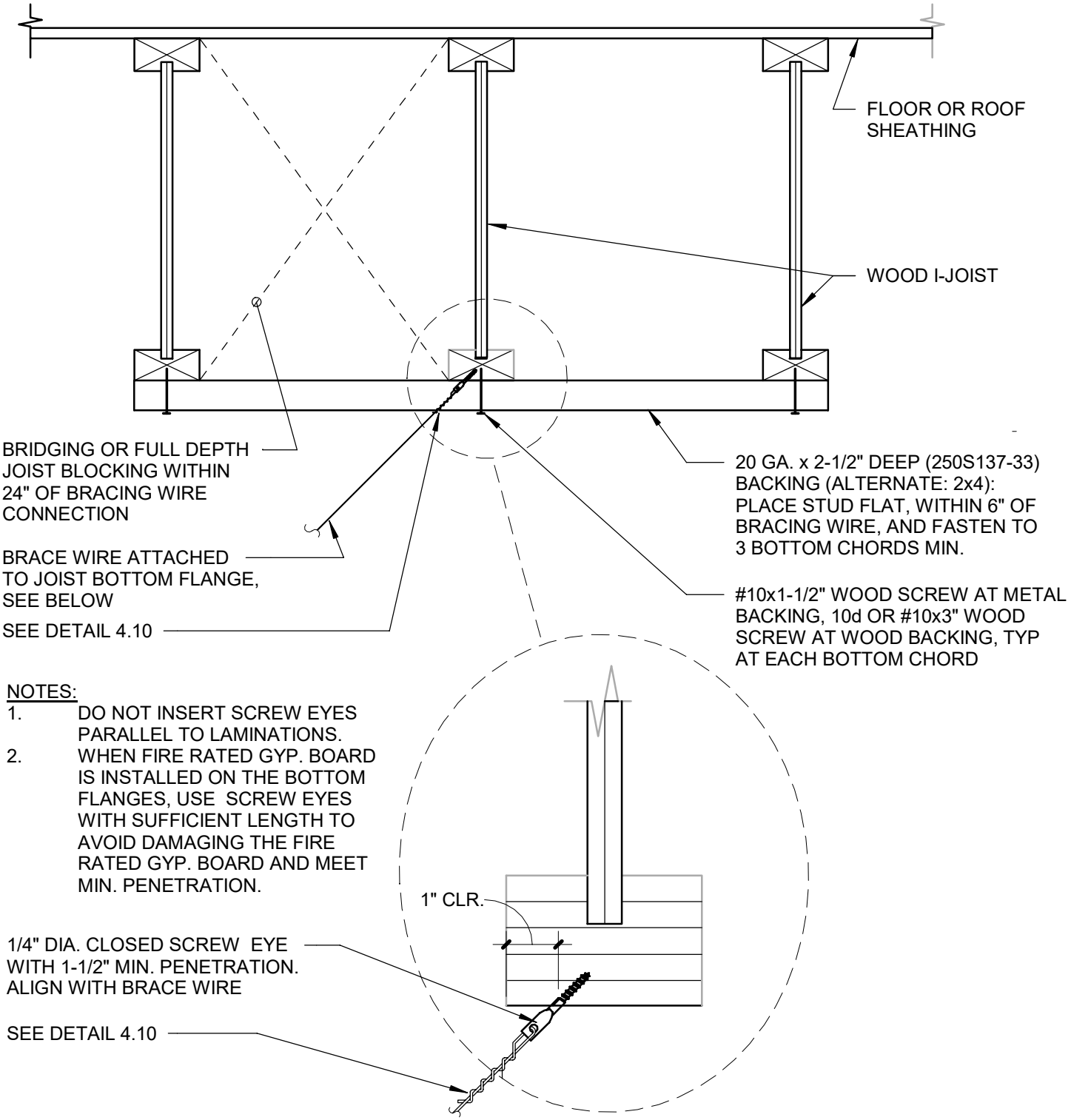


NOTES:

1. DO NOT INSERT SCREW EYES PARALLEL TO LAMANATIONS.
2. WHEN FIRE RATED GYP. BOARD IS INSTALLED ON THE BOTTOM FLANGES, USE SCREW EYES WITH SUFFICIENT LENGTH TO AVOID DAMAGING THE FIRE RATED GYP. BOARD AND MEET MIN. PENETRATION.

Detail Title :	REV: 09/21/2015	Detail No.
BRACE WIRE CONNECTION TO WOOD I-JOIST	REV: 03/2022	4.36

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

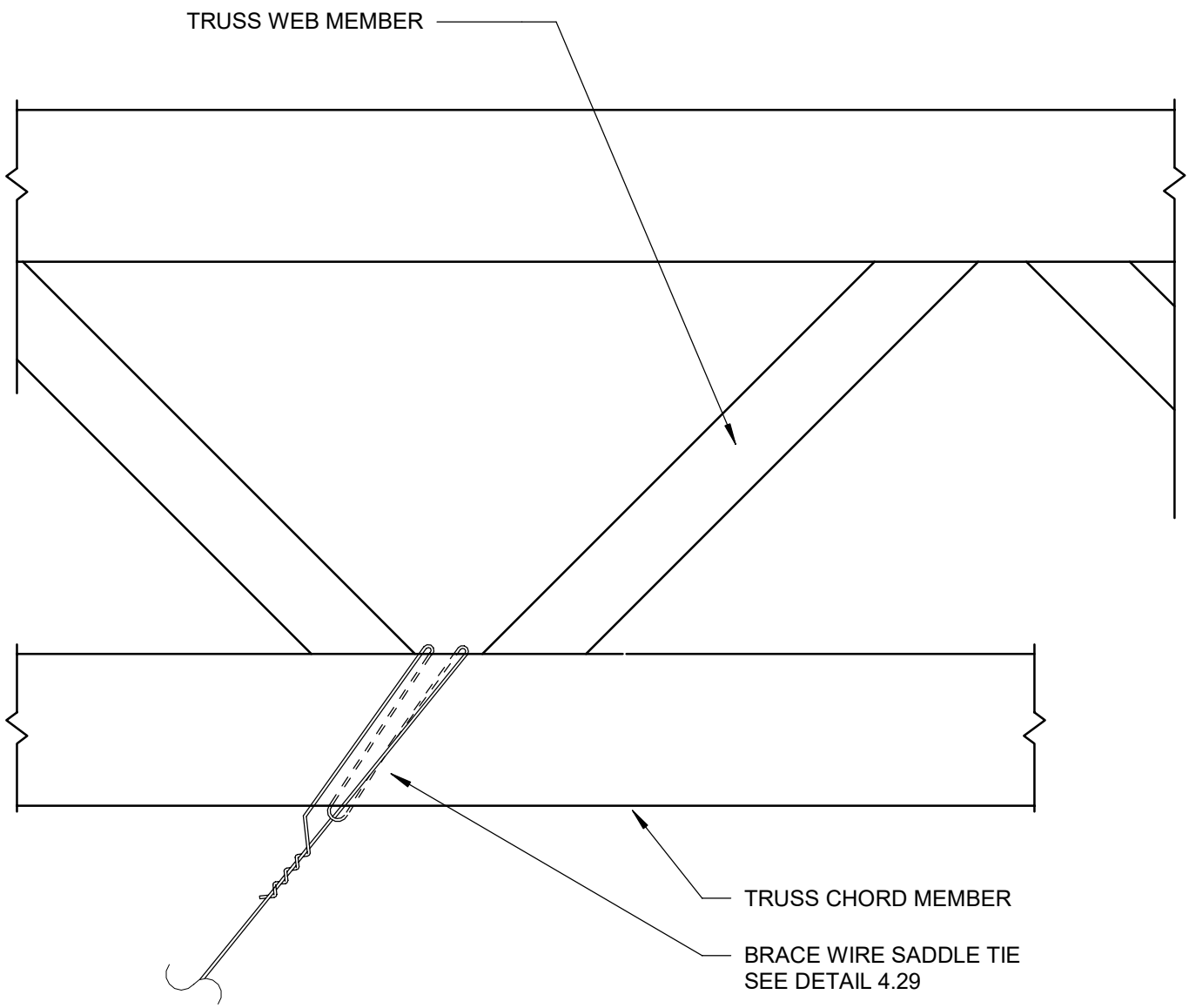


NOTES:

1. DO NOT INSERT SCREW EYES PARALLEL TO LAMINATIONS.
2. WHEN FIRE RATED GYP. BOARD IS INSTALLED ON THE BOTTOM FLANGES, USE SCREW EYES WITH SUFFICIENT LENGTH TO AVOID DAMAGING THE FIRE RATED GYP. BOARD AND MEET MIN. PENETRATION.

Detail Title :	REV: 09/21/2015	Detail No.
BRACE WIRE CONNECTION TO WOOD I - JOIST	REV: 03/2022	4.37

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

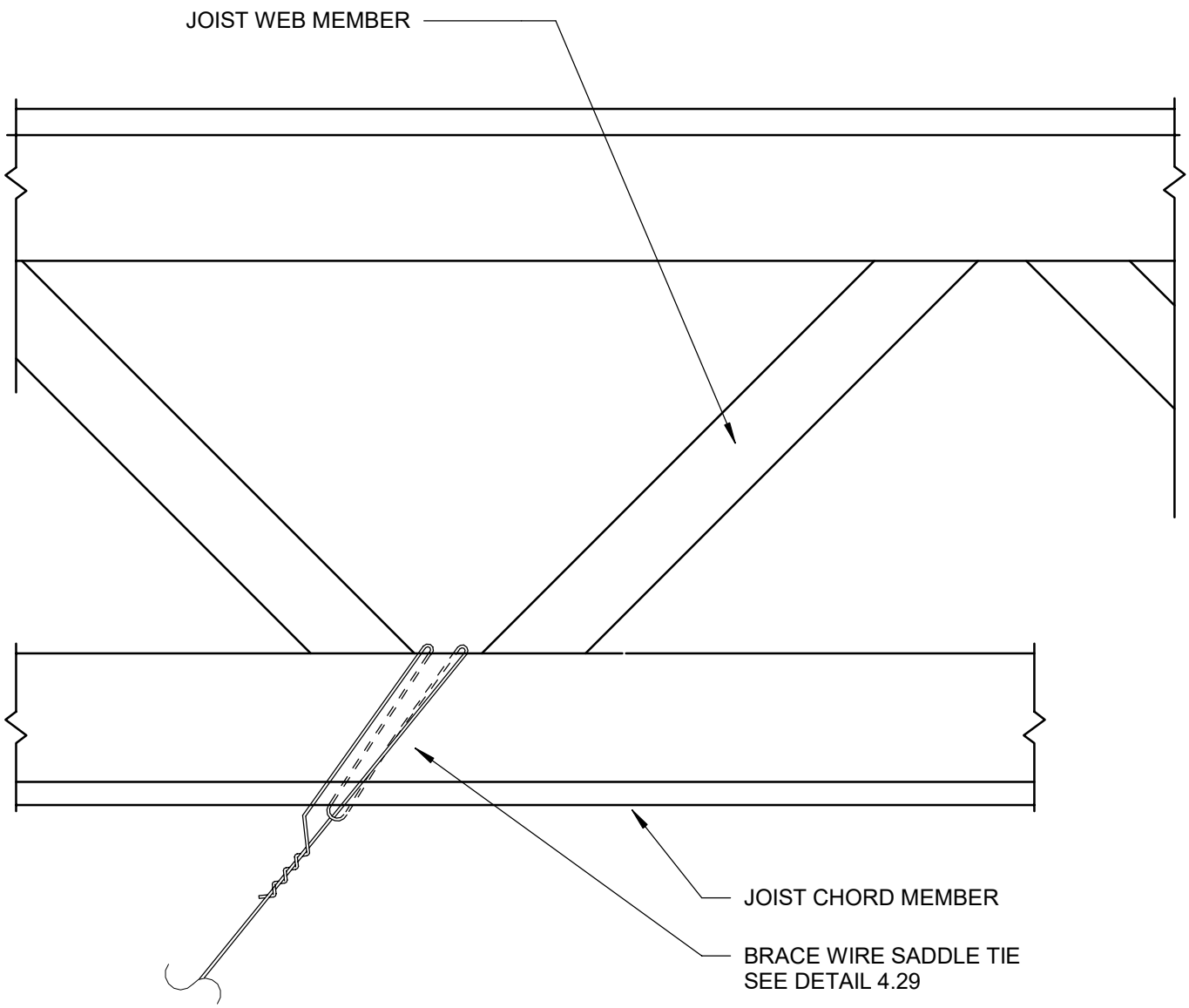


NOTES:

1. BRACE WIRE SHALL ALIGN PARALLEL WITH THE TRUSS BOTTOM CHORD.
2. BRACE WIRES PERPENDICULAR TO THE TRUSS SHALL BE INSTALLED TO BLOCKING BETWEEN TRUSS TOP CHORDS PER DETAIL 4.35.
3. WHERE TRUSS BOTTOM CHORD IS A 2x4 OR GREATER, BRACE WIRES PARALLEL TO THE TRUSS MAY BE ATTACHED TO THE TOP OR BOTTOM CHORD PER DETAIL 4.35 AT THE CONTRACTOR'S OPTION.

Detail Title :	REV: 09/21/2015	Detail No.
BRACE WIRE CONNECTION TO WOOD CHORD TRUSS	REV: 03/2022	4.38

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

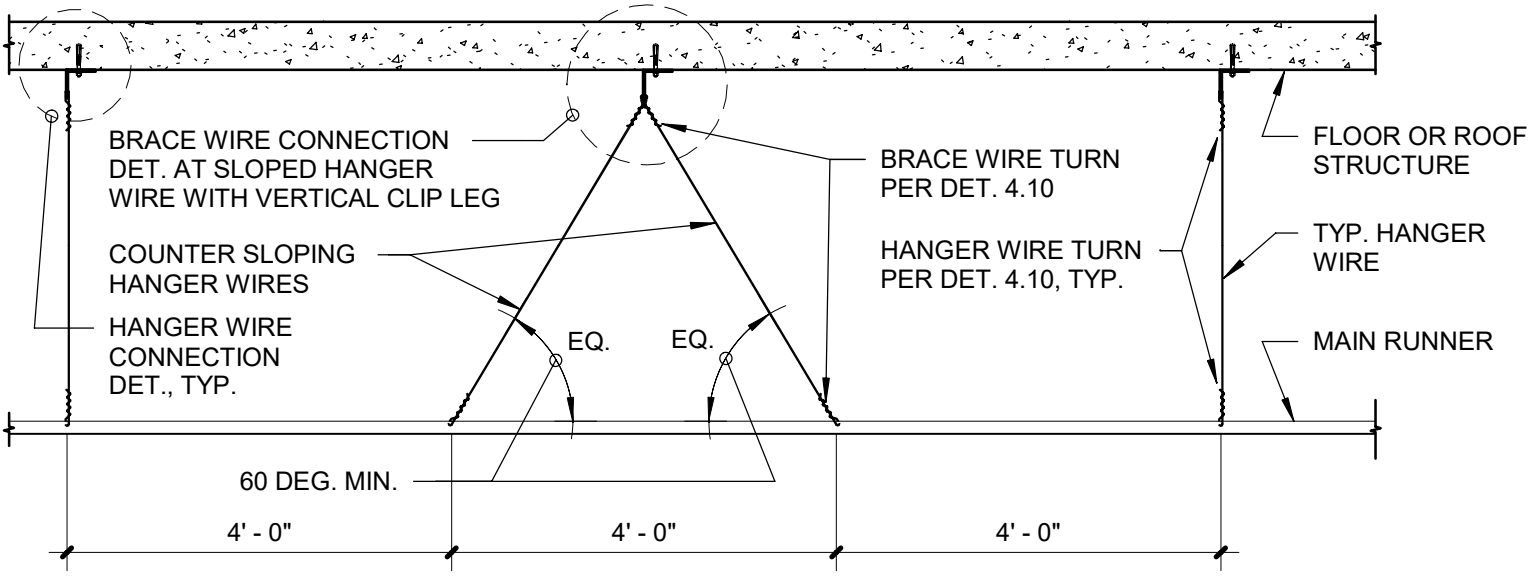


NOTES:

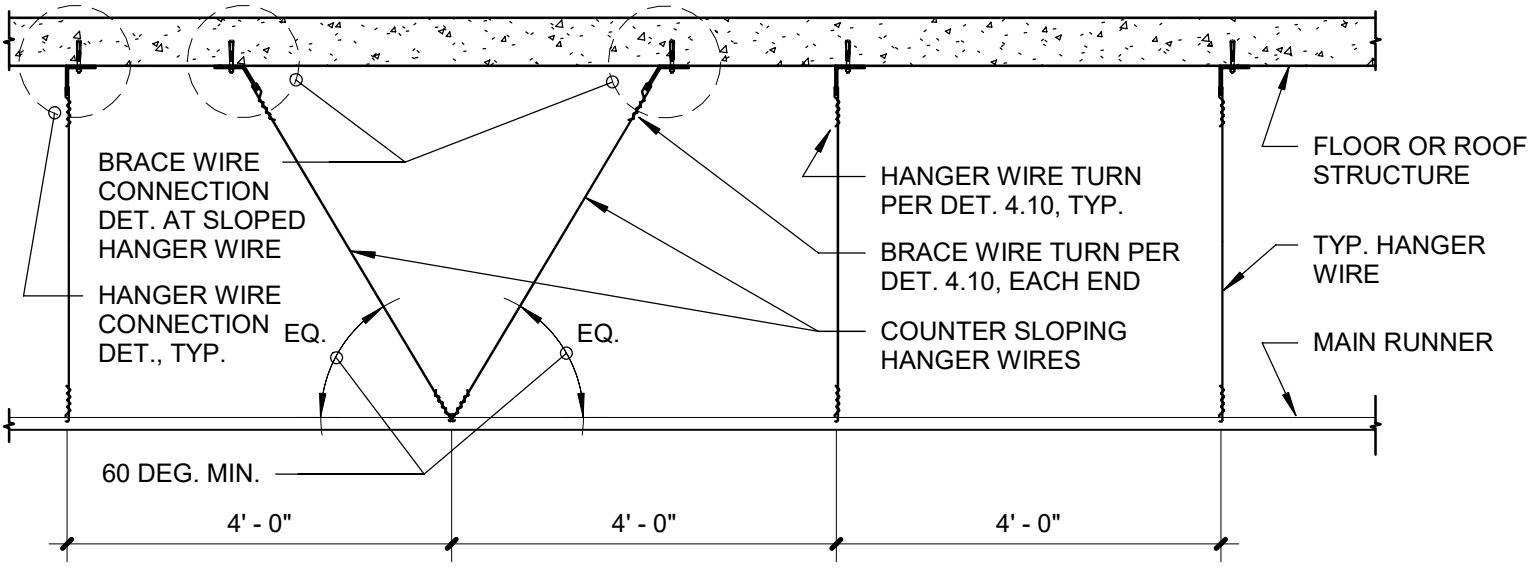
1. BRACE WIRE SHALL ALIGN PARALLEL WITH THE TRUSS BOTTOM CHORD.
2. BRACE WIRES PERPENDICULAR TO THE TRUSS SHALL BE ATTACHED TO THE HORIZONTAL LEG OF THE TOP CHORD ANGLE PER DETAIL 4.33.
3. BRACE WIRES PARALLEL TO THE TRUSS MAY BE ATTACHED TO THE BOTTOM CHORD PER DETAIL 4.33 AT THE CONTRACTOR'S OPTION.

Detail Title :	REV: 09/21/2015	Detail No.
BRACE WIRE CONNECTION TO OPEN-WEB STEEL JOIST	REV: 03/2022	4.39

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



METHOD 1: COMMON POINT AT STRUCTURE



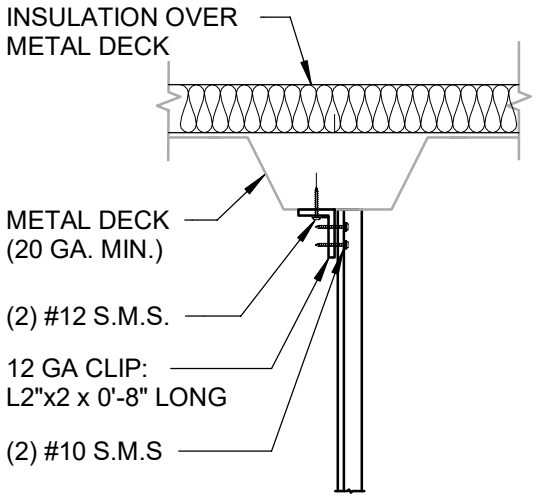
METHOD 2: COMMON POINT AT CEILING

Detail Title :	REV: 03/2022	Detail No.
HANGER WIRE COUNTERSLOPING METHODS (REF. ASTM C636)		4.40

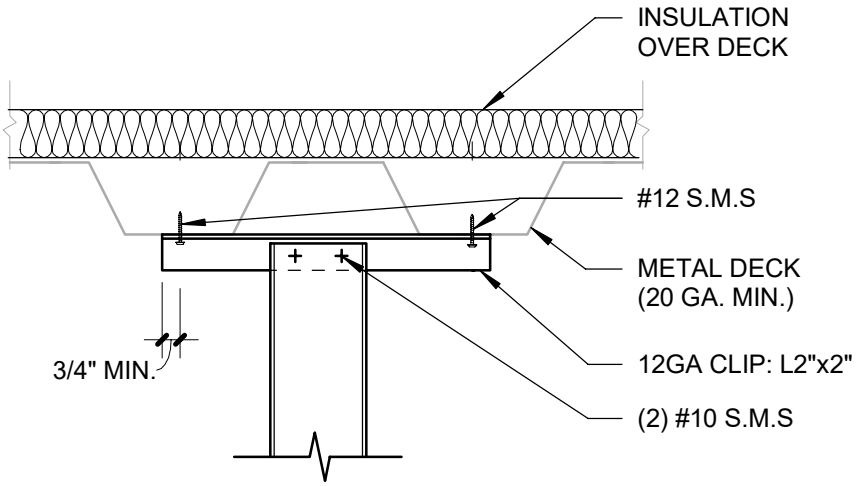
STRUCTURAL SYSTEM OF FLOOR/ ROOF ABOVE SUSPENDED CEILING	APPLICABLE DETAIL
BARE METAL DECK	5.20
CONCRETE OVER METAL DECK	5.21
CONCRETE SLAB, BEAM, OR JOIST	5.30
STRUCTURAL STEEL	5.40
SAWN TIMBER WITH GYPSUM BOARD	5.50
SAWN TIMBER WITHOUT GYPSUM BOARD	5.51
WOOD I-JOIST	5.52

Detail Title :	REV: 09/21/2015	Detail No.
COMPRESSION STRUT CONNECTION TABLE	REV: 03/2022	5.10

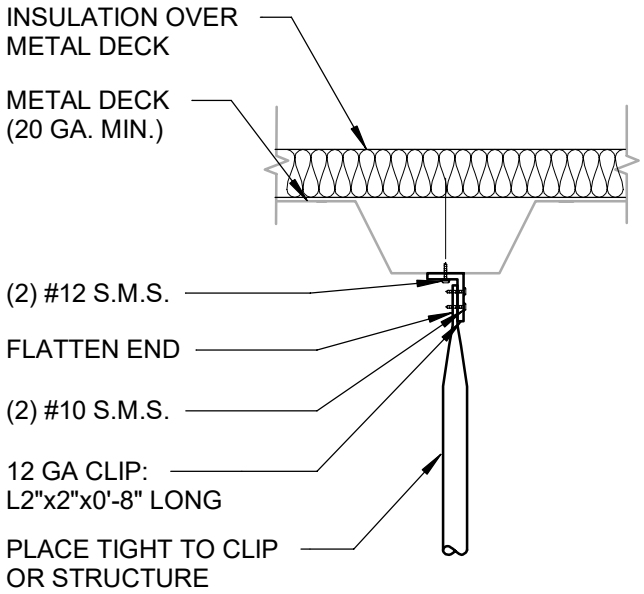
SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



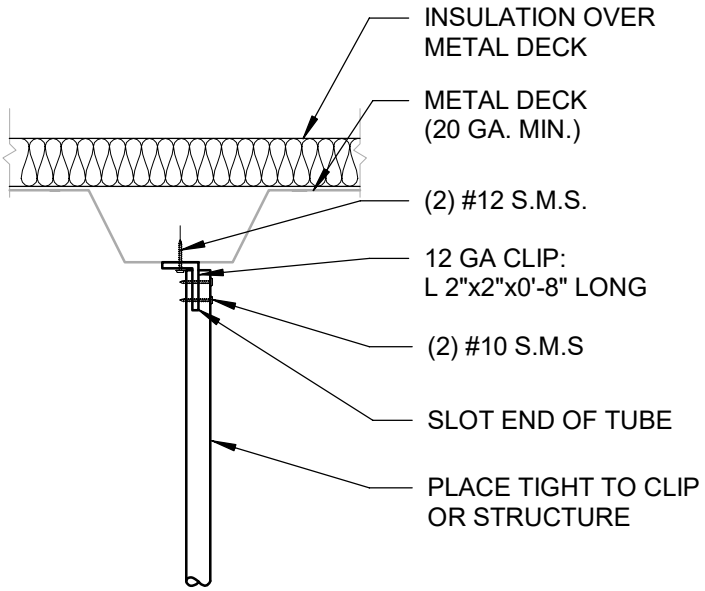
CHANNEL STRUT: OPTION 1



CHANNEL STRUT: OPTION 2



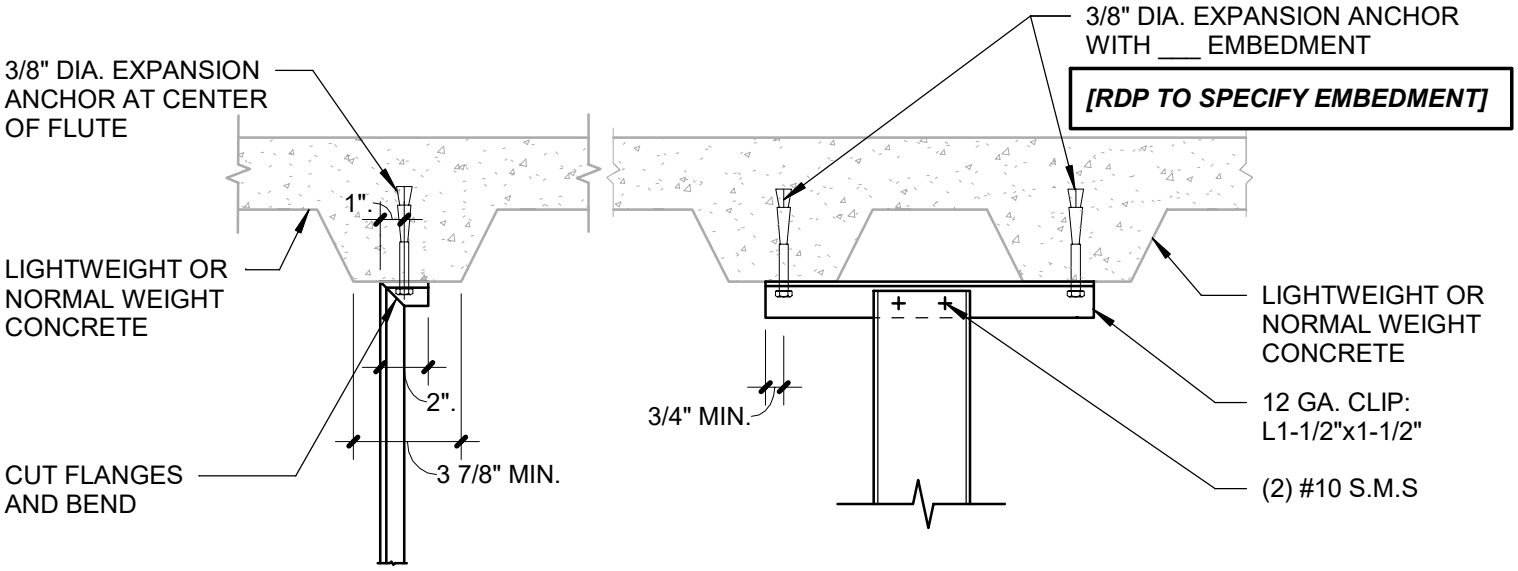
EMT STRUT: OPTION 1



EMT STRUT: OPTION 2

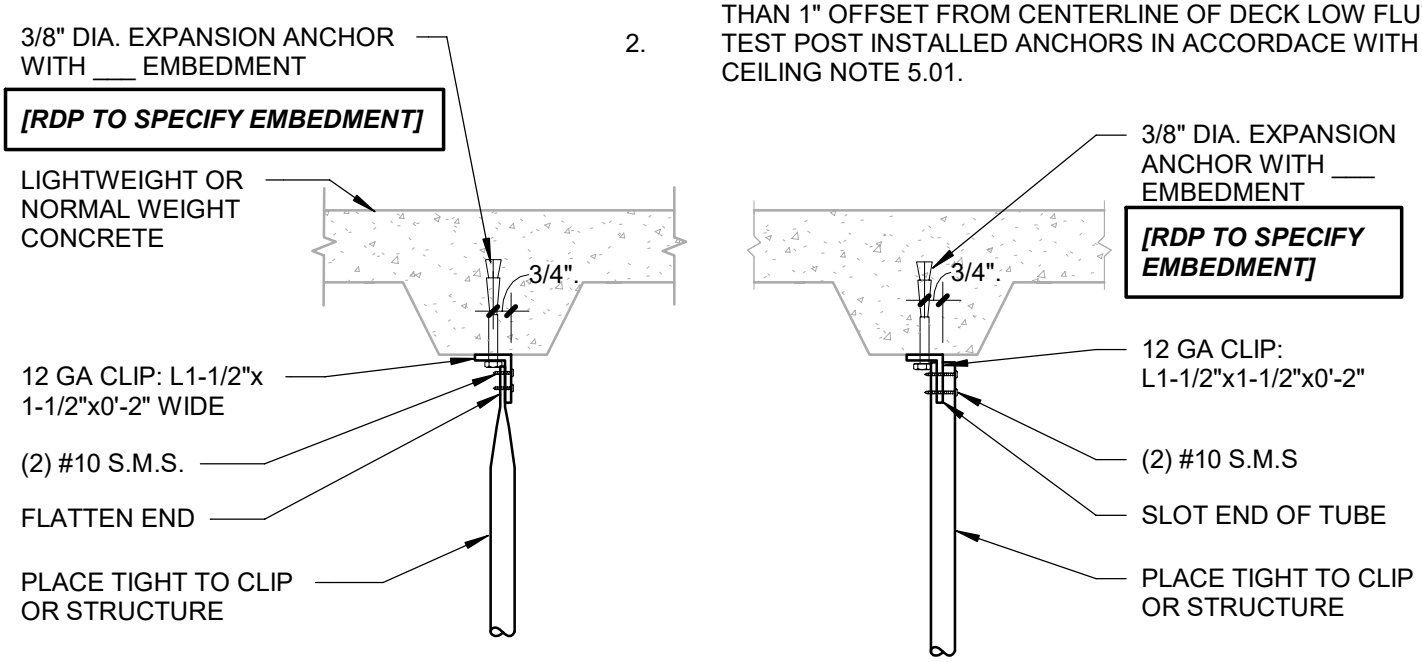
Detail Title :	REV: 09/21/2015	Detail No.
STRUT CONNECTION TO BARE METAL DECK	REV: 03/2022	5.20

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



CHANNEL STRUT: OPTION 1 **CHANNEL STRUT: OPTION 2**

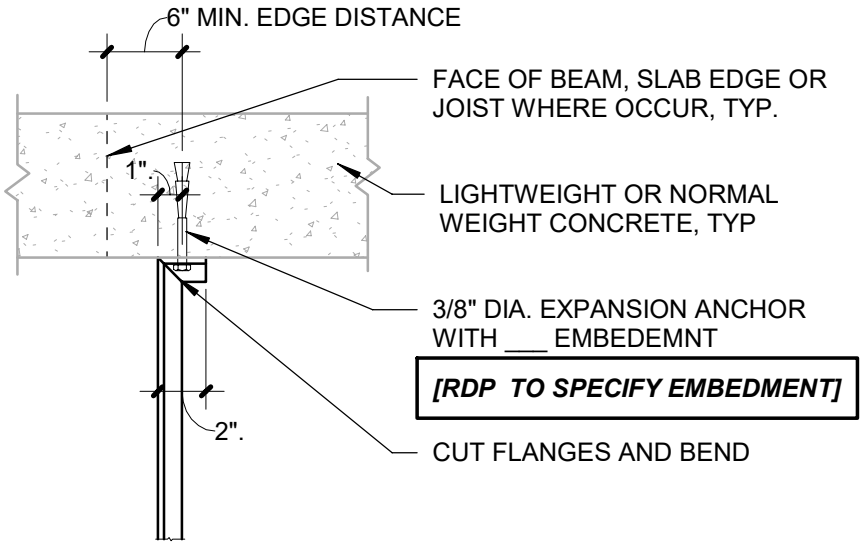
NOTES:
1. POST-INSTALLED ANCHORS TO BE PLACED NO MORE THAN 1" OFFSET FROM CENTERLINE OF DECK LOW FLUTE.
2. TEST POST INSTALLED ANCHORS IN ACCORDACE WITH CEILING NOTE 5.01.



EMT STRUT: OPTION 1 **EMT STRUT: OPTION 2**

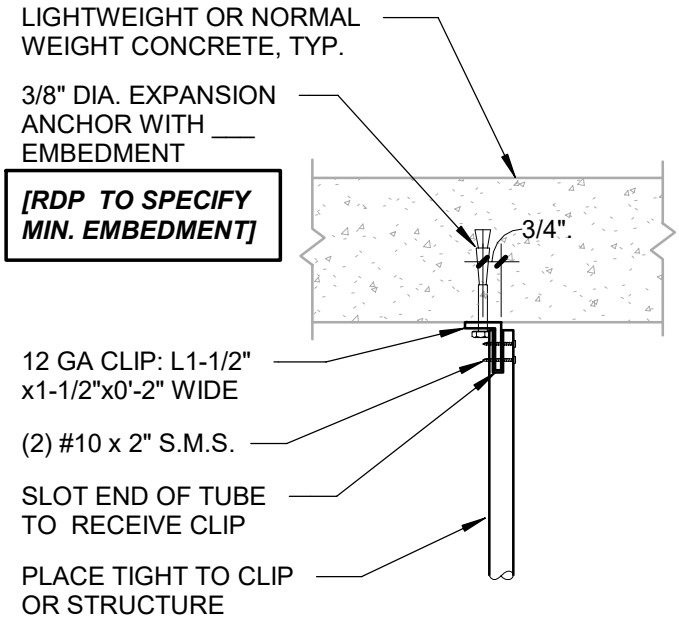
Detail Title :	REV: 09/21/2015	Detail No.
STRUT CONNECTION TO CONCRETE OVER METAL DECK	REV: 03/2022	5.21

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

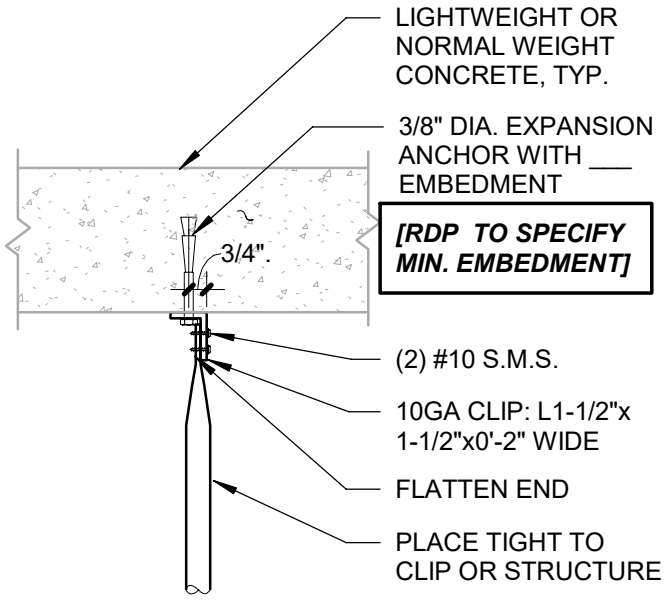


NOTES:
1. TEST POST INSTALLED ANCHORS IN ACCORDANCE WITH CEILING NOTE 5.01.

CHANNEL STRUT



EMT STRUT: OPTION 1

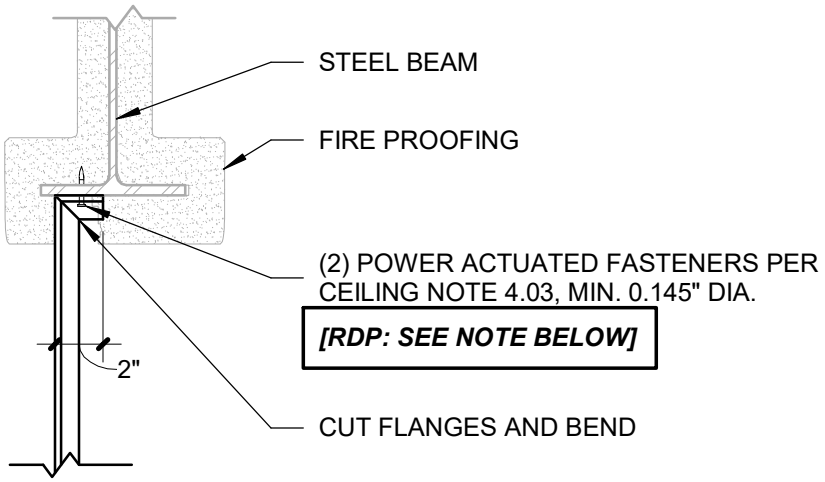


EMT STRUT: OPTION 2

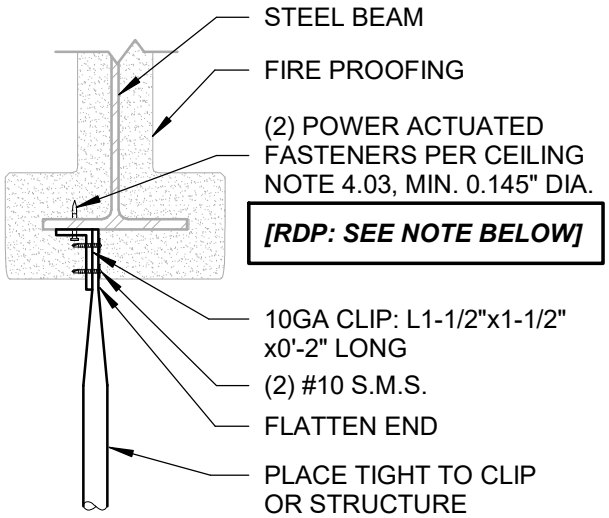
Detail Title :	REV: 09/21/2015	Detail No.
STRUT CONNECTION TO CONCRETE SLAB, BEAM, OR JOIST	REV: 03/2022	5.30

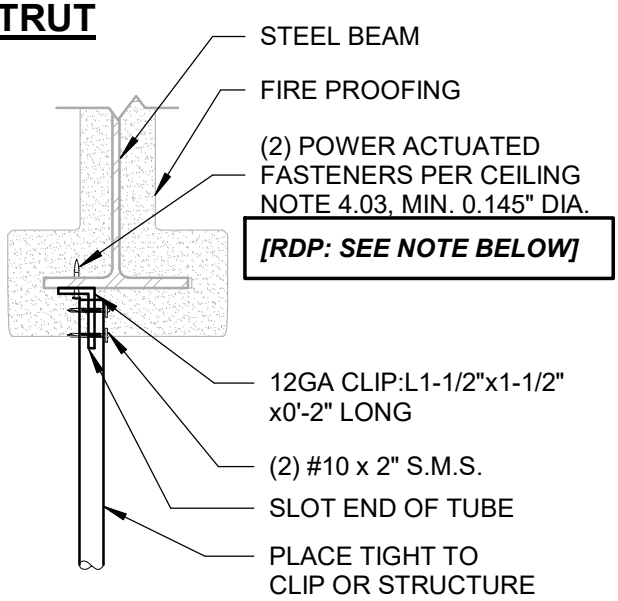
SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

NOTES:
1. STRUCTURAL STEEL MEMBER SHALL NOT BE LESS THAN 3/16".
2. ARCHITECT, I.O.R. AND CONTRACTOR SHALL VERIFY THAT NO POWER ACTUATED FASTENER IS INSTALLED IN THE PROTECTED ZONE OF ANY STEEL MEMBER, SEE AISC 341.
3. REFER TO DETAILS 5.20 AND 5.30 FOR ADDITIONAL INFORMATION



CHANNEL STRUT





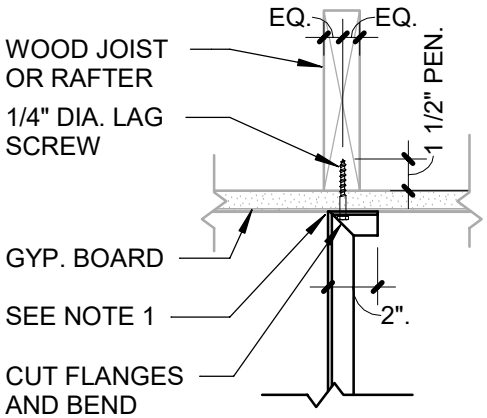
EMT STRUT: OPTION 1

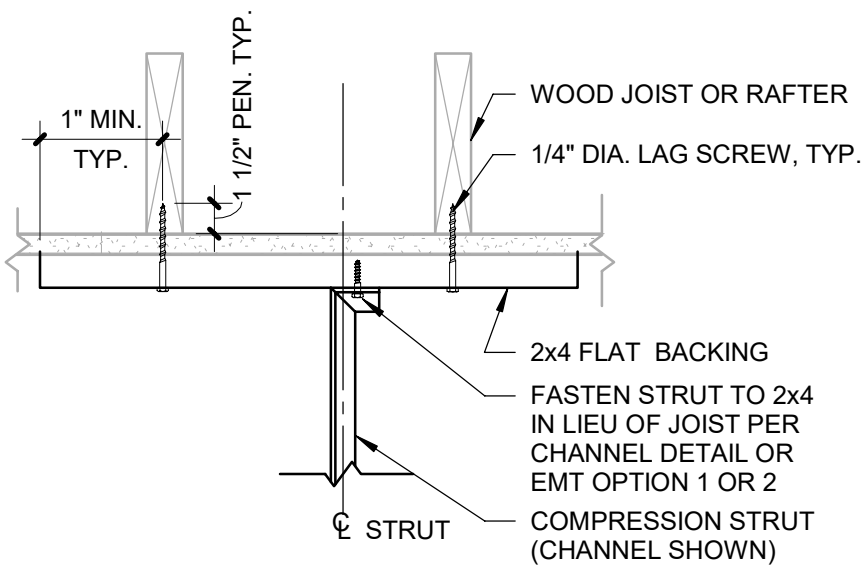
EMT STRUT: OPTION 2

[RDP TO COORDINATE WITH THE PRODUCT EVALUATION REPORT TO SPECIFY A FASTENER TYPE AND DIAMETER APPRORIATE FOR ALL THICKNESSES OF STEEL USED ON THE PROJECT.]

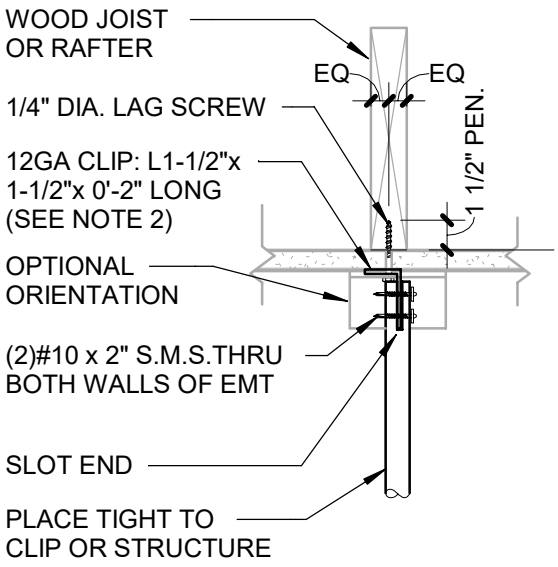
Detail Title :	REV: 09/21/2015	Detail No.
STRUT CONNECTION TO STRUCTURAL STEEL	REV: 03/2022	5.40

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC

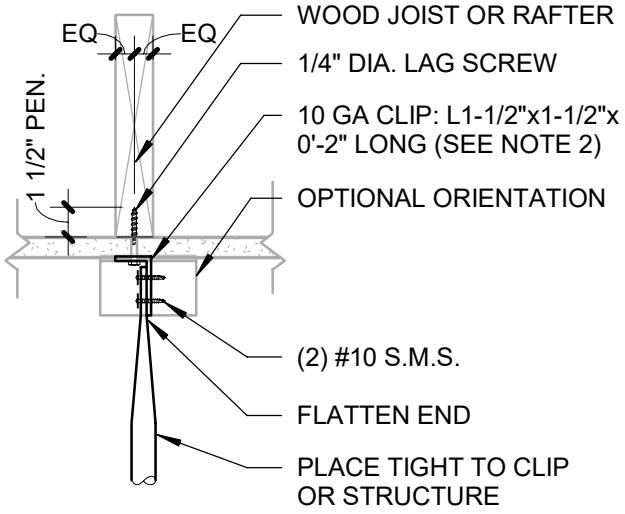




CHANNEL STRUT



CHANNEL OR EMT STRUT: BETWEEN JOIST



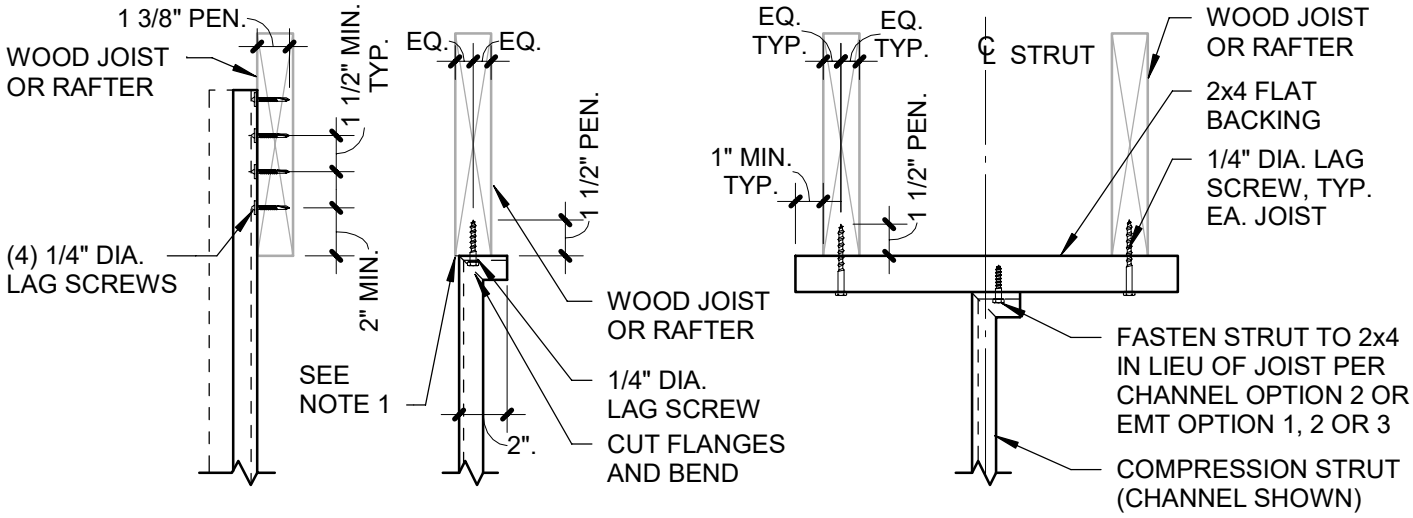
EMT STRUT: OPTION 1

EMT STRUT: OPTION 2

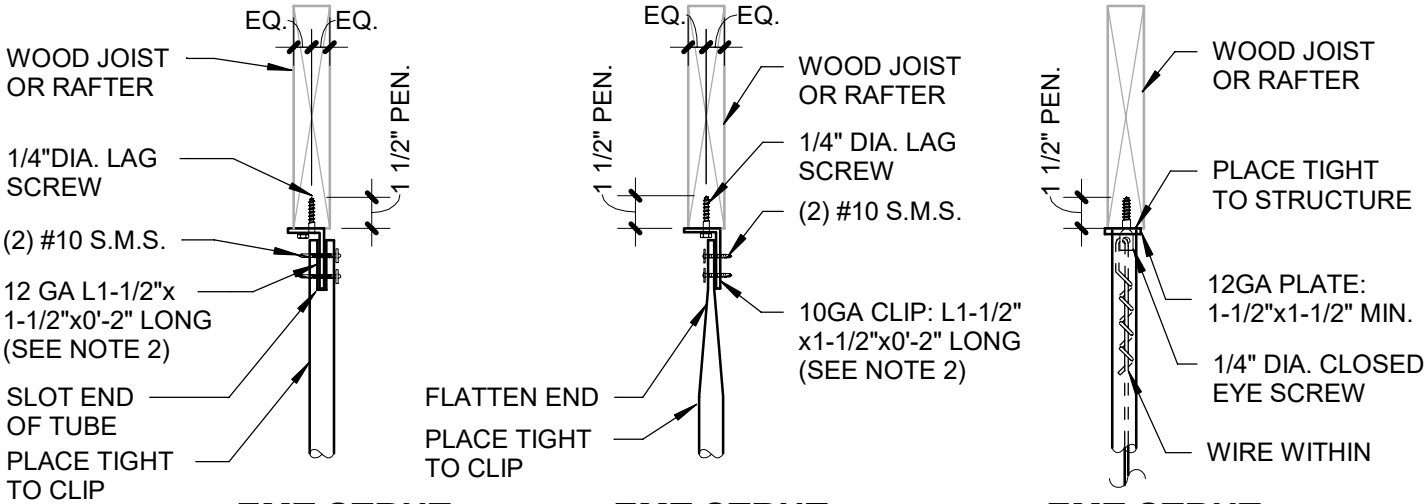
NOTES:
1. WEB OF CHANNEL TO BEAR WITHIN WIDTH OF THE WOOD MEMBER.
2. FOR ANGLE ORIENTED IN THE STANDARD POSITION, VERTICAL LEG TO FALL WITHIN THE WIDTH OF THE WOOD MEMBER.
3. PEN. = MINIMUM PENETRATION OF LAG SCREW THREADS INTO THE WOOD MEMBER.
4. NO. 14 WOOD SCREW MAY BE USED IN LIEU OF 1/4" LAG SCREW.

Detail Title :	REV: 09/21/2015	Detail No.
STRUT CONNECTION TO SAWN TIMBER WITH GYPSUM BOARD	REV: 03/2022	5.50

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



CHANNEL STRUT: OPTION 1 | **CHANNEL STRUT: OPTION 2** | **CHANNEL OR EMT STRUT: BETWEEN JOIST**

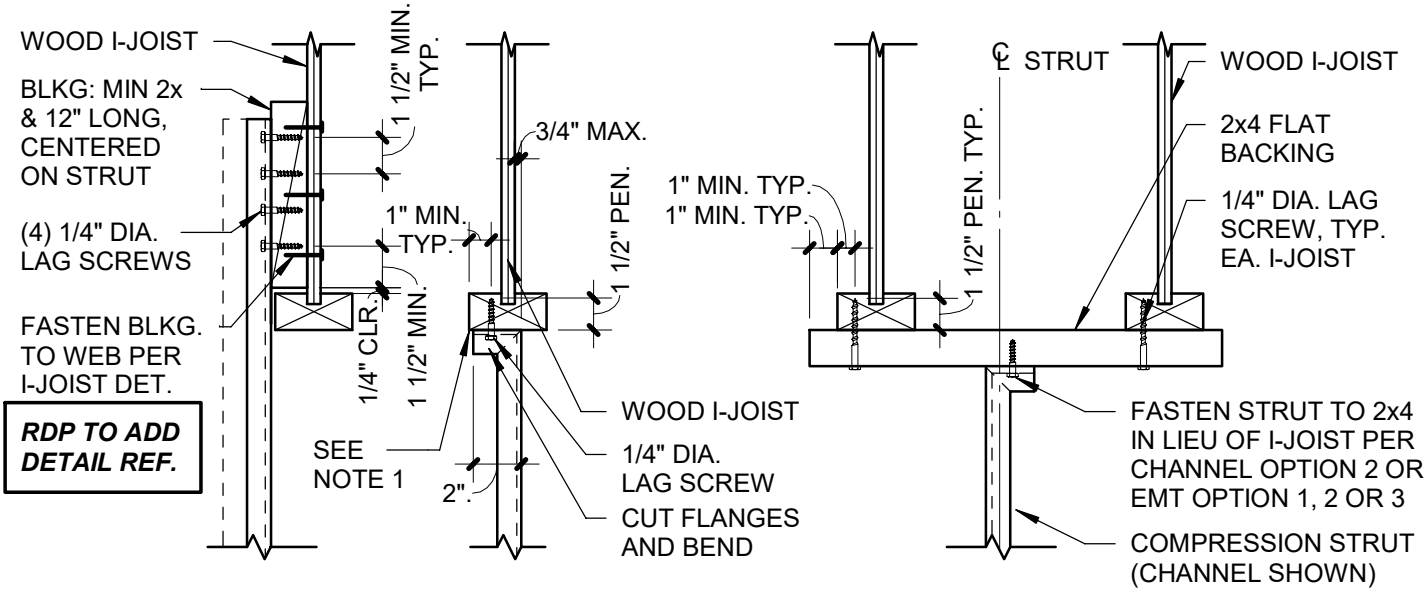


EMT STRUT: OPTION 1 | **EMT STRUT: OPTION 2** | **EMT STRUT: OPTION 3**

NOTES:
1. WEB OF CHANNEL TO BEAR WITHIN WIDTH OF WOOD MEMBER.
2. VERTICAL LEG OF MEMBER TO FALL WITHIN THE WIDTH OF THE WOOD MEMBER.
3. SEE DETAIL 5.50 FOR ADDITIONAL INFORMATION.
4. PEN. = MINIMUM PENETRATION OF LAG SCREW THREADS INTO THE WOOD MEMBER.
5. NO. 14 WOOD SCREW MAY BE USED IN LIEU OF 1/4" LAG SCREW.

Detail Title :	REV: 09/21/2015	Detail No.
STRUT CONNECTION TO SAWN TIMBER WITHOUT GYPSUM BOARD	REV: 03/2022	5.51

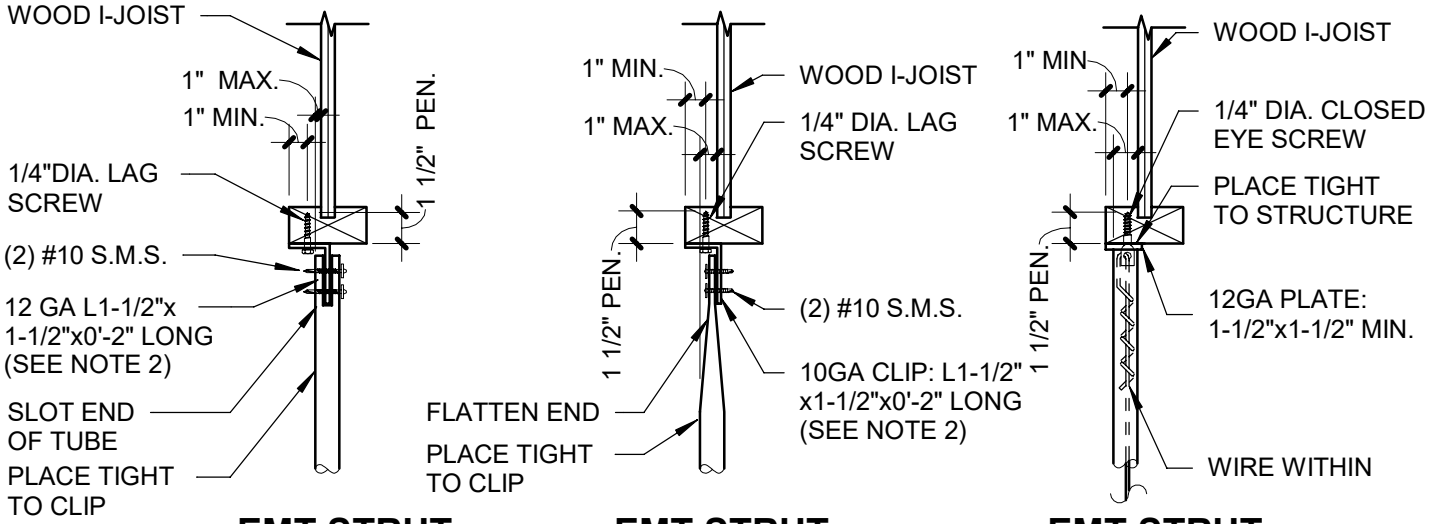
SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



CHANNEL STRUT: OPTION 1

CHANNEL STRUT: OPTION 2

CHANNEL OR EMT STRUT: BETWEEN I-JOIST



EMT STRUT: OPTION 1

EMT STRUT: OPTION 2

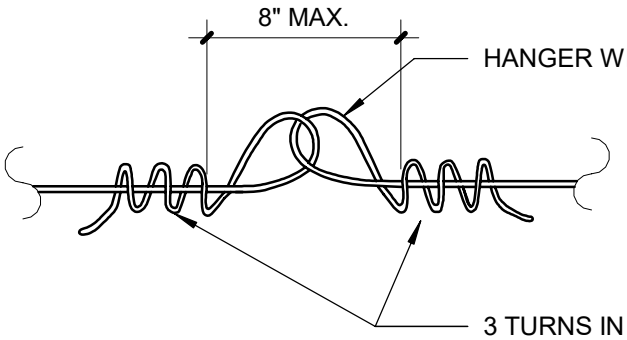
EMT STRUT: OPTION 3

NOTES:

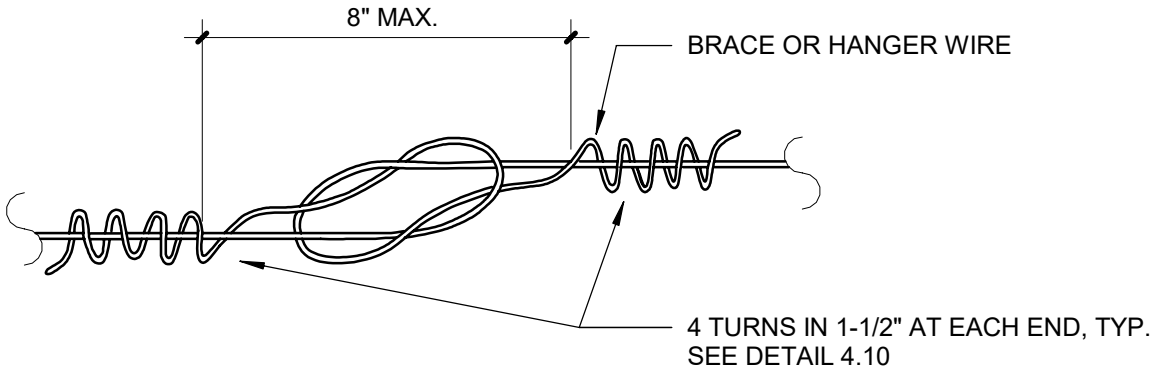
1. WEB OF CHANNEL TO BEAR WITHIN WIDTH OF WOOD MEMBER.
2. VERTICAL LEG OF MEMBER TO FALL WITHIN THE WIDTH OF THE WOOD MEMBER.
3. SEE DETAIL 5.50 FOR ADDITIONAL INFORMATION.
4. PEN = MINIMUM PENETRATION OF LAG SCREW THREADS INTO THE WOOD MEMBER.
5. NO. 14 WOOD SCREW MAY BE USED IN LIEU OF 1/4" LAG SCREW.

Detail Title :	REV: 03/2022	Detail No.
STRUT CONNECTION TO I-JOIST		5.52

SUSPENDED LAY-IN PANEL CEILING: 2019 CBC



HANGER WIRE ONLY



HANGER OR BRACE WIRE

NOTES:

1. WIRE SPLICES ARE SHOWN LOOSELY TIED FOR ILLUSTRATIVE PURPOSES ONLY AND SHALL BE DRAWN TIGHT TO COMPLETE INSTALLATION WHEN CONSTRUCTED.
2. WIRE LOOPS SHALL BE TIGHTLY WRAPPED AND SHARPLY BENT TO PREVENT ANY VERTICAL MOVEMENT OR ROTATION WITHIN THE LOOPS.
3. EACH HANGER AND BRACE WIRE SHALL BE SPLICED NO MORE THAN ONCE ALONG ITS LENGTH.

Detail Title :	REV: 09/21/2015	Detail No.
CEILING WIRE SPLICES	REV: 03/2022	6.10

APPENDIX B: GUIDANCE FOR RECESSED LINEAR LUMINAIRES

Recessed linear luminaires require specific detailing where they interrupt consecutive cross runners in the length of the luminaire. Light-gauge steel yokes are commonly used to vertically support the grid where the cross runners are interrupted. The lateral tie between cross runners is essential to maintaining a continuous ceiling grid system. Yokes require testing to confirm their capacity to transfer the required 180-pound force between cross runners per ASTM E580 Section 5.1.2.

B.1 Option 1 Installation

Linear luminaires meeting the following requirements can be installed in a similar manner as a 2-feet wide by 4-feet long troffer luminaire. The grid and luminaires shall be installed per the requirements of this IR. See Figure B1 below for reference.

B.1.1 Luminaire is 4-feet long or less in length and fits within the typical grid layout.

B.1.2 Luminaire interrupts no more than a single cross runner along its length where oriented parallel to a main runner.

B.1.3 Where oriented parallel to a main runner, the luminaire is attached to a main runner on one side.

B.1.4 Where oriented parallel to a cross runner, the luminaire is attached to a continuous line of cross runners on at least one side.

B.1.5 Runners shall be installed to bound the luminaire on all sides.

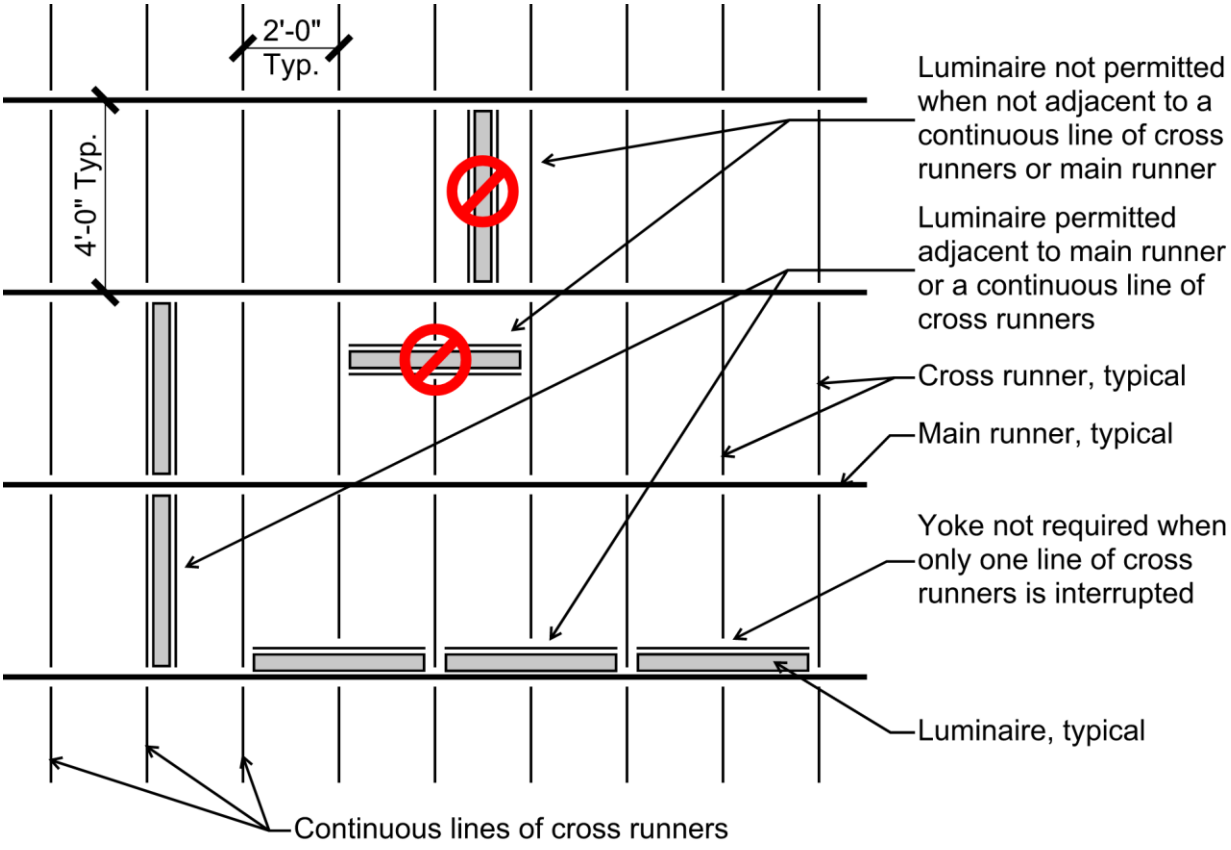


Figure B1: Option 1 Reflected Ceiling Plan

B.2 Option 2 Installation

Linear luminaires up to 12-feet long and oriented parallel to the main runners can be installed according to the provisions of this section. See Figure B2 for reference.

B.2.1 The luminaire must be manufactured as a single, continuous unit in the determination of its length (multiple units screwed together may be considered as an individual unit). A short cross runner attached to the main runner shall be installed at the end of each luminaire unit. The maximum weight of each luminaire unit shall be 56 pounds.

B.2.2 Linear luminaires shall be oriented parallel to the main runners.

B.2.3 Linear luminaires shall be installed with main runners on both its longitudinal sides and extend the entire length of the ceiling (wall to wall).

B.2.4 Where consecutive cross runners are interrupted, a yoke shall be installed at each end of the luminaire and at four feet on center maximum along its length.

B.2.4.1 When the proprietary yoke has evaluation report approval in accordance with IR A-5 confirming approved use in Seismic Design Category D, E, and F, including capacity to resist the 180-pound force required by ASTM E580 Section 5.1.2, supplemental framing is not required at the yoke. Evaluation report approvals based on testing per the Acceptance Criteria for Suspended Ceiling Framing Systems (AC 368) published by the International Code Council Evaluation Service (ICC-ES), include testing for this force.

B.2.4.2 When the yoke does not have evaluation report approval complying with Section B.2.4.1 above, supplemental framing is required at the yoke to demonstrate compliance with the requirements of ASTM E580 Section 5.1.2. See Section B.2.5.8 below.

B.2.5 The following information shall be provided on the construction documents:

B.2.5.1 A typical plan or isometric detail showing the layout of the main runners and cross runners, linear luminaires, yokes and brace assembly spacing relative to luminaires.

B.2.5.2 Manufacturer’s yoke part, model, or catalog number.

B.2.5.3 Detail illustrating the screw attachment of the yoke legs to each other.

B.2.5.4 Detail illustrating the connection of the yoke to the main and cross runners along the length of the linear luminaire.

B.2.5.5 Detail illustrating the connection of the yoke to the pair of main runners and cross runners at the end of the linear luminaire.

B.2.5.7 Detail illustrating the attachment of the hanger wire(s) to the yoke. Where the yoke is vertically supported by a single hanger wire, the hanger wire shall be centered on the top horizontal span of the yoke.

B.2.5.7 Detail(s) illustrating the attachment of the hanger wire to the floor or roof above.

B.2.5.8 Detail(s) illustrating supplemental framing when required by Section B.2.4.2 above to transfer the 180-pound lateral force at the cross runner across the yoke in accordance with ASTM E580 Section 5.1.2. A schematic illustration of this supplemental framing is shown in Figure B3.

B.2.6 Linear luminaires shall be fastened to the grid system as follows:

B.2.6.1 A minimum of four screws for linear luminaires up to 8-feet long.

B.2.6.2 A minimum of six screws for linear luminaires greater than 8-feet long and up to 12-feet long.

B.2.6.3 Fasteners shall be uniformly distributed.

B.2.7 In addition to the requirements of Section 1.7 above, slack safety wires shall be installed at linear luminaires as follows. Each individual unit shall be supported as noted.

B.2.7.1 Luminaire units up to 8-feet long: Install at opposite corners (2 minimum).

B.2.7.2 Luminaire units greater than 8-feet long and up to 12-feet long: Install at each corner (4 total).

B.2.8 The spacing of lateral force bracing assemblies (refer to Section 1.3 above) shall be coordinated to not exceed the maximum spacing even though an additional main runner has been added for the linear light. For example, if a 6-inch wide luminaire is used and the maximum spacing of lateral force bracing assemblies is specified as 12-feet, one of the following layouts would comply:

B.2.8.1 Reduce the main runner spacing adjacent to the luminaire to 3’-6” and space bracing assemblies at 12’-0” on center.

B.2.8.2 Maintain the 4’-0” main runner spacing on each side of the luminaire and space bracing assemblies at 8’-6” in the direction perpendicular to the main runners.

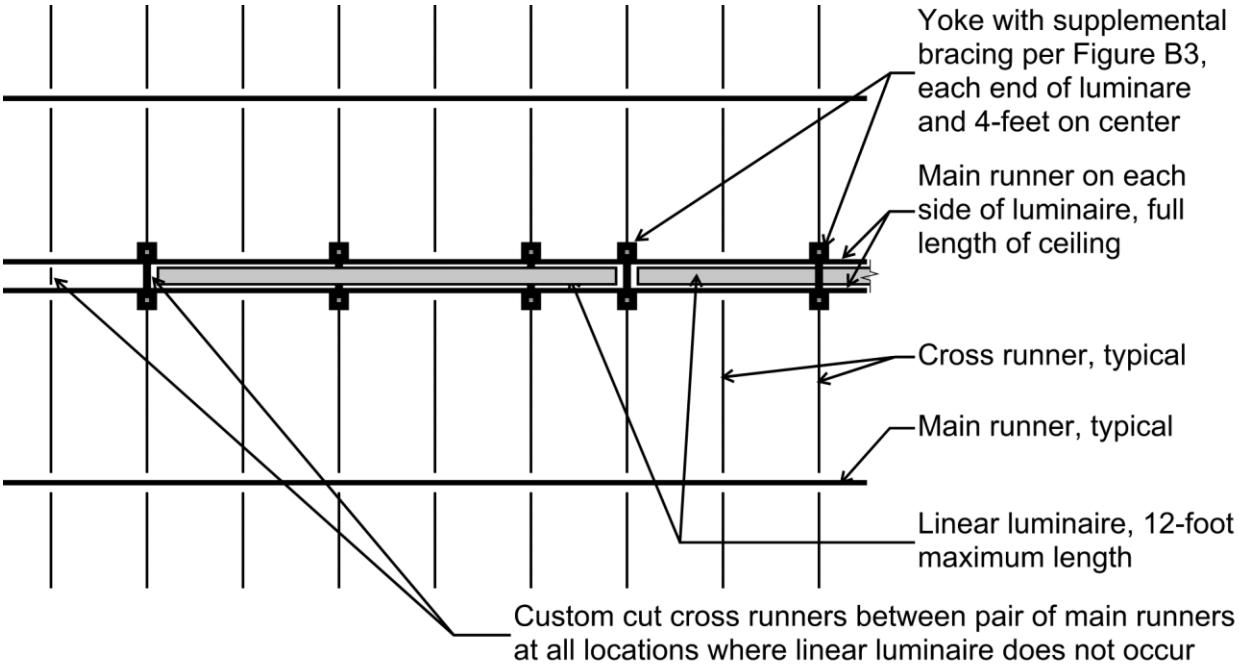


Figure B2: Option 2 Reflected Ceiling Plan

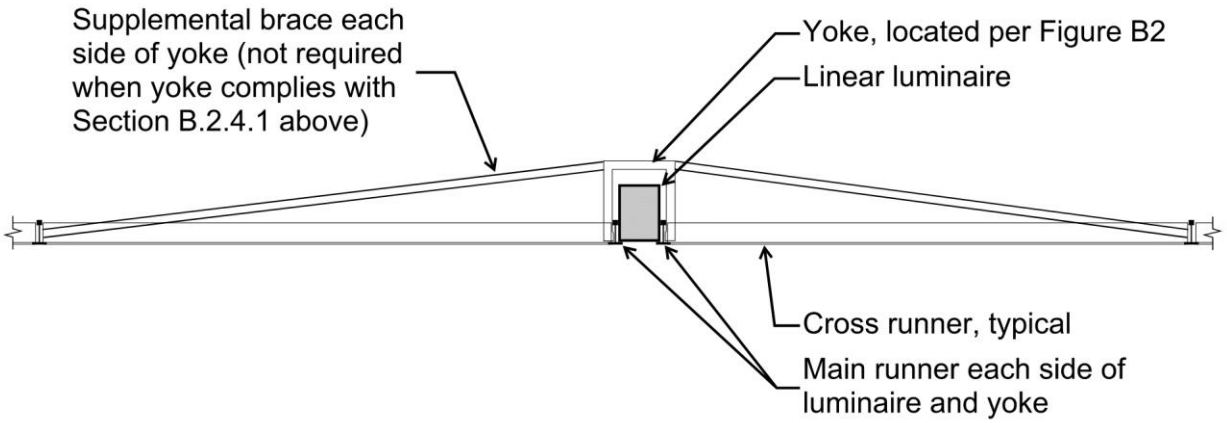


Figure B3: Option 2 Supplemental Yoke Bracing Section

B.3. Option 3 Installation

Linear luminaires oriented parallel to the main runners can be installed according to the provisions of this section. This option considers the ceiling in separate laterally supported zones between linear luminaires. All the requirements of Section B.2 above apply except as noted below.

B.3.1 Seismic separation joint shall be provided immediately adjacent to one of the main runners located on either side of the linear luminaire. The seismic separation joint shall extend the entire length of the ceiling (wall to wall).

B.3.2 At each cross runner that is interrupted at the linear luminaire, an additional hanger wire shall be installed 8” max from the end of the cross runner.

B.3.3 A lateral force bracing assembly (refer to Section 1.3 above) shall be located within one-half the distance of the required spacing from each side of the seismic separation joint. For example, where 8-feet spacing is specified, bracing assemblies shall be located 4-feet maximum from each side of the joint.

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Work includes furnishing and installing acoustical lay-in units and suspension systems.

B. Related Sections:

1. Section 09 29 00 – Gypsum Board.
2. Mechanical work,
3. Electrical work

1.02 CODES AND REFERENCE STANDARDS

A. Acoustical panels and tile shall be listed by Underwriter's laboratories, Inc. for flame spread rating specified herein.

B. Acoustical ceiling assemblies shall comply with the seismic design requirements of Title 24, California Building Code (CBC), 2022, Chapter 25 and Sections 803.9, 1617A.1.21 and DSA IR 25-1 and 25-2.

C. Acoustical panels shall be made in accordance with ASTM C423 sound absorption coefficients by reverberation room method in the type E mounting described in ASTM E795 and tested per accreditation program for ASTM C423.

1.03 SUBMITTALS

A. Submit shop drawings for review. Show sizes and locations of grids, locations of hanger wires, methods of attachment to supporting structure, and locations and framing conditions for mechanical and electrical equipment within or attached on ceiling.

B. Secure permits for seismic conditions. Show lateral bracing, suspension members, and other information necessary on shop drawings to secure these permits.

C. Submit samples of acoustical materials and suspension systems for review.

D. Recycled Content Certification.

E. Submit acoustical test reports from an independent acoustical testing Laboratory.

1.04 EXTRA MATERIALS

A. Leave extra ceiling panels for Owner's use, equal to 10 percent of total number of units used on project, but in no case less than two full boxes of each pattern.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project in original unopened packages bearing the manufacturer's name, brand designation, and label verifying compliance with these specifications. Store materials in properly protected and dry storage area.

B. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed.

1.06 PROJECT CONDITIONS

A. Maintain a uniform temperature of not less than 60 degrees F. nor more than 85 degrees F. and a relative humidity of not more than 70 percent continuously from 24 hours before installation until 24 hours after completion of work.

1.07 SCHEDULING

A. Wet operations such as plastering, concrete and masonry work shall be completed and dry before installation of acoustical ceilings. Mechanical, electrical and other work above the ceiling line shall be completed and approved prior to start of acoustical ceiling installation.

PART 2 - PRODUCTS

2.01 GENERAL

A. Acoustical materials shall be as specified herein.

B. Use Code Approved Seismic Clip to allow for 7/8” wall angle in lieu of 2” wall angle. USG ACM7 Seismic Clip with USG M7 wall angle. With aluminum capped grids, use aluminum capped wall angle, USG M7A.

2.02 CEILING (2' x 4')

A. Ceiling Grid: 24" x 48" with 15/16-inch wide grid.

B. (ACT) Ceiling Tile Pattern: Armstrong, Ultima High NRC, 1943, 24x48x1 square lay-in with score joint to make tile appear like two 24x24 tiles. NRC 0.80, Light Reflectance 0.87

C. Surface Burning Characteristics (Flame Spread and Smoke Developed): Class A (Flame spread 25 or under) UL labeled per ASTM E1264. Smoke developed shall be no greater than 450 when tested in accordance with CBC Chapter 8, Section 803.

D. **2' x 4' Acoustical Lay-in Ceiling Suspension System:**

1. Suspension system shall conform to the heavy duty classification of ASTM C635 and shall be 24" x 48" x 15/16" steel system. Minimum pre-consumer recycled content of 23% and post-consumer recycled content of 68%

2. Main runners, cross tees, spacer bars, variable placement tees, grid adapters and wall moldings shall be of cold-rolled hot-dipped galvanized steel.

3. Finish shall be white baked-on vinyl painted finish.

4. Provide suspension system of one of the following manufacturers:

a. Armstrong World Industries, Inc.
Prelude XL Heavy Duty System
Main Runner – Prelude XL –7301 Heavy Duty
Cross Runner – Prelude XL – XL7340

b. USG Corporation
Donn® DX® Heavy Duty System
Main Runner – DX-26 Heavy Duty
Cross Runner – DX-422

c. Chicago Metallic Corporation
Series 1200
Main Runner – 200 Heavy Duty
Cross Runner – 1274

PART 3 - EXECUTION

3.01 GENERAL

A. Examination of surfaces and conditions affecting proper installation of the materials, and reporting defects in materials or surfaces to which acoustical tile is applied. Commencement of work will signify acceptance of above indicated materials and surfaces as satisfactory.

3.02 INSTALLATION

A. Layout work in accordance with reviewed and approved shop drawings. Adjust spacing of runners to achieve intent of drawings.

B. Secure perimeter acoustical moldings to walls at maximum 2 foot intervals, with power driven studs for cementitious substrates, and with screws at 16-inch intervals at stud walls. Provide moldings at perimeters of penetrations and room areas. Attach border units for clean finish and tight appearance.

C. Unless shown otherwise, ensure that installed tiles are square within each room area, in continuous lines parallel to walls, symmetrical about centerline of room area.

D. Drill holes for pipes. Tiles cut from sides to permit penetration and installation of other construction will not be acceptable.

3.03 SUSPENSION SYSTEM INSTALLATION
(Division of the State Architect Interpretation of Regulations, IR 25-1 and 25-2)

A. 12 gauge (minimum) hanger wires may be used for up to and including 4'-0" x 4'-0" grid spacing. Splices will not be permitted in hanger wires unless specifically approved by DSA/Structural Safety Section.

B. Provide hanger wires within 8 inches of the ends of main and cross runners or at one-quarter of the length of the end tee, whichever is least at the perimeter of the ceiling area.

C. Provide trapeze or other supplementary support members at obstructions to maintain hanger spacing. Provide additional hangers, struts or braces as required at ceiling breaks, soffits or discontinuous areas. Hanger wires that are more than one in six out of plumb are to have counter braced wires.

D. Ceiling grid members may be attached to not more than two adjacent walls. Ceiling grid members should be at least 3/4-inch free of other walls. If walls run diagonally to ceiling grid systems runners, one end of main and cross runners should be free and a minimum of 3/4-inch clear of wall.

E. At the perimeter of the ceiling area where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal strut or one 16 gage wire with a positive mechanical connection to the runner may be used. Where the perpendicular distance from the wall to the first parallel runner is 12-inches or less, this interlock is not required.

F. Lateral force brace assembly spacing shall be per Table 1 of DSA IR 25-2.

G. Fasten hanger wires with not less than three tight turns. Fasten splay wires with four tight turns. Make tight turns within a distance of 1-1/2 inches. Hanger or bracing wire anchors to the structure should be installed in such a manner that the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.

H. Separate ceiling hanging and bracing wires at least 6 inches from unbraced ducts, pipes, conduit, etc. It is acceptable to attach lightweight items, such as single electrical conduit not exceeding 3/4-inch nominal diameter, to hanger wires using connectors acceptable to DSA/Structural Safety Section.

I. When drilled-in concrete anchors or shot-in anchors are used for hanger wires, one out of ten must be field tested for 200 pounds of tension. When drilled-in concrete anchors are used for bracing wires, one out of two must be field tested for 440 pounds in tension. Shot-in anchors are not permitted for bracing wires. If shot-in or drilled-in anchor fails, adjacent anchors must be tested.

J. Attach light fixtures to the ceiling grid runners to resist a horizontal force equal to the weight of the fixtures.

K. Fixtures and air terminals or services supported on intermediate duty grid systems must be independently supported by not less than four taut No. 12 gage wires attached to the structure above.

Flush or recessed light fixtures and air terminals or services weighing 56 pounds or more must be independently supported by not less than four No.12 gage taut wires attached to the structure above regardless of the type of ceiling grid system used. The (4) four taut No.12 gauge wires including their attachment to the structure above must be capable of supporting four times the weight of the unit.

L. Flush or recessed light fixtures and air terminals or services weighing less than 56 pounds, may be supported directly on the runners of a heavy duty grid system. In addition, they must have a minimum of two (2) 12 gauge slack safety wires attached to the fixture at diagonal corners and anchored to the structure above. All 4 ft. by 4 ft. light fixtures must have slack safety wires at each corner.

M. Support surface mounted light fixtures by at least two positive devices which surround the ceiling runner and which are supported from the structure above by a No.12 gage wire. Spring clips or clamps that connect only to the runner are not acceptable.

N. Support pendant mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting four times the weight of the fixture.

3.04 LAY-IN PANEL INSTALLATION

A. Install factory pre-fabricated acoustical units manufactured specifically for the drop-in and for the concealed suspension system per manufacturer's specifications and directions.

3.05 CLEANUP

A. Replace loose and damaged tile and panels when directed. Touch-up damaged finish. Leave surfaces clean and free from markings and other disfigurements. Remove debris resulting from the work of this section.

END OF SECTION

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SECTION 09 72 00

VINYL WALL COVERINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Wallcovering for fixed walls, including preparation of surfaces.

1. Furnishing wallcovering for operable walls, and vinyl wrapped wall panels provided under other Sections.

B. Related Work:

1. Substrate materials
2. Wall texturing
3. Section 09 29 00 – Gypsum Board.
4. Section 10 11 00 – Visual Display Units

1.02 SUBMITTALS

A. Samples: Provide 12 inch by 12 inch samples of selected wallcovering for review of quality, color, texture and weight. Provide from dye lots to be used on project only.

B. Manufacturer's Instructions:

1. Provide copies of maintenance instructions for wallcovering.

2. Provide recommendation of cleaning materials and application methods, including precautions in use of cleaning materials which may be detrimental to surfaces if improperly applied.

1.03 QUALITY ASSURANCE

A. Three full length panels of each type wallcovering to be used shall be installed in areas selected by Architect. Approved test panels shall be used as standard of quality of appearance and installation for Work.

1. Test panels found deficient by Architect per specification standards or application shall be replaced.

B. Conform to 2022 California Building Code, Title 24, Part 2, Chapter 8 and ASTM E112.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store wallcovering in clean and dry area where temperatures are maintained at 55 degrees F. minimum, with normal humidity. Do not store in an upright position. Do not cross stack wallcovering.

B. Take reasonable precautionary measures to prevent fire hazards with adhesives and solvents.

C. Where toxic materials and both toxic and explosive solvents and adhesives are used, take

appropriate precautions and provide proper ventilation.

1.05 PROJECT CONDITIONS

A. Environmental Requirements:

1. Maintain substrate surfaces and ambient temperatures above 60 degrees F. seven days before, during, and after application period.

2. Ensure maximum surface moisture of substrate conforms to wallcovering manufacturer's requirements and does not exceed 5 percent. Surface shall exhibit negative alkalinity.

3. Lighting: Provide a minimum of 80 foot candles per square feet on surfaces to be covered.

4. Provide continuous and adequate ventilation during work and after installation of wallcovering.

5. Install specified materials only when normal temperature and humidity conditions approximate the interior conditions that will exist when the building is occupied.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Vinyl wallcovering shall be the product of one manufacturer. Design is based on the use of products manufactured by the following:

1. Koroseal Interior Products Group, a Division of RJF International Corporation, Fairlawn, Ohio.

2. Wallscape, East Brunswick, NJ, (866) 216 4483.

3. Len-Tex Corporation, North Walpole, NH, (603) 445-2342.

2.02 MATERIALS

A. Vinyl Fabric:

1. Vinyl-coated fabric shall comply with Federal Specifications CCC-W-408-A and with the CFFA-W-101-D Quality Standard for Vinyl Coated Fabric Wallcovering. Wall covering shall be Type II, with minimum weight of 20 ounces per lineal yard in 54-inch width. Wall covering shall be Class A rated, when tested in accordance with ASTM E84. Material shall have a flame spread rating of 25 or less, a fuel contributed rating of 10 or less and a smoke density rating of 450 or less.

2. Fabric shall be Koroseal, “Insight”, color: gilt 6322-55, or equal. Architect may select up to five different colors for the project.

3. Engraving roller die marks, roller repeat marks, glossy surface appearance or other imperfections will be proper basis for TOTAL REJECTION by the Architect, if evidenced in either the submitted samples, or the manufactured materials supplied and delivered to the job.

B. Primer and Adhesives: Provide manufacturer's recommended strippable types that allow for

future removal of wall coverings without damage to substrate.

C. Provide Owner with one can of adhesive and additional wall covering equal to 3 percent of each color used.

D. Protective Coating: The vinyl wallcovering shall have a protective coating applied to its surface to minimize migration of stains into the vinyl and, therefore offer stain protection from a variety of staining agents and provide greater ease of cleanability.

2.03 SOURCE QUALITY CONTROL

A. Tests: Perform in accordance with Federal Standard, FED-STD-191A, except as follows:

1. Each roll of material delivered to the job site, must be affixed with U.L. labels, attesting to the maximum ratings specified herein, as determined by the ASTM E84 tunnel test.

2. The vinyl wallcovering shall contain thermo-particulating ingredients, which when exposed to a direct heat of 300 degrees F., emits a colorless and odorless vapor that activates ionization type smoke detectors, when installed according to manufacturer's specifications.
Certified copies of ASTM E603 Standard Guide for Room Fire Experiments, must be submitted to the Architect attesting to conformance of materials with this test.

3. Toxicity shall be determined by the National Institute of Standards and Technology (NIST).

4. Adhesive of vinyl coating to the fabric backing, shall be tested in accordance with ASTM D751.

5. Resistance to strong cleaning solutions, shall be tested by immersing one-half of the material into a solution of 1% sodium hydroxide (NaOh) or a common cleanser, for a period of twenty-four (24) hours, then rinsed, dried and observed for possible discoloration.

6. Materials shall have a zone inhibition rating of "0" to resist the growth of mildew and bacteria, as determined by test method ASTM G21.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine the areas and conditions under which wallcovering is to be installed and notify in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in an approved manner.

3.02 PREPARATION

A. Remove wallcovering from packaging and allow acclimatizing to the area of installation 24-hours before application.

B. Remove switchplates, wall plates, escutcheons, and surface-mounted fixtures, where wallcoverings are to be applied.

C. Prime and seal substrates in accordance with the wallcovering manufacturer's printed recommendations for the type of substrate material to be covered.

3.03 INSTALLATION

A. Place wallcovering panels consecutively in the order they are cut from rolls, including filling spaces above or below openings. Hang by reversing alternate strips except on match patterns.

B. Apply adhesive to back of wallcovering and place in accordance with the manufacturer's printed instructions. Install seams vertically and plumb, and at least 6 inches away from corner; horizontal seams will be permitted only where specifically approved by Architect. Place wallcovering continuously over internal and external corners. Overlap seams and double-cut to ensure tight closure. Roll, brush, or use a broad knife to remove air bubbles, wrinkles, blisters and other defects. Cut wallcovering evenly to the edges of openings.

C. Trim selvages as required to ensure color uniformity and pattern match at seams.

D. Remove excess adhesive along finished seams and clean well.

E. Install the wallcovering with an intimate substrate bond, smooth; clean, without wrinkles, gaps and overlaps.

F. Replace removed plates and fixtures to verify accuracy of concealment of cut edges.

3.04 CLEANING

A. Upon completion of work, remove surplus materials, rubbish, and debris resulting from this material installation and leave area of work in a neat, clean condition.

3.05 WARRANTY

A. Upon completion of work, contractor shall provide a written five (5) year warranty

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Provide materials, labor and equipment necessary for the completion of a completely painted project, including preparation of painted surfaces. Provide finishes based on materials and products scheduled in these specifications and on the drawings. If not otherwise specified, provide prime coat and two finish coats on all exposed to view or weather surfaces. This shall include painting all pigmented exterior plaster (integral color stucco) in not less than three colors. The following miscellaneous items shall also be painted:

1. Areas shown to be painted on the Room Finish Schedule or Exterior and Interior Elevations. Items called out to be painted in Divisions 23 and Division 26. All hollow metal.

2. Exposed site plumbing items, such as PIV's, backflow preventors, exposed pipes and standpipes, fire hydrants, irrigation air relief valve covers, exposed valves, exposed roof drain pipes, etc.

3. Exposed interior piping and electrical conduits (except in electrical rooms and closets), wall and ceiling access covers, hatches, panel covers, and plates, and exposed cable tray and supports.

4. Roof hatches (interior and exterior), exterior galvanized ladders, sheet metal parapet copings on both sides and top. Exposed metal components that arrive on job with only prime finish. Sign posts. Decorative metal fence and gates. Metal railings and bollards. Exposed steel connectors, bolts, and plates.

5. Stain and seal exposed wood components.

B. Specific items NOT to be painted or finished: Factory finished items (as opposed to factory primed), chain link fence, volleyball and basketball posts, football goals, chin-up bars, concrete benches, wood casework finished by casework fabricator.

C. Related Work:

1. Section 07 92 00 – Joint Sealants
2. Section 09 29 00 – Gypsum Board
3. Mechanical Division 23
4. Electrical Division 26

1.02 REFERENCE STANDARDS

A. Conform to California Air Resources Board (CARB) Rules, especially 1113, Architectural Coatings.

B. Title 19, California Code of Regulations (CCR), Public Safety, State Fire Marshal Regulations

1.03 SUBMITTALS

A. Prepare eight, 8-1/2-inch by 11-inch samples of finishes, to be provided to District's Maintenance and Operations Department. When possible, apply finishes on identical type materials to which they will be applied on job.

B. Identify each sample as to finish formula, color name, reflectance number and sheen name and gloss units.

C. Colors will be selected by Owner and Architect prior to commencement of work, from manufacturer's full range of standard and custom colors.

D. State Fire Marshal, Fire and Life Safety Approval: Flame retardant coatings shall be listed by the California State Fire Marshal's office. A copy of this listing and a material specification sheet shall accompany the submittal.

E. Submittal to be reviewed and signed by District's Maintenance and Operations Department prior to Architects approval.

1.04 QUALITY ASSURANCE

A. Mock-up: Before proceeding with paint application, finish one complete surface of each color scheme required, clearly indicating selected colors, finish texture, materials and workmanship. If approved, sample area will serve as a minimum standard for work throughout.

1.05 MAINTENANCE MATERIALS

A. Leave on premises where directed, not less than one full gallon of each color, of each type of paint, in new unopened containers. Label each container for identification.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver paint materials in sealed original labeled containers bearing manufacturer's name, type of paint, brand name, solids content, color designation and instructions for mixing and/or reducing.

B. Provide adequate storage facilities. Store paint materials at a minimum ambient temperatures of 65 degrees F., in well ventilated area.

C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.07 PROJECT CONDITIONS

A. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture contents of surfaces are below following minimums: gypsum board - 12 percent; cementitious materials - 12 percent.

B. Ensure surface temperatures and surrounding temperatures are above 50 degrees F., before applying finishes.

C. Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 50 degrees F., for 24 hours before, during, and 48 hours after application of finishes.

D. During painting, provide minimum of 25 foot candles of lighting on surfaces to be painted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and coatings manufactured by one of the following companies noted in Section 2.02, D and refer to cross-reference guide for acceptable alternates.

2.02 PAINT MATERIALS

A. Accessories: Provide linseed oil, turpentine and other materials not specifically specified but required to achieve finishes.

B. Paints and Coatings: Provide ready-mixed type except field catalyzed coatings; pigments fully ground maintaining soft paste consistency, capable of being readily and uniformly dispersed to complete homogeneous mixtures.

C. Provide paints and coatings with good flowing and brushing properties and capable of drying or curing free of streaks and sags.

D. **Painting**
Provide equivalent paint types according to the following schedule.

Interior

New Drywall (Semi Gloss Finish)

1st coat	S-W ProMar 200 Zero VOC Primer
2nd coat	S-W ProMar 200 Zero VOC Semi-Gloss
3rd coat (to cover*)	S-W ProMar 200 Zero VOC Semi-Gloss

New Drywall (Low Sheen Finish)

1st coat	S-W ProMar 200 Zero VOC Primer
2nd coat	S-W ProMar 200 Zero VOC Low-Sheen Eg-shel
3rd coat (to cover*)	S-W ProMar 200 Zero VOC Low-Sheen Eg-shel

New Drywall (Eggshell Finish)

1st coat	S-W ProMar 200 Zero VOC Primer
2nd coat	S-W ProMar 200 Zero VOC Eg-shel
3rd coat (to cover*)	S-W ProMar 200 Zero VOC Eg-shel

New Wood Painted Surfaces (Semi Gloss Finish)

1st coat	S-W Preprite ProBlock Primer
2nd coat	S-W ProIndustrial WB Alkyd Urethane Semi-Gloss
3rd coat (to cover*)	S-W ProIndustrial WB Alkyd Urethane Semi-Gloss

New Steel Door / Door and Window Frames

1st step	GLL Clean n Etch
1st coat	S-W ProCryl Acrylic Metal Primer
2nd coat	S-W ProIndustrial WB Alkyd Urethane Semi-Gloss
3rd coat (to cover*)	S-W ProIndustrial WB Alkyd Urethane Semi-Gloss

New Ferrous Metal (including steel doors and hollow metal frames)

Pretreatment	GLL Clean n Etch

1st coat	S-W ProCryl Acrylic Metal Primer
2nd coat	S-W ProIndustrial WB Alkyd Urethane Semi-Gloss
3rd coat (to cover*)	S-W ProIndustrial WB Alkyd Urethane Semi-Gloss

New Galvanized Metal

Pretreatment	GLL Clean n Etch
1st coat	S-W ProCryl Acrylic Metal Primer
2nd coat	S-W ProIndustrial WB Alkyd Urethane Semi-Gloss
3rd coat (to cover*)	S-W ProIndustrial WB Alkyd Urethane Semi-Gloss

Ceilings

1st coat	S-W Quick Dry Stain Blocking Primer
2nd coat (to cover*)	S-W ProIndustrial WB Acrylic Dry Fall Flat

Exterior

New Painted Stucco-Plaster-Concrete (Low Sheen Finish)

1st coat	S-W Loxon Masonry Primer
2nd coat	S-W A100 Satin
3rd coat (to cover*)	S-W A100 Satin

New Painted Wood (Gloss Finish)

1st coat	S-W Preprite ProBlock Primer
2nd coat	S-W ProIndustrial WB Alkyd Urethane Gloss
3rd coat (to cover*)	S-W ProIndustrial WB Alkyd Urethane Gloss

New Painted Wood (Semi-Gloss Finish)

1st coat	S-W Preprite ProBlock Primer
2nd coat	S-W ProIndustrial WB Alkyd Urethane Semi-Gloss
3rd coat (to cover*)	S-W ProIndustrial WB Alkyd Urethane Semi-Gloss

New Painted Wood (Low Sheen Finish)

1st coat	S-W Preprite ProBlock Primer
2nd coat	S-W A100 Satin
3rd coat (to cover*)	S-W A100 Satin

New Steel Doors / Door and Window Frames

1ST step	GLL Clean n Etch
1st coat	S-W ProCryl Acrylic Metal Primer
2nd coat	S-W ProIndustrial WB Alkyd Urethane Gloss
3rd coat (to cover*)	S-W ProIndustrial WB Alkyd Urethane Gloss

New Ferrous Metal

1ST step	GLL Clean n Etch
1st coat	S-W ProCryl Acrylic Metal Primer
2nd coat	S-W ProIndustrial WB Alkyd Urethane Gloss
3rd coat (to cover*)	S-W ProIndustrial WB Alkyd Urethane Gloss

New Galvanized Metal

Pretreatment	GLL Clean n Etch
1st coat	S-W ProCryl Acrylic Metal Primer
2nd coat	S-W ProIndustrial WB Alkyd Urethane Gloss
3rd coat (to cover*)	S-W ProIndustrial WB Alkyd Urethane Gloss

E. **Other** – Wood, metal and concrete steps and ramps attached to buildings indicated will

be painted as follows:

Concrete Steps/Ramps

1st coat	S-W Macropoxy 646
2nd coat	S-W High Solids Polyurethane
3rd coat (to cover*)	Include yellow safety stripes

Metal Steps/Ramps

1st coat	S-W Macropoxy 646
2nd coat	S-W High Solids Polyurethane
3rd coat (to cover*)	S-W High Solids Polyurethane w/ sand
4th coat	Include yellow stripes

*"to cover" is defined – coverage must meet district's approval
**"spot prime" is defined as priming all bare metal areas

H. **Anti-Graffiti Coating**

1. Preferred Product: Graffiti Barrier VOC: by Surtec, Inc., Surface Technology, 1880 N. MacArthur Drive, Tracy, CA 95376, Phone: (209) 820-3700.

2. Approved Alternate: Monochem Permashield Premium: by Monopole Inc., 4661 Alger Street, Los Angeles, CA. 90039, Phone: 818-500-8585

I. **Paint Guide**

SURFACES	SHERWIN WILLIAMS
Interior	ProIndustrial WB Alkyd Urethane S/G
Interior	ProIndustrial WB Alkyd Urethane L/S
Exterior	A100 Satin
Exterior	ProIndustrial WB Alkyd Urethane Gloss

J. **Primer Guide**

SURFACES	SHERWIN WILLIAMS
Interior – New Gypsum Board	ProMar 200 Zero VOC Primer
Interior – New Wood	Preprite ProBlock Primer
Interior – New Metal Surfaces	GLL Clean n Etch
Exterior – New Painted Wood	Preprite ProBlock Primer
Exterior – New Painted Stucco, Concrete, and Plaster	Loxon Masonry Primer
Exterior – New Painted Metal	GLL Clean n Etch

PART 3 - EXECUTION

3.01 EXAMINATION

A. Thoroughly examine surfaces scheduled to be painted prior to commencement of work. Report in writing of conditions potentially detrimental to proper application. Do not commence until satisfied that defects and deficiencies in surfaces have been rectified.

3.02 PROTECTION

A. Adequately protect other surfaces from paint and damages. Repair damages as a result of inadequate or unsuitable protection.

B. Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation areas.

C. Place cotton waste cloths and materials which may constitute a fire hazard in closed metal containers and remove daily from site.

D. Remove or cause to have removed, electrical plates, fittings, fastenings, escutcheons, and hardware prior to painting operations. These items are to be carefully stored, cleaned and replaced on completion of work in each area. Do not use solvents or other harsh cleansers on surfaces which could be damaged by such use of materials.

3.03 PREPARATION OF SURFACES

A. Thoroughly clean surfaces to be painted with hydro-cleaning process to remove chalk, dirt and other deleterious materials where such cleaning methods are practical. Spot prime before application of finish coats.

B. Remove dirt, grease and oil from canvas and cotton covered insulated materials such as pipes and ducts.

C. On surfaces to be cleaned which cannot be hydro-cleaned, where possible, wash with solution of TSP and thoroughly rinse.

D. Patch and prime cementitious materials.

E. Remove contamination from gypsum board surfaces and prime to conceal defects. Paint after defects have been remedied.

F. Remove surface contamination and oils from zinc coated/galvanized surfaces, wash with solvent, apply etching primer or as recommended by paint manufacturer and confirmed with metal manufacturer.

G. Remove dirt, loose scale, powder, mortar and other foreign matter from cementitious surfaces which are to be painted or to receive sealer. Remove oil and grease with TSP solution, rinse well and allow to thoroughly dry.

H. Remove stains from cementitious surfaces caused by weathering of corroding materials with a solution of sodium metasilicate after being thoroughly wetted with water. Allow to thoroughly dry.

I. Fill hairline cracks, small holes and imperfections. Smooth off to match adjacent surfaces. Smooth off to match adjacent surfaces. Wash and neutralize high alkali where they occur.

J. Remove grease, rust, scale, dirt and dust from steel and iron surfaces. Where heavy coatings of scale are evident, remove by wire brushing, sandblasting or other method necessary, practical and in accordance with Steel Structures Painting Council.

K. Clean non-primed steel surfaces by washing with solvent. Apply a treatment of

phosphoric acid solution, ensuring welded joints, bolts and nuts are similarly cleaned. Prime surfaces to indicate defects. Paint after defects have been remedied.

L. Sand and scrape shop primed steel surfaces to remove loose primer, and rust. Feather out edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare surfaces.

M. Wipe off sanding dust and grit from miscellaneous wood and carpentry items prior to priming. Spot coat knots, pitch steaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried and sand between coats. Back prime interior and exterior woodwork.

N. Doors:

1. Painting Contractor shall not remove or reinstall any door hardware.

2. Except for door hinges, painting of doors must be completed prior to installation of hardware.

3.04 APPLICATIONS

A. Apply each coat at proper consistency.

B. Each coat of paint is to be slightly darker than preceding coat unless otherwise directed, or finish is clear.

C. Sand lightly between coats to achieve required finish.

D. Do not apply finishes on surfaces that are not sufficiently dry.

E. Allow each coat to dry before following coats are applied.

F. Backprime wood which is to receive paint or enamel paint, with enamel undercoater paint.

G. Prime top and bottom edges of wood doors with enamel undercoater when they are to be painted.

H. Apply flame retardant coating to the wood surface prior to applying stain and/or paint per manufacturer's instructions. Furnish certification of application of flame retardant coating.

I. Do not paint over labels.

3.05 MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to mechanical and electrical sections of these specifications, as well as Drawings, with respect to painting and finishing requirements, color coding, identification banding of equipment, ductwork, piping and conduit.

B. Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.

C. Finish paint primed equipment to colors selected.

D. Prime and paint insulated and bare pipes, conduits, boxes, insulated and bare ducts,

hangers, brackets, collars and supports, except where items are plated or covered with a pre-finished coating, or are not exposed-to-view.

E. Replace identification markings on mechanical and electrical equipment when painted over or spattered.

F. Paint interior surfaces of air ducts, convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sightline. Paint dampers exposed immediately behind louvers, grilles, convector and baseboard cabinets to match face panels, as applicable.

G. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.

H. Color code equipment, piping, conduit, and exposed ductwork of mechanical and electrical work. Color banding and identification shall include flow arrows, naming, numbering, stenciling, etc.

3.06 CLEANING

A. As work progresses and upon completion, promptly remove paint where spilled, splashed, smeared and splattered.

B. During progress of work, keep premises free from unnecessary accumulations of tools, equipment, surplus materials and debris.

C. Upon completion of work, leave premises neat and clean, to satisfaction of Owner.

END OF SECTION

SECTION 10 11 00

VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Markerboards and tackboards, fixed units of widths and heights shown including marker trays, map rails, hooks, flag holders, and other components as indicated on the Drawings and specified herein.

B. Related Work:

1. Markerboards shown on portable or operable walls.
2. Section 06 10 00 – Rough Carpentry.
3. Section 09 72 00 – Vinyl Wall Coverings.

1.02 REFERENCE STANDARDS

A. Sliding display units shall comply with 2022 CBC Section 11B-309.4.

1.03 SUBMITTALS

A. Provide material list of items proposed to be provided.

B. Submit data sufficient to demonstrate compliance with specifications and drawing requirements.

C. Submit shop drawing and catalog cuts of items to be provided. Manufacturer or producer's standard drawings and technical information may be acceptable where complete enough to determine acceptability.

D. Submit samples of products and materials where options of color, finish, pattern or texture exist.

1.04 QUALITY ASSURANCE

A. Products and materials to be provided are to be from manufacturers and producers regularly engaged full-time in the manufacture or production of this and similar items, with a history of successful manufacture or production acceptable to the Owner.

B. In addition to complying with pertinent codes and regulations, comply with industry and trade standards normally associated with this product or material, except where specified product or material is superior in quality to industry and trade standards.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products and materials to the project; and store in a safe, dry place with shop-supplied protection and labeling intact and legible until set, applied, or installed.

B. Use reasonable means necessary to protect products and materials before, during, and after installation.

C. In the event of damage, regardless of responsibility and culpability, make repairs and replacements necessary to satisfaction of Owner, and at no additional cost to Owner.

1.06 WARRANTY

A. Provide owner with a five year written warranty as a condition of work acceptance, signed by Contractor and Installer (where applicable), agreeing to maintain, repair and/or replace products and materials for five years following Notice of Completion date, and without additional cost to Owner, as specified in Section 01 78 30 – Warranties, Guarantees, and Bonds.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. For purpose of determining minimum performance and quality standards, these specifications are based on Claridge Company. Other manufacturers such as PolyVision, and US Markerboard, whose products meet or exceed the requirements of this section, may be submitted for approval, with necessary information and samples.

2.02 MARKERBOARDS

A. Whiteboards LCS II Gauge- No. 32 LCS porcelain enameled steel dry-erase marker writing surface shall comply with the Porcelain Enamel Institute Recommendations PEI-1002 for Porcelain Enamel Chalkboards and be free of projections or depressions, free of dents, cracks and or other similar defects. Color - light gray low gloss finish. Bond under pressure to aluminum foil backed 1/2-inch plywood or 1/2-inch hardboard. Flame test rating per ASTM E84.

B. Horizontal Sliding Markerboard: Manually operated - 4 ft. high by length shown on Plans and Interior Elevations.

C. Vertical Sliding Markerboards: Manually operated – height and width as shown on Plans and Interior Elevations.

D. 1” tack strip with natural cork insert over marker board.

2.03 COMPONENTS

A. Markertray: Extruded aluminum, alloy No. 6063-T5 anodized, (mill finish not acceptable), with aluminum end closures. Minimum weight .803 lbs. per linear foot. Drill and countersink 24-inches on center maximum, top and bottom flange, ends rounded. Unless otherwise specified, each board shall be equipped with markertray the same length as boards.

B. Trim at Markerboard and Tackboard: Perimeter trim extruded aluminum alloy shapes in alloy No. 6063-T5 anodized (mill finish not acceptable). Joint strap "H" bar same color as markerboard.

C. Map Rail and Hooks: Extruded aluminum alloy, with insert (color: Specify Color; submit sample for approval), drill 24 inches on center maximum. Furnish one hook per each 24 inches of board. Provide additional map rails and hooks wall mounted where shown on the drawings; one hook for each 24 inches of rail. Map hooks equipped with spring clips, provide map rail end closures in matching finish; map hooks must be smooth finished non-hazardous type with no rough edges and/or projections.

2.04 TACKBOARDS

A. Cork covered with vinyl fabric with flame spread rating of 25 or less, as specified in Section 09 72 00 – Wall Coverings, 1/4-inch thick cork, bonded to 1/4-inch plywood or 1/4-inch hardwood.

2.05 FASTENINGS

A. Screws for fastening trim, chalktray and map rail oval head, Phillips type, of proper length for 1-1/2 inch penetration of studs or blocking, 1/4-inch diameter toggle bolts at steel stud wall, spacing for each, 24-inches on center.

B. Fasteners are to be tamperproof where exposed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fasten board standards over the wall with screws or bolts as detailed and specified. Trim mitered at corners, chalk trays rounded at ends.

B. Between finished wall surface and chalkboards wider than four feet, provide spaces or blocks to prevent deflection of boards.

C. Whiteboards with three sliding panels must be installed to ensure that no cupping or rubbing of boards occurs. Sliding panels shall be checked to ensure there are no clearance issues after installation.

3.02 CLEANING

A. Keep areas clean during the progress of work. After completion of the work clean up rubbish, containers, debris, etc., and remove from the site.

3.03 WARRANTY

A. Provide unlimited warranty on writing surface for scratch, damage, ghosting, semi-permanent ink, and abrasion resistance.

END OF SECTION

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SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Site signs, building signs, room identification (door) signs, and code-required informational signs, except electrical light exit signs.

B. Related Work Not Included: Electrical light exit signs.

1.02 SUBMITTALS

A. Provide all submittals in accordance with the requirements of Section 01 33 00.

B. Product Data: Submit manufacturer's technical data related to materials, component dimensions, profiles, finishes, and installation.

C. Shop Drawings: Submit shop drawings for fabrication and erection of site signs. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

1. Submit full-scale layout for each sign larger than 48 inches in any dimension required for review of wording, spacing, and letter design.

D. Samples: Submit sample of each product and material indicating color, finish, pattern, and texture.

1. Submit samples of each color and finish of exposed materials and accessories required for specialty signs.

2. Submit one full-size sample sign of type, style, and color specified, including method of attachment. If accepted, sample will become part of the job.

1.03 QUALITY ASSURANCE

A. In addition to complying with pertinent codes and regulations, comply with industry and trade standards normally associated with this product or material.

B. Design Data: Design, fabricate, and install exterior signs to withstand a wind pressure of 100 mph on the total sign area in all directions.

C. Mock-up: Construct full-size mock-up, in medium of supplier's choice, of school site sign for approval.

1.04 DELIVERY, STORAGE AND HANDLING

A. Protect signs components and surfaces against damage during transportation and unloading.

1.05 WARRANTY

A. Provide written warranty to maintain, repair and replace products and materials for one year following Notice of Completion date, without additional cost to Owner, as specified in Section 01 78 30 – Warranties, Guarantees, and Bonds. Provide 20 year life expectancy for legibility,

color retention and resistance to climatic elements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide products from Best Sign Systems - 1-800-235-2378, or ASI Sign Systems - 800-247-7732, or equal.

2.02 MATERIALS

A. All signage shall conform to CBC, 2022, Title 24, Part 2, Sections 11B-603.2.3, 11B-604.8.1.2, and 11B-703. Tactile exit signage shall be provided per Section 1011.4.

B. Fiberglass - Glass fiber reinforced thermosetting resin – 1/4-inch 2.48 lb/SF.

C. Metal: Cast aluminum with baked enamel finish. Engraved areas shall be filled with contrasting color paint. Use only where existing signage is metal.

D. Signage and graphics:
1. Raised Characters

a. **Raised characters** shall comply with ***CBC Section 11B-703.2***:

b. **Depth**: It shall be 1/32 inch (0.8 mm) minimum above their background and shall be sans serif uppercase and be duplicated in Braille.

c. **Height**: It shall be 5/8 inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter “I”. ***CBC Section 11B-703.2.5***

d. **Finish and contrast**: Characters and their background shall have a non-glare finish. Character shall contrast with their background with either light characters on a dark background or dark characters on a light background. ***CBC Section 11B-703.5.1***

e. **Proportions**: It shall be selected from fonts where the width of the uppercase letter “O” is 60 % minimum and 110 % maximum of the height of the uppercase letter “I”. Stroke thickness of the uppercase letter “I” shall be 15 % maximum of the height of the character. ***CBC Sections 11B-703.4 and 11B-703.6***

f. **Character Spacing**: Spacing between individual tactile characters shall comply with ***CBC Section 11B-703.2.7 and 11B-703.2.8***

g. **Braille:** It shall be contracted (Grade 2) and shall comply with ***CBC Sections 11B-703.3 and 11B-703.4***. Braille dots shall have a domed and rounded shape and shall comply with ***CBC Table and Figure 11B-703.3.1***.

h. **Mounting height**: A tactile sign shall be located 48” minimum to the baseline of the lowest Braille cells and 60” maximum to the baseline of the highest line of raised characters above the finish floor or ground surface.

i. **Mounting location**: A tactile sign shall be located on the approach side, as one enters or exits rooms or space, and be reached within 0" of the required clear floor space per ***CBC Section and Figure 11B -703.4.2*** as follows:

- a clear floor space of 18' x 18" minimum, centered on the tactile characters, shall be provided beyond the arc of any door swings between the closed position and 45 degree open position.
- on the wall at the latch side of a single door.
- on the inactive leaf of a double door with one active leaf.
- on the wall at the right side of a double door with two active leafs.
- on the nearest adjacent wall where there is no wall space at the latch side of a single door or no space at the right side of a double door with two active leafs.

2. **Visual characters** shall comply as follows:
•Visual characters shall comply with CBC Section 11B-703.5 and shall be 40" minimum above finish floor or ground.
•Characters and their background shall have a non-glare finish. Character shall contrast with their background with either light characters on a dark background or dark characters on a light background. CBC Section 11B-703.5.1
•Character height shall be determined based upon height above ground and horizontal viewing distance per CBC Table 11B-703.5.5.
•Proportions for Visual Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 % minimum and 110 % maximum of the height of the uppercase letter "I". Stroke thickness shall be 10% minimum and 20% maximum of the height of the character. CBC Sections 11B-703.5.4 and 11B-703.5.7
•Spacing between separate lines of characters shall comply with CBC Section 11B-703.5.9

3. **Pictograms** shall comply with ***CBC Section 11B-703.6***.

4. **Symbol of accessibility** shall comply with ***CBC Section 11B-703.7***.

2.03 SIGNS

A. Exterior Room Identification Signs: Equal to Best Sign Systems FG, Graphic Blast®, Format: borderless. Color as selected by Architect from manufacturer's standard colors. Color to contrast building background. Sign material 1/4-inch thick, non-glare, Fiberglass, X" x X" with 1/2-inch radius rounded corners and beveled edges. Tactile character/symbols shall be raised 1/32-inch from sign face. The size of the signage shall be confirmed with the Architect. The intention is for the new signage for this project to match the existing signage which has been used in recent construction elsewhere on the campus.

All text shall be accompanied by California Contracted (Grade 2) Braille. Provide one (1) sign per exterior door. Each sign to bear a room number and up to 16 letter text.

Unless shown otherwise on the Drawings, room number shall be 2 inches high, text shall be 1 inch high. Letter styles shall be Helvetica, medium. Signs shall comply with CBC 2022, Title 24, Part 2, Sections 11B-216 and 11B-703.

B. Interior Room Identification Signs: Equal to Best Sign Systems FG, Graphic Blast®, Format- as specified in drawings. Color as selected by Architect from manufacturer's standard colors. Color to contrast building background. Sign material 1/8-inch, non-glare, phenolic ES plastic laminate, X" x X" with 1/2-inch radius rounded corners and beveled edges. The size of the signage shall be confirmed with the Architect. The intention is for the new signage for this project to match the

existing signage which has been used in recent construction elsewhere on the campus.

Tactile character/symbols shall be raised 1/32-inch from sign face. All text shall be accompanied by California Contracted Grade 2 Braille.

Provide one sign per interior door. Each sign to bear a room number and up to a 16 letter text. Unless shown otherwise on the Drawings, room number shall be 2 inches high, text shall be 3/4-inch high. Letter styles shall be Helvetica, medium. Signs shall comply with CBC 2022, Title 24, Part 2, Sections 11B-216 and 11B-703.

C. "Fire Sprinkler Valve Inside" Signs: Equal to Best Sign Systems, Graphic Blast®, 1/4-inch thick Fiberglass, X inches square. Provide one (1) for each fire sprinkler valve located at entrance to space where fire sprinkler valve is located.

D. Toilet Room Signs: Equal to Best Sign System FG, Graphic Blast®. Provide 1/4-inch thick, non-glare fiberglass with International symbols for WOMEN and MEN and RESTROOM. Locate 5'-0" above floor to center line of sign. (No Braille or raised Pictograms on door signs.) Sign color to contrast 70% with door leaf.

1. For men provide a door-mounted 12-inch equilateral triangular sign per CBC 2022, Title 24, Part 2, Section 11B-703.7.2.6.1.

2. For women provide a door-mounted 12-inch diameter circular sign per CBC 2022, Title 24, Part 2, Section 11B-703.7.2.6.2.

3. For unisex toilets, provide a door-mounted sign consisting of a circle 1/4-inch thick and 12 inches in diameter with a 1/4-inch thick triangle, 12 inches in diameter, with a vertex pointing upward, superimposed on the circle. Triangle shall contrast in color with circle, and circle shall contrast 70% with door leaf. Entire background color of geometric symbol sign must contrast with door. Sign shall comply with CBC 2022, Title 24, Part 2, Section 11B-703.7.2.6.3.

4. Provide a wall mounted Best Sign Systems, size 8"x8" with 1/2 radius corners (as detailed on the Drawings) with pictogram, where noted, and California Contracted Grade 2 Braille.

E. Entrance Signs: All building entrances that are accessible to and usable by persons with disabilities shall be identified with at least one (1) Accessible to persons with disabilities sign, equal to Best Sign Systems FG, Graphic Blast®, ¼" – Fiberglass. Provide a 9-inch square with the International Symbol of Accessibility (ISA) on doors or adjacent glass indicated in the Door Schedule.

F. Metal Letters for School Sign: By Matthews Bronze, (888) 838-8890. School sign shall be cast aluminum alloy C443.2, baked enamel, medium bronze color, Helvetica medium, all caps, X inches high letters, 3/8-inches deep, flush concealed mounting. Copy to be verified with Owner prior to ordering.

G. Occupancy Load Sign: Size as indicated on Drawings to match sign per paragraph 2.03B above, reading: "MAXIMUM OCCUPANCY 000 PERSONS", Verify occupant number with Drawings.

H. Building Signs: Building signs shall be cast aluminum letters 4" high minimum per CFC 505.1 and set off the face of the wall.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Locate signs where indicated on Drawings, and at heights as detailed, or where required by CBC 2022, Title 24, using mounting methods appropriate to application and in compliance with manufacturer's instructions.

B. Install signs level, plumb, and at required height.

C. Interior Wall and Door Mounted Signs:

1. Glass Surfaces or Doors: Use double-sided foam tape and liquid silicone adhesive. At glass surfaces, provide a blank 9" x 9", 1/8-inch sign panel with 1/2-radius corners, at the opposite side of glass. Color to match sign panel.

2. Irregular, Porous, or Vinyl-Covered Surfaces: Use one-way tamper proof screws, painted to match signs, in pre-drilled holes. Provide adequate spaces behind signs so signs are in a plumb, square, level plane.

3. Brick, Masonry, and Concrete Surfaces: Use one-way tamperproof screws, painted to match signs, in pre-drilled holes. Provide adequate spaces behind signs so signs are in a plumb, square, level plane.

D. Exterior Wall and Door Mounted Signs:

1. Brick, Masonry, Plaster and Masonry Surfaces: Use tamper proof screws, painted to match signs, in pre-drilled holes; one at each corner, and set in liquid silicone adhesive. Provide adequate spaces behind signs so signs are in a plumb, square, level plane.

3.02 CLEANING

A. Clean sign and surrounding surfaces to remove all dirt and debris from work of this section.

END OF SECTION

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SECTION 10 28 13

TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Toilet accessories including attachment devices, and required rough-in frames as indicated on the Drawings and specified herein.

B. Related Work:

1. Blocking and unframed mirrors.

1.02 SUBMITTALS

A. Samples: Submit one sample, if requested, of each item and model specified. If approved sample may be incorporated into project.

B. Manufacturer's catalog and data sheets, parts list, and installation requirements for each unit specified.

C. Maintenance, operation instructions and keys required for each type of equipment and lock.

1.03 QUALITY ASSURANCE

A. Manufacturers: Model numbers are for washroom accessories manufactured by Bobrick Washroom Equipment, Inc. and are listed as a standard of quality. Equivalent products of other manufacturers may be acceptable, if, in the judgment of the architect, they meet the intent of the specification in terms of design, function, materials, and quality of workmanship. Products by other manufacturers may be provided, if approved equal by Architect.

B. Accessories shall be products of a single manufacturer. Keyed (tumbler lock) accessories shall be keyed alike with the exception of coin receiving boxes on vending equipment.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver items in manufacturer's original unopened protective packaging.

B. Store material in original protective packaging to prevent soiling, physical damage, or wetting.

C. Handle so as to prevent damage to finished surfaces.

D. Maintain protective covers on units until installation is complete. Remove covers at final clean-up of installation.

1.05 GUARANTEE

A. Mirrors guaranteed 15 years against silver spoilage. Accessories guaranteed to be free from defects in workmanship and material for a period of one year, as specified in Section 01 78 30 – Warranties, Guarantees, and Bonds.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Contract documents are based on Bobrick Washroom Equipment, Inc., and are listed as a standard of quality. Products by other manufacturers may be acceptable if approved equal by Architect in terms of design, function, materials and quality of workmanship.

B. Accessories shall be product of one manufacturer. Keyed accessories shall be keyed alike with exception of coin receiving boxes on vending equipment. Provide recessed accessories at all accessible compartments.

C. Toilet Accessories required to be accessible shall be mounted at heights according to CBC 2022, Title 24, Part 2, Section 11B-213.

D. Dispensing controls must be accessible without pinching, grasping, or twisting of the wrist, per CBC 2022, Title 24, Part 2, Section 11B-309.4

2.02 REFERENCES

A. Toilet Accessories required to be accessible shall be mounted at heights according to CBC 2022, Title 24, Part 2, Section 11B-213

1. Toilet paper and feminine napkin disposal located on the grab bar side of an accessible toilet room or stall shall not project more than 3 inches from the finish wall surface nor be located closer than 1-1/2-inch clear of the tangent point of the grab bar.

2. Toilet tissue dispensers to be continuous flow type, CBC 2022, Title 24, Part 2, Section 11B-604.7.

3. Toilet paper dispenser in accessible toilet compartment to be recessed, or semi-recessed so as not to project more than 3 inches (76.2 mm) from face of wall.

B. Grab *Bars (CBC 2022, Title 24, Part 2, Section 11B-213.3, 11B-604.5, and 11B-609)*

1. Length for rear and side walls:

a. 36 inches (914 mm) min. for rear wall, per Section 11B-604.5.2
b. 42 inches (1,067 mm) min. for side wall, per Section 11B-604.5.1

2. Maximum and minimum diameters:

a. 1 1/4 - 1 1/2 inches (32-38 mm) diameter or equivalent gripping surface
b. 1 1/2 inches (38 mm) min. clearance between grab bar and wall.

C. Following (but not limited to) operable parts (including coin slots) of table room accessories to be mounted within 40 inches (1,016 mm) max above finish floor per CBC 2022, Title 24, Part 2, Section 11B-603.5:

1. Towel dispensers
2. Sanitary napkin dispenser/receptacles
3. Waste receptacles
4. Other similar dispensing and disposal fixtures
5. Bottom of reflective surface of mirrors to be 40 inches (1,0616 mm) maximum above finish floors per CBC 2022, Title 24, Part 2, Section 11B-603.3

D. Elements of Sanitary facilities shall be mounted at locations in compliance with ***CBC Sections 11B-602 through 11B-612***.

E. Grab bars in toilet facilities and bathing facilities shall comply with ***CBC Section 11B-609***.
Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges. The space around the grab bars shall be as follows:
- 1 ½" between the grab bar and the wall.
- 1 ½" minimum between the grab bar and projecting objects below and at the ends.
- 12" minimum between the grab bar and projecting objects above.

2.03 ACCESSORIES

A. Surface Mounted Soap Dispenser: B-2111

~~B. Recessed Electric Hand Dryer: World Dryer, Model RA5, single phase 115V, color coated, push button, fixed model, (Recessed ADA compliant)~~

C. Stainless Steel Welded Frame Mirror: B-165 18"x30"

One-piece channel frame, 1/2" x 1/2" x 3/8" type 430 stainless steel with bright-polished finish and mitered corners. Phillips-head frame screw. No. 1 quality 1/4**"** glass mirror. Mirror corners and back protected by shock-absorbing material. Back is galvanized steel secured to conceal wall hander with theft resistant locking device.

~~D. Frameless Stainless Steel Mirrors: B-1556 18"x30" (Student Toilet Rooms only)~~

E. Recessed toilet tissue, seat-cover dispenser and waste disposal (left side of toilet while seated): B-3091

~~F. Surface Mounted Toilet Seat Cover Dispenser: B-221.~~

~~G. Surface Mounted Paper Towel Dispenser: B-2620~~

H. Grab Bars:

1. 1-1/2 inches diameter, 48 inches length: B-6806x48

2. Same as (1.) above, 36 inches length: B-6806x36

3. ~~Not Used- Two-wall Shower Grab Bar: B-68616.99~~

Flanges shall be 1/8" thick stainless steel plate and each shall have two screw holes for attachment to wall. Flange covers shall be 22 gauge stainless steel and snap over mounting flange to conceal screws.

~~I. Mop Rack: B-223x36~~

~~Constructed of type 304 Stainless Steel, 36 inches in length, and have spring loaded rubber cam holders.~~

~~J. Recessed Seat Cover Dispenser, Sanitary Napkin Disposal and Toilet Tissue Dispenser: B-3574~~

~~K. Recessed Seat Cover Dispenser and Toilet Tissue Dispenser: B-3474~~

~~L. Surface Mounted Hat and Coat Hook: B-6827~~

M. Recessed Paper Towel Dispenser and Waste Receptacle: B-3944

~~N. Surface Mounted Sanitary Napkin Vendor: B-2706 50~~

~~O. Recessed Toilet Seat Cover Dispenser: B-301.~~

~~Constructed of type 304 Stainless Steel, welded construction. Door shall be equipped with full-length piano hinge and tumbler lock.~~

PART 3 - EXECUTION

3.01 INSPECTION

A. Check wall opening for correct dimensions, plumbness of blocking, or frames, and other preparation that would affect installation of accessories.

3.02 INSTALLATION

A. Install manufacturers recommended anchor system for grab bars.

B. Refer to Drawing details for mounting heights.

C. Conceal evidence of drilling, cutting, and fitting on adjacent finishes.

D. Fit flanges of accessories snug to wall surfaces. Provide for caulking in gaps between 90 degree return flanges and finish wall surface after accessories are installed.

3.03 ADJUSTING

A. Adjust accessories for proper operation.

3.04 CLEANING

A. Clean and polish exposed surfaces prior to final inspection.

3.05 PROTECTION

A. Deliver accessory schedule, keys and parts manual as part of project-closeout documents. For Owner's permanent records, provide two sets of the following items of manufacturer's literature:

1. Technical Data sheets of each item used for the project.

2. Service and Parts Manuals.

3. Name of local representative to be contacted in the event of need of field service or consultation.

END OF SECTION

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10 28 13 2.03 A

BOBRICK

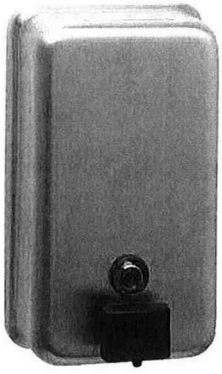
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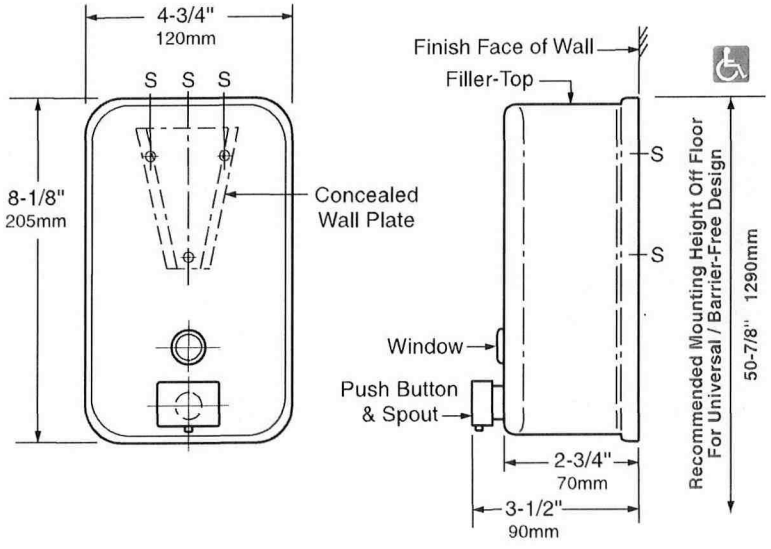
ClassicSeries® SURFACE-MOUNTED SOAP DISPENSER

B-2111

1015

KEYNOTE 1015





10 28 13 2.03 A

MATERIALS:

Container — 18-8 S, type-304, 22-gauge (0.8mm) stainless steel with satin-finish. Body is drawn, one-piece, seamless construction. Back plate has mounting bracket attached. Furnished with concealed wall plate. Equipped with a clear acrylic refill-indicator window and a locked, hinged stainless steel lid for top filling. Capacity: 40-fl oz (1.2-L).

Valve — Black molded plastic push button and spout. Soap head-holding mushroom valve. Stainless steel spring. U-packing seal and duckbill. Antibacterial-soap-resistant plastic cylinder.

OPERATION:

Corrosion-resistant valve dispenses commercially marketed all-purpose hand soaps. To prevent corrosion of the tank, use only chloride-free pH-neutral liquid soaps. Valve is operable with one hand, without tight grasping, pinching, or twisting of the wrist, and with less than 5 pounds of force (22.2 N) to comply with barrier-free accessibility guidelines (including ADAAG in the U.S.A.). Window indicates when refill is required. The locked, hinged lid opens for top filling only with special key provided. Concealed, vandal-resistant mounting.

INSTALLATION:

Secure wall plate to the wall with three sheet-metal screws, furnished by manufacturer, at points indicated by an *S*. Slide mounting bracket of container down onto wall plate and secure unit with furnished locking-screw. For plaster or dry wall construction, provide concealed backing to comply with local building codes and secure with sheet-metal screws furnished. For other wall surfaces, provide fiber plugs or expansion shields for use with sheet-metal screws furnished, or provide 1/8" (3mm) toggle bolts or expansion bolts.

Note: Surface-mount the dispenser plumb and true with valve 6" (150mm) to right or left of lavatory center. Provide 4" (100mm) minimum clearance from the lid to the underside of any horizontal projection. Push buttons should be located 44" (1120mm) maximum above the finish floor.

SPECIFICATION:

Surface-mounted soap dispenser shall be type-304 stainless steel with satin-finish. Corrosion-resistant valve shall dispense commercially marketed all-purpose hand soaps. To prevent corrosion of the tank, use only chloride-free pH-neutral liquid soaps. Valve shall be operable with one hand and with less than 5 pounds of force (22.2 N) to comply with barrier-free accessibility guidelines (including ADAAG in the U.S.A.). Container shall be equipped with a clear acrylic refill-indicator window; a locked, hinged stainless steel lid for top filling; and shall have a capacity of 40-fl oz (1.2-L). Unit shall have concealed, vandal-resistant mounting.

Surface-Mounted Soap Dispenser shall be Model B-2111 of Bobrick Washroom Equipment, Inc., Clifton Park, New York; Jackson, Tennessee; Los Angeles, California; Bobrick Washroom Equipment Company, Scarborough, Ontario; Bobrick Washroom Equipment Pty. Ltd., Australia; and Bobrick Washroom Equipment Limited, United Kingdom.

The illustrations and descriptions herein are applicable to production as of the date of this Technical Data Sheet.
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10 28 13 2.03 C

BOBRICK

Technical Data

MIRROR WITH STAINLESS STEEL CHANNEL FRAME

B-165 SERIES

1012

KEYNOTE 1012

SNAP LOCKING DESIGN

(Rear View)

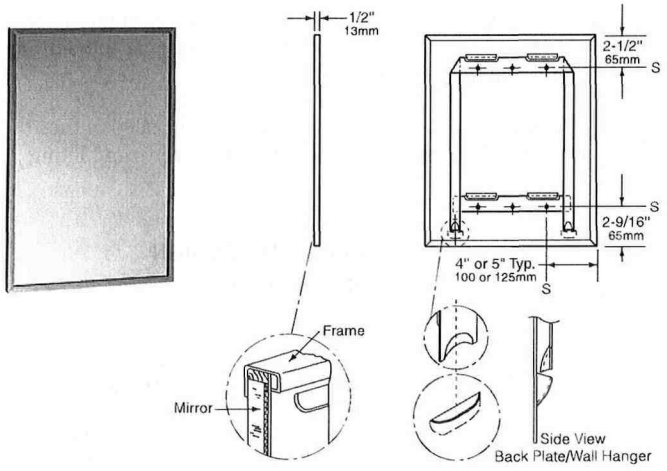


Figure: 1

STANDARD B-165 SERIES MIRRORS

MODEL NO.	OVERALL SIZE W	H
B-165 1824	18" (46cm)	24" (61cm)
B-165 1830	18" (46cm)	30" (76cm)
B-165 1836	18" (46cm)	36" (91cm)
B-165 2430	24" (61cm)	30" (76cm)
B-165 2436	24" (61cm)	36" (91cm)
B-165 2448	24" (61cm)	48" (122cm)
B-165 2460	24" (61cm)	60" (152cm)

SCREW LOCKING DESIGN

(Rear View)

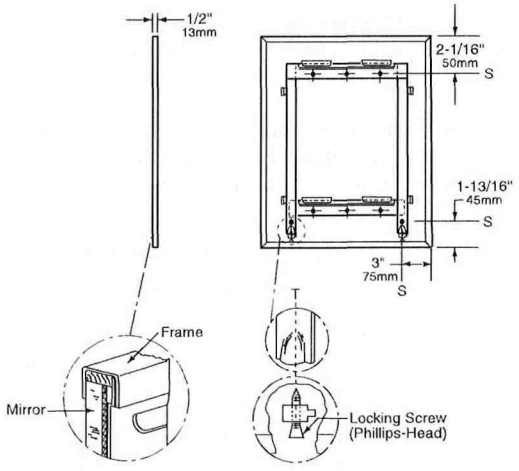


Figure: 2

STANDARD B-165 SERIES MIRRORS

MODEL NO.	OVERALL SIZE W	H
B-165 4836	48" (122cm)	36" (91cm)
All Other Size Mirrors		

10 28 13 2.03 C

Designer's Notes:

1. Special-order sizes available on request.
2. Maximum size mirror available, 72" x 60" (183 x 152cm); minimum size, 12" x 12" (30 x 30cm).
3. All Bobrick framed mirrors are manufactured to overall width and height dimensions. EXAMPLE: A 24" x 36" (61 x 91cm) mirror will be furnished 24" x 36" (61 x 91cm) outside-of-frame to outside-of-frame.
4. To specify special sizes use Series Number followed by width then height in inches. EXAMPLE: B-165 2024.
5. Bobrick framed mirrors are manufactured to a tolerance 1/8" (3.2mm).
6. For sufficient space to lift mirror onto wall hanger(s), provide 3-1/4" (85mm) minimum clearance above center line of mounting screw holes.
7. Provide 1" (25mm) minimum clearance at bottom of mirror for engaging locking screws and 1" (25mm) clearance on each side.

MATERIALS:

Frame — Type-430 stainless steel, 1/2" x 1/2" x 3/8" (13 x 13 x 9.5mm) channel with 1/4" (6mm) return at rear with bright polished finish. One piece frame with 90 degree mitered corners. Galvanized steel back has integral horizontal hanging brackets near the top for hanging the mirror and near the bottom to prevent the bottom of the mirror from pulling away from the wall. Locking devices secure mirror to concealed wall hanger. In Screw Locking Design (see figure 2), concealed Philips-head locking screws securely fasten mirror to wall hanger.

Mirror — No. 1 quality, 1/4" (6mm) select float glass: selected for silvering, electrolytically copper-plated by the galvanic process, and guaranteed for 15 years against silver spoilage. Corners are protected by friction-absorbing filler strips; back is protected by full-size, shock-absorbing, water-resistant, nonabrasive, 3/16" (5mm) thick polyethylene padding.

Concealed Wall Hanger — 20-gauge (0.9mm) galvanized steel. Incorporates lower support member, forming rigid rectangle, which engages lower backplate louvers to keep bottom of mirror against wall.

continued . . .

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INSTALLATION:

Mount wall hanger on wall with screws (not furnished) at points indicated by an *S*. For plaster or dry wall construction, provide backing to comply with local building codes, then secure wall hanger with screws (not furnished) . When providing a concealed backing, allow backing to cover minimum range of mounting hole locations shown on drawing. For other wall surfaces, provide fiber plugs or expansion shields for use with screws (not furnished), or provide 1/8" (3mm) toggle bolts or expansion bolts. Hang mirror on wall hanger with all four backplate louvers engaged behind horizontal wall hanger members. Hang mirror on wall hanger with all four backplate louvers engaged behind horizontal wall hanger members. To do this, mirror must be centered in front of the wall hanger horizontally, pressed flat against the wall approximately 1" (25mm) above final position and then lowered into final position.

Snap Locking Design — Locking devices automatically secure mirror to concealed wall hanger when it is lowered into final position. Locking devices may be unlocked by inserting two flat blade screwdrivers behind each side of mirror near the bottom or under the bottom of the mirror and pulling mirror bottom forward and then up (see figure 3).

Screw Locking Design — Lock mirror to wall hanger by tightening Phillips-head locking screws that are concealed in the bottom of frame at points indicated by a *T*. Mirror may be unlocked from wall hanger by loosening locking screws and lifting mirror off of concealed wall hanger (see figure 4).

SNAP LOCKING DESIGN
(Front View)

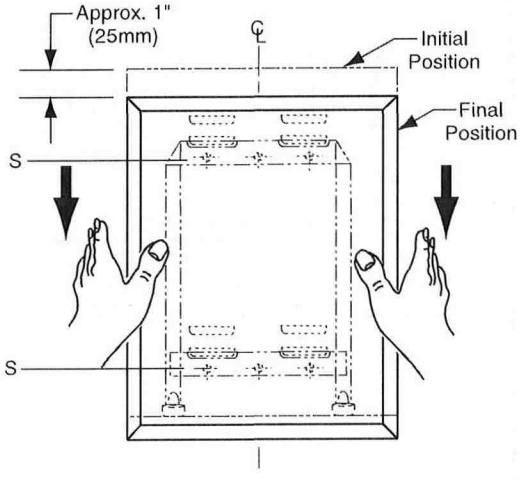


Figure: 3

SCREW LOCKING DESIGN
(Front View)

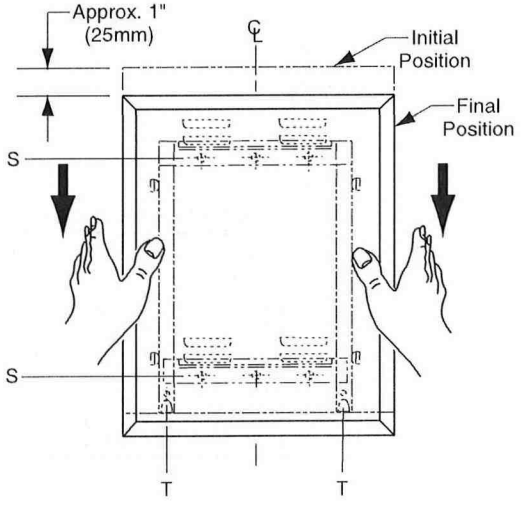


Figure: 4

SPECIFICATION:

Mirror shall have a one-piece type-430 stainless steel channel frame, 1/2" x 1/2" x 3/8" (13 x 13 x 9.5mm), with 90° mitered corners; all exposed surfaces shall have bright polished finish. Select float glass mirror shall be guaranteed for 15 years against silver spoilage. Corners shall be protected by friction-absorbing filler strips and the back shall be protected by full-size, shock-absorbing, water-resistant, nonabrasive, 3/16" (5mm) thick polyethylene padding. Galvanized steel back shall have integral horizontal hanging brackets located at top and bottom for mounting on concealed rectangular wall hanger to prevent the mirror from pulling away from the wall. Locking devices secure mirror to concealed wall hanger. Mirror shall be removable from the wall.

Framed Mirror shall be Model B-165 _____ (insert width and height) of Bobrick Washroom Equipment, Inc., Clifton Park, New York; Jackson, Tennessee; Los Angeles, California; Bobrick Washroom Equipment Company, Scarborough, Ontario; Bobrick Washroom Equipment Pty. Ltd., Australia; and Bobrick Washroom Equipment Limited, United Kingdom.

The illustrations and descriptions herein are applicable to production as of the date of this Technical Data Sheet.
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BOBRICK

Technical Data

ClassicSeries®

RECESSED TOILET TISSUE, SEAT-COVER DISPENSER AND WASTE DISPOSAL - LEFT SIDE OF TOILET WHILE SEATED

B-3091

KEYNOTE 1009

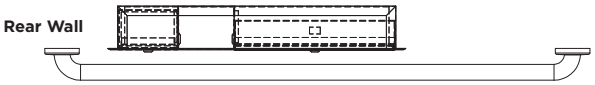
Specify Finish Required

☐ Stainless Steel, Satin Finish
☐ Matte Black Finish, please use model no. B-3091.MBLK

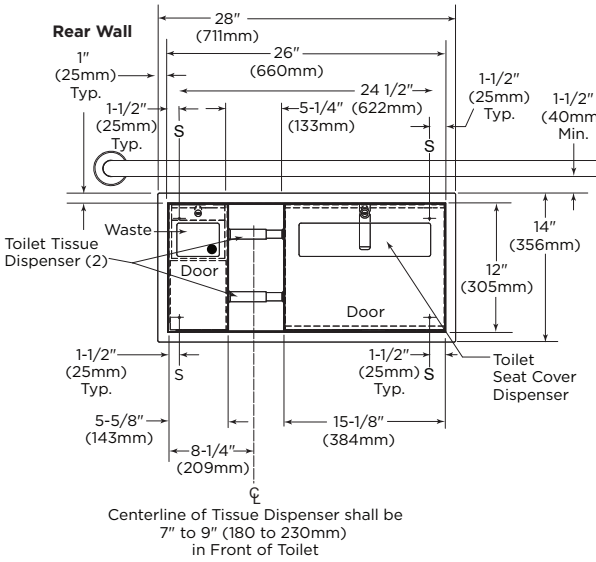


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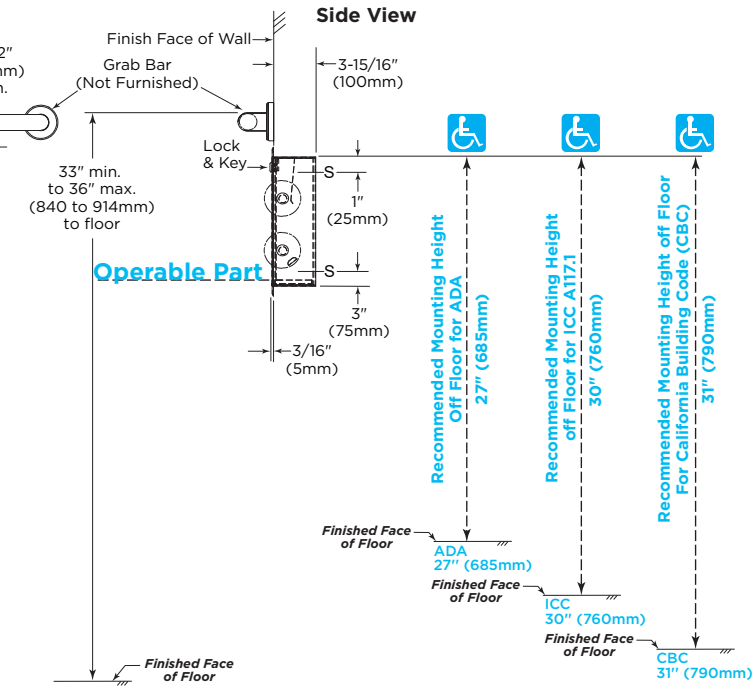
Top View



Front View



Side View



Rough Wall Opening

26-5/8" (675mm) wide

12-5/8" (320mm) high

4" (102mm) minimum recessed depth

ADA/ICC/CBC Installation Guidance

***Operable Part:** Bottom of outlet of toilet tissue dispenser

Minimum mounting height of Operable Part:

ADA: 15" (380mm) above finished floor (AFF)

ICC: 18" (457mm) above finished floor (AFF)

CBC: 19" (482mm) above finished floor (AFF)

*For more information regarding operable parts, please refer to Bobrick Planning Guide for Accessible Restrooms, page 9.

continued . . .

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Revised 8/9/24

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MATERIALS:

Cabinet — 18-8, Type-304, heavy-gauge stainless steel. All-welded construction. Exposed surfaces have satin finish or matte black, as specified.

Flange — 18-8, Type-304, 22-gauge (0.8mm) stainless steel with satin finish or matte black, as specified. Drawn and beveled, one-piece, seamless construction.

Doors (2) — 18-8, Type-304, 18-gauge (1.2mm) stainless steel with satin finish or matte black, as specified. One-piece, seamless construction. Secured to cabinet with a full-length stainless steel piano-hinge. Equipped with a tumbler lock keyed like other Bobrick washroom accessories.

Toilet Tissue Dispensers (2) — 18-8, Type-304, 22-gauge (0.8mm) stainless steel with satin finish or matte black, as specified. Equipped with two chrome-plated plastic spindles, each with a heavy-duty internal spring.

Disposal Panel — 18-8, Type-304, 22-gauge (0.8mm) stainless steel with hemmed edges; exposed surface has satin finish or matte black, as specified. Panel equipped with graphic symbol for waste "drop here". Secured to door with a spring-loaded, full-length stainless steel piano-hinge.

Waste Receptacle — 18-8, Type-304, heavy-gauge stainless steel. All-welded construction. Removable for servicing. Capacity: 0.4-gal. (1.5-L).

OPERATION:

Doors unlock with key provided and swing open for servicing. Toilet seat-cover dispenser holds 500 single- or half-fold paper covers. Receptacle is removable for servicing. Unit holds two standard-core toilet tissue rolls up to 5-1/4" (135mm) diameter (1800 sheets).

Designer's Note: It is recommended that one full toilet tissue roll remain wrapped until the other roll has been depleted to avoid wasting ends of both rolls.

INSTALLATION:

Provide framed rough wall opening 26-5/8" (675mm) wide, 12-5/8 (320mm) high. Minimum recessed depth required from finish face of wall is 4" (102mm). Allow clearance for construction features that may protrude into rough wall opening from opposite wall. Coordinate with mechanical engineer to avoid pipes, vents, and conduits in wall. If unit projects above top of wainscot, provide aluminum channel or other filler to eliminate gap between flange and finish face of wall. Mount unit in wall opening with shims between framing and cabinet at all points indicated by an S, then secure unit with #8 x 1-1/4" (4.2 x 30mm) sheet-metal screws (not furnished).

Designer's Notes:

1. Surface-mounted B-3091 mounts on left side of toilet (when seated on toilet).
2. For unit to mount on the right side of toilet (when seated on toilet) see model B-3092.
3. For visual placement of models inside toilet compartment, refer to Technical Bulletin TB-92.

SPECIFICATION:

Recessed toilet seat-cover dispenser, waste disposal, and toilet tissue dispenser shall be Type-304 stainless steel with all-welded construction; exposed surfaces shall have satin finish or matte black, as specified. Toilet tissue dispensers shall be ABS plastic. Flange shall be drawn and beveled, one-piece, seamless construction. Doors shall be one-piece, seamless construction; secured to cabinet with a full-length stainless steel piano-hinge; and equipped with a tumbler lock keyed like other Bobrick washroom accessories. Toilet seat-cover dispenser holds 500 paper covers. Self-closing disposal panel shall be secured to door with a spring-loaded, full-length stainless steel piano-hinge and hemmed edges. Disposal panel equipped with graphic symbol, "drop here". Disposal shall be furnished with a removable receptacle, 18-8, Type-304, heavy-gauge stainless steel. All-welded construction with a capacity of 0.4-gal. (1.5-L). Unit shall be equipped with two chrome-plated plastic spindles, each with a heavy-duty internal spring, that hold standard-core rolls up to 5-1/4" (135mm) diameter (1800 sheets).

Recessed Toilet Tissue, Seat-Cover Dispenser and Waste Disposal - Left Side of Toilet While Seated shall be Model B-3091 of Bobrick Washroom Equipment, Inc., Clifton Park, New York; Jackson, Tennessee; Los Angeles, California; Bobrick Washroom Equipment Company, Scarborough, Ontario; Bobrick Washroom Equipment Pty. Ltd., Australia; and Bobrick Washroom Equipment Limited, United Kingdom.

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BOBRICK

Technical Data

1½" (38mm) DIAMETER STAINLESS STEEL GRAB BARS WITH SNAP FLANGE

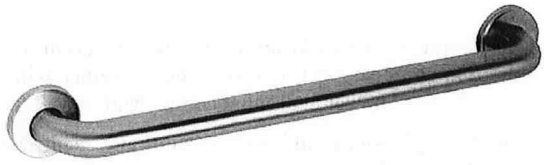
B-6806 SERIES

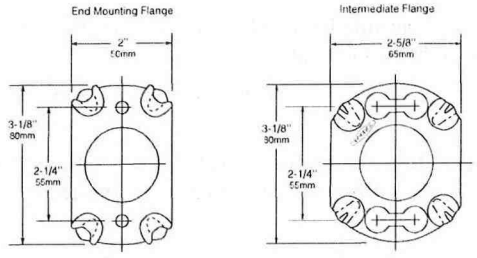
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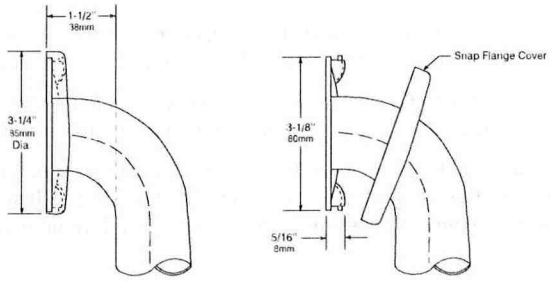
KEYNOTE 1005

Specify Finish Required:

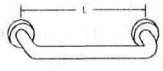
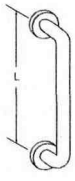
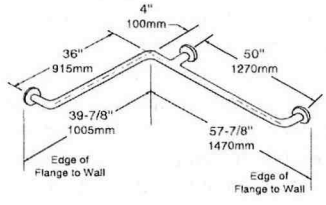
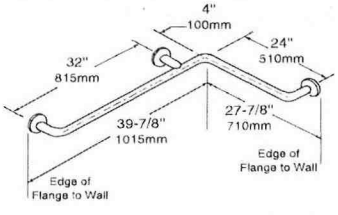
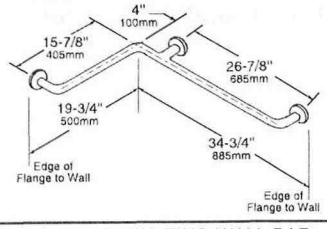
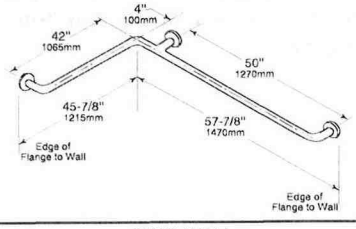
- ☐ Satin finish
- ☐ Satin finish with peened gripping surface; add suffix .99 to model number







10 28 13 2.03 H

		
HORIZONTAL	VERTICAL	TWO-WALL WHEELCHAIR TOILET COMPARTMENT
B-6806 x 12, 18, 24, 30, 36, 42, 48		B-68137
		
HORIZONTAL TUB BATH 24 x 36	HORIZONTAL TWO-WALL BAR for Shower Stall	TWO-WALL TOILET COMPARTMENT BAR 42 x 54
B-68616	B-6861	B-6897

continued . . .

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MATERIALS:

Grab Bar — 18-8 S, type-304, 18-gauge (1.2mm) stainless steel tubing with satin-finish. 1-1/2" (38mm) outside diameter. Ends are heliarc welded to flanges. Clearance between the grab bar and wall is 1-1/2" (38mm).

Concealed Mounting Flanges — 18-8 S, type-304, 1/8" (3mm) thick, stainless steel plate; end flanges 2" x 3-1/8" (50 x 80mm) with two holes for attachment to wall. Intermediate flanges 2-5/8" x 3-1/8" (65 x 80mm) wide x 3-1/8" (80mm) diameter.

Snap Flange Covers — 18-8 S, type-304, 22-gauge (0.8mm) drawn stainless steel with satin-finish. 3-1/4" (85mm) diameter x 1/2" (13mm) deep. Each cover snaps over mounting flange to conceal mounting screws.

STRENGTH:

Bobrick grab bars that provide 1-1/2" (38mm) clearance from wall can support loads in excess of 900 pounds (408kg) if properly installed. Other grab bar configurations can support loads in excess of 250 pounds (113kg) if properly installed, complying with barrier-free accessibility guidelines (including ADAAG in the U.S.A.) for structural strength

Warning: *Grab bars are no stronger than the anchors or walls to which they are attached and, therefore, must be firmly secured in order to support the loads for which they are intended.*

INSTALLATION:

Provide concealed anchor device or backing as specified or required in accordance with local building codes before wall is finished. Fasten concealed mounting flanges to anchor device or backing with two screws in each flange. Snap flange covers over each mounting flange to conceal mounting screws. Concealed anchor devices and mounting screws are not included with Bobrick grab bars and must be specified as an accessory.

For Grab Bars with an Intermediate Flange(s), Pull Snap-Flange Covers away from mounting flanges. Place grab bar in desired mounting location. Use intermediate flange as a template to mark location of mounting screws at intermediate flange only. Mark screw locations at the center of the slot in the middle of the double-keyhole shaped mounting holes (2) in the intermediate flange. Remove grab bar from wall. Drive the intermediate flange mounting screws into wall at marked locations. **Note:** Make sure to leave a space of just over 1/8" (3.17mm) between the underside of the screw head and the wall. install grab bar on the wall by placing the round ends of the intermediate flange double-keyhole shaped mounting holes over the mounting screws (2) are located in the middle of the flange slots. Install the mounting screws into the wall at the end flanges and secure tightly. Tighten the mounting screws at the intermediate flange. Press all snap-flange covers into place to conceal mounting flanges.

Note: Recommend use of 1/4" or #14 (M6.3) sheet metal or wood screws to install Intermediate Flange. #12 (M5.5) screws may also be used.

Important Notes:

1. **Mounting Kits** — Bobrick has a selection of mounting screws and fasteners available for different types of installations; **one Bobrick mounting kit is required for each flange.**

Mounting Kit No.	Description
252-30	Consists of (3) #14 x 2½" (M6.3 x 64mm) type-304 stainless steel, Phillips round-head, sheet-metal screws.
2521-30	Consists of (3) 1/4"–20 x 3½" (M6.3–1 x 89mm) type-304 stainless steel, Phillips round-head, machine screws with plated-steel toggle nuts.
2522-30	Consists of (3) 1/4"–20 x 2" (M6.3–1 x 51mm) type-304 stainless steel, Phillips round-head, machine screws with metal expansion shields.

2. **Grab Bar Fastener** — Bobrick has a grab bar fastening system that secures all Bobrick grab bar series; **one Bobrick fastener is required for each flange.** Install grab bar without backing in wall requires minimum 5/8" (16mm) thick painted or tiled drywall.

WingIt™ Fastener No.	Description
251-4	Consists of (3) 10–32 x 5/16" round-head, Phillips 18/8 stainless steel screws. (1) WingIt grab bar fastener.

3. **Optional Anchor Device** — Bobrick grab bar anchor device includes stainless steel machine screws to be used for attaching grab bars to anchors. **one Bobrick concealed anchor device is required for each flange.**

Optional Anchor No.	Description
2583	Anchor for 3/4" to 1" (19-25mm) panel 1 anchor required for each flange.
2586	Anchor for 1/2" to 1" (13mm) panel 1 anchor required for each flange.

SPECIFICATION:

Grab bar shall be type-304 stainless steel with satin-finish. Grab bar shall have 18-gauge (1.2mm) wall thickness and 1-1/2" (38mm) outside diameter. Clearance between the grab bar and wall shall be 1-1/2" (38mm). Concealed mounting flanges shall be 1/8" (3mm) thick stainless steel plate, 2" x 3-1/8" (50 x 80mm), and equipped with two screw holes for attachment to wall. Flange covers shall be 22 gauge (0.8mm), 3-1/4" (85mm) diameter x 1/2" (13mm) deep, and shall snap over mounting flange to conceal mounting screws and/or WingIt fasteners. Ends of grab bar shall pass through concealed mounting flanges and be heliarc welded to form one structural unit. Grab bar shall comply with barrier-free accessibility guidelines (including ADAAG in the U.S.A.) for structural strength.

Grab Bar shall be Model _____ (insert model number) of Bobrick Washroom Equipment, Inc., Clifton Park, New York; Jackson, Tennessee; Los Angeles, California; Bobrick Washroom Equipment Company, Scarborough, Ontario; Bobrick Washroom Equipment Pty. Ltd., Australia; and Bobrick Washroom Equipment Limited, United Kingdom.

The illustrations and descriptions herein are applicable to production as of the date of this Technical Data Sheet.
The manufacturer reserves the right to, and does from time to time, make changes and improvements in designs and dimensions.

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BOBRICK

Technical Data

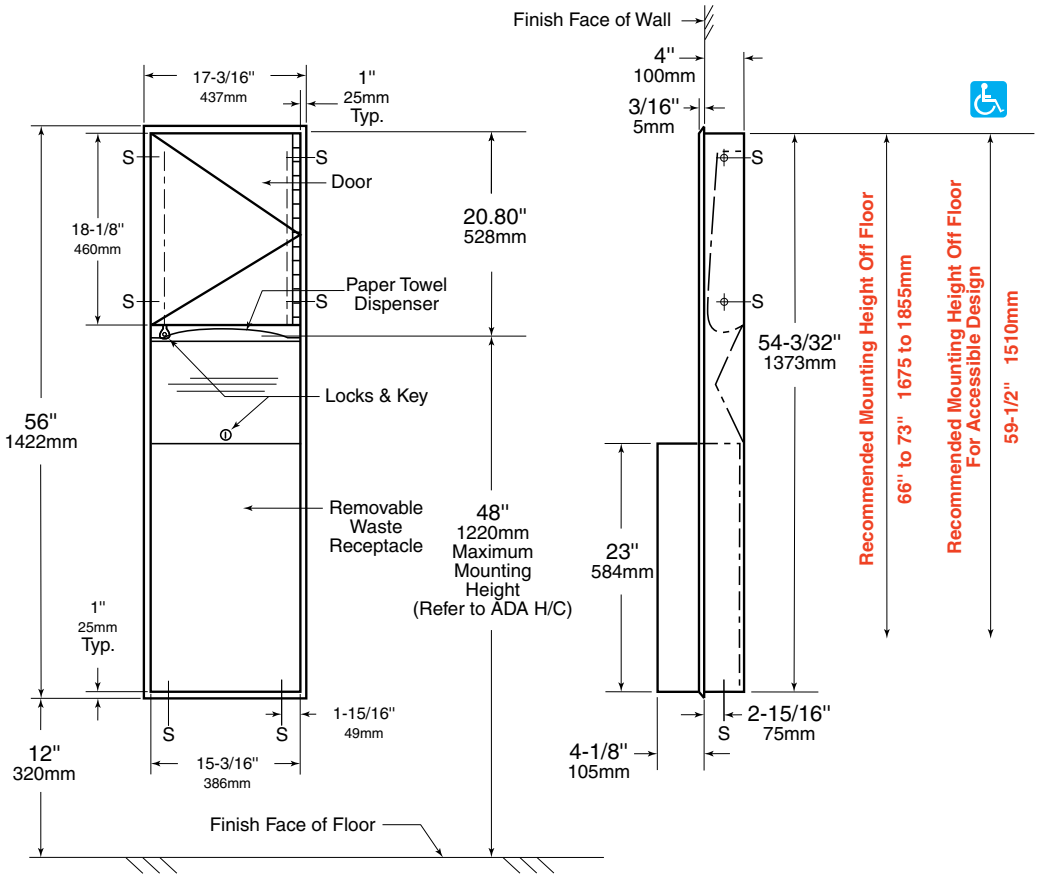
ClassicSeries® RECESSED CONVERTIBLE PAPER TOWEL DISPENSER AND WASTE RECEPTACLE

B-3944

KEYNOTE 1006

10 28 13 2.03 M





Rough Wall Opening
16" (406mm) wide
54-3/4" (1390mm) high
4" (100mm) minimum
recessed depth

MATERIALS:

Cabinet — 18-8, Type-304, heavy-gauge stainless steel. Welded construction. Exposed surfaces have satin-finish.

Flange — 18-8, Type-304, 22-gauge (0.8mm) stainless steel with satin-finish. Drawn and beveled, one-piece, seamless construction.

Door — 18-8, Type-304, 22-gauge (0.8mm) stainless steel with satin-finish. Double-pan-back construction. Secured to cabinet with a full-length stainless steel piano-hinge. Equipped with a semi-concealed tumbler lock keyed like other Bobrick washroom accessories.

Paper Towel Dispenser — 18-8, Type-304, 22-gauge (0.8mm) stainless steel with satin-finish. Rounded towel tray has hemmed opening to dispense paper towels without tearing. Capacity: 600 C-fold or 800 multifold paper towels.

Optional: Order Bobrick Model No. 3944-130 TowelMate® available as on optional accessory. TowelMate accessory allows for paper towels to dispense one at a time without bulging or sagging, or falling through the towel tray opening. The 90 degree return on the towel guide prevents papers from falling forward and out when door is opened for servicing. TowelMate fits Gamco and most other manufacturers'.

continued . . .

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SECTION 12 36 00

LABORATORY CASEWORK

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. Wood laboratory casework.
2. Laboratory countertops.
3. Fume hood.

B. Related Sections:

1. Division 6 Section "Rough Carpentry" for wood blocking for anchoring laboratory casework.

2. Division 22 Plumbing

1.3 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and visible surfaces in open cabinets or behind glass doors.

1. Ends of cabinets indicated to be installed directly against and completely concealed by walls or other cabinets are defined as "concealed."

C. Semiexposed Surfaces of Casework: Surfaces behind opaque doors, such as cabinet interiors, shelves, and dividers; interiors and sides of drawers; and interior faces of doors. Tops of cabinets 78 inches or more above floor are defined as "semiexposed."

D. Concealed Surfaces of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

E. Hardwood Plywood: A panel product composed of layers or plies of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive and faced both front and back with hardwood veneers.

1.4 PERFORMANCE REQUIREMENTS

A. System Structural Performance: Laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:

1. Support Framing System: 600 lb/ft..
2. Suspended Base Cabinets (Internal Load): 160 lb/ft.
3. Work Surfaces (Including Tops of Suspended Base Cabinets): 160 lb/ft.
4. Wall Cabinets (Upper Cabinets): 160 lb/ft.
5. Shelves: 40 lb/sq. ft.

B. Delegated Design: Design laboratory casework, including comprehensive engineering analysis by a qualified professional engineer, using seismic performance requirements and design criteria indicated.

C. Seismic Performance: Laboratory casework and support framing system, including attachments to other work, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and the 2022 California Building Code.

1.5 SUBMITTALS

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

B. Shop Drawings: For laboratory casework. Include plans, elevations, sections, details, and attachments to other work.

1. Indicate locations of hardware and keying of locks.
2. Indicate locations and types of service fittings.
3. Indicate locations of blocking and reinforcements required for installing laboratory casework.
4. Include details of utility spaces showing supports for conduits and piping.
5. Include details of support framing system.
6. Include details of exposed conduits, if required, for service fittings.
7. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.
8. Include coordinated dimensions for laboratory equipment specified in other Sections.

C. Samples for Verification: For each type of cabinet finish and each type of countertop material indicated, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For laboratory casework indicated to comply with seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Qualification Data: For qualified manufacturer.

F. Product Test Reports for Casework: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework with requirements of specified product standard and system structural performance specified in "Performance Requirements" Article.

G. Product Test Reports for Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface materials with requirements specified for chemical and physical resistance.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that produces casework of types indicated for this Project that has been tested for compliance with SEFA 8.

B. Source Limitations: Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.

1. Obtain countertops, sinks, accessories and service fittings from casework manufacturer.

C. Casework Product Standard: Comply with SEFA 8, "Laboratory Furniture - Casework, Shelving and Tables - Recommended Practices."

D. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by FM Approvals.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

F. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

G. Preinstallation Conference: Conduct conference at Project site.

H. Casework: Operable parts for all accessible casework shall comply with CBC Section 11B-309.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, utility roughing-in and wet work are complete and dry, and temporary HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.9 COORDINATION

A. Coordinate installation of laboratory casework with installation of fume hoods and other laboratory equipment.

1.10 EXTRA MATERIALS

A. Furnish complete touchup kit for each type and color of metal laboratory casework provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.

B. Furnish complete touchup kit for each type and color of wood laboratory casework provided. Include scratch fillers, stains, finishes, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.

C. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cabinet Mounting Clips and Related Hardware: Quantity equal to 5 percent of amount installed, but no fewer than 20 of each type.

PART 2 - PRODUCTS

2.1 WOOD CABINET MATERIALS

A. General:

1. Adhesives: Do not use adhesives that contain urea formaldehyde.
2. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
3. Hardwood Plywood: HPVA HP-1, either veneer core or particleboard core, unless otherwise indicated, made without urea formaldehyde.
4. MDF: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde].
5. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
6. Hardboard: AHA A135.4, Class 1 Tempered.
7. Edgebanding for Wood-Veneered Construction: Minimum 1/8-inch- thick, solid wood of same species as face veneer.

B. Exposed Materials:

1. General: Provide materials that are selected and arranged for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
2. Wood Species: Red oak.
3. Plywood: Hardwood plywood with face veneer of species indicated, selected for compatible color and grain. Grade A exposed faces at least 1/50 inch thick, and Grade J crossbands. Provide backs of same species as faces.

a. Face Veneer Cut: Plain sliced.

4. Solid Wood: Clear hardwood lumber of species indicated, selected for compatible grain and color.

C. Semiexposed Materials:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects, of same species as exposed solid wood.

2. Plywood: Hardwood plywood of same species as exposed plywood. Grade B faces and Grade J crossbands. Provide backs of same species as faces.
3. Provide solid wood or hardwood plywood for semiexposed surfaces unless otherwise indicated.

D. Concealed Materials:

1. Solid Wood: Any species, with no defects affecting strength or utility.
2. Plywood: Hardwood plywood. Provide backs of same species as faces.
3. Particleboard.
4. MDF.
5. Hardboard.

2.2 AUXILIARY CABINET MATERIALS

A. Acid Storage-Cabinet Lining: 1/4-inch- thick, polyethylene, polypropylene, epoxy, or phenolic-composite lining material.

2.3 COUNTERTOP, TABLE TOP AND SINK MATERIALS

A. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.

1. Physical Properties:

a. Flexural Strength: Not less than 10,000 psi.
b. Modulus of Elasticity: Not less than 2,000,000 psi.
c. Hardness (Rockwell M): Not less than 100.
d. Water Absorption (24 Hours): Not more than 0.02 percent.
e. Heat Distortion Point: Not less than 260 deg F.

2. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:

a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).

3. Color: As selected by Architect from manufacturer's full range.

2.4 WOOD CABINETS

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. Fisher Hamilton L.L.C.
2. Kewaunee Scientific Corporation; Laboratory Products Group.
3. Sargent-Welch.
4. Or equal.

B. Design: Lipped overlay with radiused edges.

C. Grain Direction:

1. Vertical on both doors and drawer fronts, with continuous vertical matching.
2. Lengthwise on face frame members.
3. Vertical on end panels.
4. Side to side on bottoms and tops of units.
5. Vertical on knee-space panels.
6. Horizontal on aprons and table frames.

D. Veneer Matching:

1. None required; select and arrange veneers for compatible grain and color.

E. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as adjacent exposed cabinet surfaces unless otherwise indicated.

1. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
2. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.
3. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed. Fabricate from same material and with same finish as exposed cabinet backs.

2.5 WOOD FINISH

A. Preparation: Sand lumber and plywood before assembling. Sand edges of doors, drawer fronts, and molded shapes with profile-edge sander. Sand after assembling for uniform smoothness at least equivalent to that produced by 220-grit sanding and without machine marks, cross sanding, or other surface blemishes.

B. Staining: Remove fibers and dust and apply stain to exposed and semiexposed surfaces as necessary to match approved Samples. Apply stain in a manner that will produce a consistent appearance. Apply wash-coat sealer before applying stain to closed-grain wood species.

1. Stain Color: As selected by Architect from manufacturer's full range.

C. Chemical-Resistant Finish: Apply laboratory casework manufacturer's standard two-coat, chemical-resistant, transparent finish. Sand and wipe clean between coats. Topcoat(s) may be omitted on concealed surfaces.

1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.

2.6 HARDWARE

A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Hinges: Stainless-steel, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 for doors 48 inches high or less and 3 for doors more than 48 inches high.

C. Hinged Door and Drawer Pulls: Solid aluminum, stainless steel, or chrome-plated brass back-mounted pulls. Provide 2 pulls for drawers more than 24 inches wide.

1. Design: Wire pulls.
2. Overall Size: As selected from manufacturer's full range.

D. Door Catches: Dual, self-aligning, permanent magnet catches. Provide 2 catches on doors more than 48 inches high.

E. Drawer Slides: Side mounted, epoxy-coated steel, self-closing; designed to prevent rebound when drawers are closed; complying with BHMA A156.9, Type B05091.

1. Provide Grade 1 for drawers not more than 6 inches high and 24 inches wide.
2. Provide Grade 1HD-100 for drawers more than 6 inches high or 24 inches wide.
3. Standard Duty (Grade 1): Full-extension type, with polymer rollers.
4. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Full-extension, ball-bearing type.

F. Label Holders: Stainless steel, aluminum, or chrome plated; sized to receive standard label cards approximately 1 by 2 inches, attached with screws or rivets. Provide on all drawers.

G. Locks for Wood Cabinets: Cam type with 5-pin tumbler, brass with chrome-plated finish; complying with BHMA A156.11, Type E07281.

1. Provide a minimum of two keys per lock and two master keys.
2. Provide on all drawers and doors.
3. Keying: Key locks within each room alike, key each room separately.
4. Master Key System: Key all locks to be operable by master key.

H. Sliding-Door Hardware Sets: Laboratory casework manufacturer's standard, to suit type and size of sliding-door units.

I. Adjustable Shelf Supports for Wood Cabinets: Mortise-type, powder-coated steel standards and shelf rests complying with BHMA A156.9, Types B04071 and B04091.

2.7 COUNTERTOPS, TABLE TOPS AND SINKS

A. Countertops, General: Provide units with smooth surfaces in uniform plane free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch, with continuous drip groove on underside 1/2 inch from edge.

B. Sinks, General: Provide sinks per plumbing schedule and as approved by Architect.

1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2, unless otherwise indicated.
2. Overflows: Where indicated, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches less than sink depth. Provide in same material as strainer.
3. ADA compliant as manufactured by Just manufacturing; Model No. Slada1921A55-J.

C. Epoxy Countertops Table Tops and Sinks:

1. Countertop Fabrication: Fabricate with factory cutouts for sinks, holes for service fittings and accessories, and with butt joints assembled with epoxy adhesive and concealed metal splines.

    a. Countertop Configuration: Flat, 1 inch thick, with beveled or rounded edge and corners, and with drip groove and integral coved or applied backsplash.
    b. Countertop Construction: Uniform throughout full thickness.

2. Table-Top Fabrication:

    a. Table-Top Configuration: Flat, 1 inch thick, with beveled or rounded edge and corners, and with drip groove at perimeter.
    b. Table-Top Construction: Uniform throughout full thickness.

3. Sink Fabrication: Molded in 1 piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch minimum thickness.
    a. Provide integral sinks in epoxy countertops, bonded to countertops with invisible joint line.

D. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig.

1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets.
2. Aerators: Provide aerators on water fittings that do not have serrated outlets.
3. Self-Closing Valves: Provide self-closing valves where indicated.
4. S1 Faucet (ADA), cold water only, Chicago Faucets 928-317SAM
5. G0-1, gas outlet, Chicago Faucets 900 Series 982-WSV909LEB

E. Ground-Key Cocks: Tapered core and handle of one-piece forged brass, ground and lapped, and held in place under constant spring pressure. Provide units designed for working pressure up to 40 psig, with serrated outlets.

F. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L."

G. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.

H. Handles: ADA compliant as noted on Division 22 Plumbing.

I. Service-Outlet Identification: Provide color-coded plastic discs with embossed identification, secured to each service-fitting handle to be tamper resistant. Comply with SEFA 7 for colors and embossed identification.

2.8 BENCH FUME HOOD

A. ADA Bench Fume hood, Model H08 as manufactured by Kewaunee Scientific Corporation

1. Meet guidelines of the Americans with Disabilities Act (ADA)

2. With Gravity Sash Stop.

3. Fixtures and service fittings within reach of wheelchair bound operator.

4. Radiused corner posts and airfoils for smooth air movement to assure high level of comfort, safety and efficiency.

5. Interior baffles to minimize turbulence and optimize containment.

6. Frameless sash with full-length formed steel handle.

7. Low profile PVC sash tracks, sash leveling and alignment.

8. Heavy gauge cold rolled steel exterior panels with independent rigid structural frame.

9. Design and test using ASHRAE 110-1995, BS 7258 and DIN 12 924 standards.

2.9 EMERGENCY SHOWER EYE WASH

A. ESH-1 Barrier Free Combination Shower Eye Wash HAWS Model No. 8200WC ANSI 2358.1

3.0 ELECTRICAL SERVICE FITTINGS

J. Service Fittings, General: Provide units complete with metal housings, receptacles, terminals, switches, pilot lights, device plates, accessories, and gaskets required for mounting on laboratory casework.

K. Receptacles: Comply with NEMA WD 1, NEMA WD 6, and UL 498. Duplex type, Configuration 5 20R.

1. Receptacle Grade: General grade unless otherwise indicated.
2. Color of Receptacles: Ivory unless otherwise indicated or required by CEC.

L. Switches: Comply with NEMA WD 1 and UL 20. Provide single-pole, double-pole, or 3-way switches as required; rated 120 to 277-V ac; and in amperage capacities to suit units served.

1. Color of Switches: Ivory unless otherwise indicated or required by CEC.
2. Provide key-operated switch where noted as "KEY" next to switch identification.
3. Provide thermal-overload switches, single or double pole, as required, with maximum overcurrent trip setting to suit particular motor controlled.

M. Service Fittings, General: Provide units with metal housings and gaskets required for mounting on laboratory casework. Receptacles, terminals, switches, pilot lights, device plates, and accessories are specified in Division 26 Section 26 27 26 Section "Wiring Devices."

N. Pedestal-Type Fittings: Cast-aluminum housings with sloped single face or two faces, as indicated, with neoprene gasket under base and with concealed mounting holes in base for attaching to laboratory casework. Provide holes tapped for conduits.

O. Line-Type Fittings: Provide with cast-metal boxes with threaded holes for mounting on rigid steel conduit. Provide cover plates same size as boxes.

P. Recessed-Type Fittings: Provide with galvanized-steel boxes.

Q. Finishes for Service-Fitting Components: Provide housings or boxes for pedestal- and line-type fittings with manufacturer's standard baked-on, chemical-resistant enamel in color as selected by Architect from manufacturer's full range.

R. Cover Plates: Provide satin finish, Type 304, stainless-steel cover plates with formed, beveled edges.

S. Cover-Plate Identification: Use 1/4-inch- high letters unless otherwise indicated. For stainless steel or chrome-plated metal, stamp or etch plate and fill in letters with black enamel.

1. Provide at the following locations:

a. Receptacles other than standard 125-V duplex, grounding type.
b. Switches and thermal-overload switches.
c. Pilot lights when located remotely from associated equipment or switch, where function is not obvious.
d. Receptacles, switches, and other locations indicated.

2. Provide the following information:

a. Voltage and phase for receptacles other than standard 125-V duplex, grounding type.
b. Indicate equipment being controlled by switches and thermal-overload switches.
c. Indicate equipment being controlled for pilot lights when located remotely from associated equipment or switch, where function is not obvious.
d. Number of breaker in panelboard that controls device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of laboratory casework.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CABINETS

A. Comply with installation requirements in SEFA 2.3. Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.
3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.

B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.

C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.

1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches on center. and at sides of cabinets with not less than 2 fasteners per side.

D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches on center.

E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

F. Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF COUNTERTOPS

A. Comply with installation requirements in SEFA 2.3. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Prepare edges in shop for field-made joints.

1. Use concealed clamping devices for field-made joints in plastic-laminate countertops. Locate clamping devices 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 uniform heavy pressure at joints.

C. Fastening:

1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
2. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches on center.
3. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

D. Provide required holes and cutouts for service fittings.

E. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.

F. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

G. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.4 INSTALLATION OF LABORATORY ACCESSORIES

A. Install accessories according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions.

B. Securely fasten adjustable shelving supports, stainless-steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.

C. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

D. Securely fasten pegboards to partition framing, wood blocking, or reinforcements in partitions.

3.5 INSTALLATION OF SERVICE FITTINGS

A. Comply with requirements in Divisions 15 and 16 Sections for installing water and laboratory gas service fittings and electrical devices.

B. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

3.6 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches on center.

END OF SECTION

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SECTION 22 05 17 – SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

B. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

C. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Presealed Systems.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.

2. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

4. Interior Partitions:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.

END OF SECTION 22 05 17

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SECTION 22 05 18 – ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 05 18

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SECTION 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Test plugs.

B. Related Sections:

1. Division 22 Section "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
2. Division 22 Section " Domestic Water Piping" for water meters inside the building.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trerice, H. O. Co.
2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
3. Weiss Instruments, Inc.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch (76-mm) nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F (deg C).

E. Connector Type(s): Union joint, rigid, back and rigid, bottom, with unified-inch screw threads.

F. Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.

H. Window: Plain glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Trerice, H. O. Co.
b. Weiss Instruments, Inc.
c. Or approved equal.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch (178-mm) nominal size unless otherwise indicated.
4. Case Form: Straight unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.

6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMETEK, Inc.; U.S. Gauge.
    b. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    c. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Trerice, H. O. Co.
2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
3. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 (DN 8) or NPS 1/2 (DN 15), ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Industrial-style, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C).

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be the following:

1. Liquid-filled, direct -mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:

1. Liquid-filled Solid-front, pressure-relief, direct-mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

C. Pressure gages at suction and discharge of each domestic water pump shall be the following:

1. Liquid-filled, direct-mounted, metal case.
2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi (0 to 1100 kPa).

B. Scale Range for Domestic Water Piping: 0 to 160 psi (0 to 1100 kPa).

END OF SECTION 22 05 19

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SECTION 22 05 23 – GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Bronze swing check valves.
3. Lubricated plug valves.

B. Related Sections:

1. Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Section 22 11 16 "Domestic Water Piping" for valves applicable only to this piping.
3. Section 22 13 19 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves.
2. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Milwaukee Valve Company.
b. NIBCO INC.

c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.4 LUBRICATED PLUG VALVES

A. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Homestead Valve; a division of Olson Technologies, Inc.
b. Milliken Valve Company.
c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

a. Standard: MSS SP-78, Type IV.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short.
e. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Homestead Valve; a division of Olson Technologies, Inc.
b. Milliken Valve Company.
c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

a. Standard: MSS SP-78, Type IV.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
d. Pattern: Regular or short.
e. Plug: Cast iron or bronze with sealant groove.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, valves.
2. Throttling Service: Globe or ball valves.

3. Pump-Discharge Check Valves:

    a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with disc.
    b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Bronze swing check valve with bronze disc.
    c. NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Bronze swing check valve with bronze disc.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Three piece, full port, bronze with stainless-steel trim.
3. Bronze Lift Check Valves: Class 125, bronze disc.
4. Bronze Swing Check Valves: Class 125, bronze disc.

END OF SECTION 22 05 23

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SECTION 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Fastener systems.
5. Equipment supports.

B. Related Sections:

1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 22 05 16 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cooper B-Line, Inc.
    b. Flex-Strut Inc.
    c. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dipped galvanized.
8. Paint Coating: Vinyl.
9. Plastic Coating: PVC.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

C. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

D. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

E. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.6 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.

F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; 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 so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 09 91 23 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
11. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

13. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
14. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
15. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
16. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
17. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
18. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

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SECTION 22 05 48 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe-riser resilient supports.
2. Restraint channel bracings.
3. Restraint cables.
4. Seismic-restraint accessories.
5. Mechanical anchor bolts.

B. Related Requirements:

1. Section 23 05 48 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.

b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer.

C. Welding certificates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. The method of showing bracing and attachments to the structure for the identified distribution system are as detailed on the approved drawings with project specific notes and details. When bracing and attachments are based on a pre-approved installation guide (E.G. SMACNA or OSHPD OPM), copies of the installation guide or manual shall be available on the job site prior to the start of and during the hanging of the distribution systems. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Assigned Seismic Use Group or Building Category as Defined in the CBC: II.

    a. Component Importance Factor: 1.0.
    b. Component Response Modification Factor: 2.5.
    c. Component Amplification Factor: 2.5.

2. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

    a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.2 RESTRAINT CHANNEL BRACINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hilti, Inc.
3. Mason Industries, Inc.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 MECHANICAL ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hilti, Inc.
3. Mason Industries, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
3. Brace a change of direction longer than 12 feet (3.7 m).

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

I. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or

drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 22 11 16 "Domestic Water Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 22 05 48

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SECTION 22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 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 locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Green.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm)high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Aluminum.
2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) 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-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches (100 by 178 mm).
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Section 09 91 23 "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Low-Pressure, Compressed-Air Piping:

a. Background Color: Blue.
b. Letter Color: White.

2. Domestic Water Piping:

a. Background Color: Green.
b. Letter Color: White.

3. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Green.
b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; 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 subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches (38 mm), round.
   b. Hot Water: 1-1/2 inches (38 mm), round.
   c. Low-Pressure Compressed Air: 1-1/2 inches (38 mm), round.

2. Valve-Tag Color:

   a. Cold Water: Green.
   b. Hot Water: Green .
   c. Low-Pressure Compressed Air: Blue.

3. Letter Color:

   a. Cold Water: White.
   b. Hot Water: White.
   c. Low-Pressure Compressed Air: White.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

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SECTION 22 07 19 - PLUMBING PIPING 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 insulating the following plumbing piping services:

1. Domestic hot-water piping.
2. Domestic recirculating hot-water piping.
3. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 22 07 16 "Plumbing Equipment Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that product complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.

7. Detail application at linkages of control devices.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.
3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

a. One 10-foot section of NPS 2 straight pipe.
b. One each of a 90-degree threaded, welded, and flanged elbow.
c. One each of a threaded, welded, and flanged tee fitting.
d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.

e. Four support hangers including hanger shield and insert.
f. One threaded strainer and one flanged strainer with removable portion of insulation.
g. One threaded reducer and one welded reducer.
h. One pressure temperature tap.
i. One mechanical coupling.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

D. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

    a. Pittsburgh Corning Corporation; Foamglas.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: 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 following:

    a. Aeroflex USA, Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; SoftTouch Duct Wrap.
    b. Johns Manville; Microlite.
    c. Manson Insulation Inc.; Alley Wrap.

I. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Johns Manville; Micro-Lok.
    b. Knauf Insulation; 1000-Degree Pipe Insulation.
    c. Manson Insulation Inc.; Alley-K.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Ramco Insulation, Inc.; Super-Stik.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    b. Eagle Bridges - Marathon Industries; 225.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
   b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, 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, 58 percent by volume and 70 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
   c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

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 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 seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McGuire Manufacturing.
b. Plumberex.
c. Truebro; a brand of IPS Corporation.
d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Truebro; a brand of IPS Corporation.
b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- 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 bottom of 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, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches 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. 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 Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. See Details on Plumbing Documents.

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. 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.
7. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
8. 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. 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. 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.
3. 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.
4. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, 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 Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

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. Instead, 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 Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

END OF SECTION 22 07 19

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SECTION 22 11 16 – DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.4 FIELD 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 Construction Manager no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Form: Sheet.

C. Color: Natural.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cascade Waterworks Manufacturing.
b. Dresser, Inc.; Piping Specialties Products.
c. Ford Meter Box Company, Inc. (The).

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following:

a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
b. Watts; a division of Watts Water Technologies, Inc.
c. Wilkins; a Zurn company.

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elster Perfection Corporation.
b. Grinnell Mechanical Products; Tyco Fire Products LP.
c. Precision Plumbing Products, Inc.
d. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for

pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 22 11 19 "Domestic Water Piping Specialties."

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 11 19 "Domestic Water Piping Specialties."

H. Install domestic water piping level without pitch and plumb.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

L. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

N. Install piping to permit valve servicing.

O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

P. Install piping free of sags and bends.

Q. Install fittings for changes in direction and branch connections.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    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.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for 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.

F. Install supports for vertical copper tubing every 10 feet.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

3. 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.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

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 authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. 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.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 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 hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm 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. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16

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SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Backflow preventers.
2. Balancing valves.
3. Strainers.
4. Hose bibbs.
5. Wall hydrants.
6. Drain valves.
7. Water hammer arresters.
8. Trap-seal primer valves.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages For Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.

1.3 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Woodford Manufacturing Company.
    b. Zurn Plumbing Products Group; Wilkins Div.
    c. Watts Industries, Inc.; Water Products Div.
    d. MIFAB, Inc.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. FEBCO; SPX Valves & Controls.
    b. Watts Industries, Inc.; Water Products Div.
    c. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Body: Bronze for and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for and larger.
5. End Connections: Threaded.
6. Configuration: Designed for horizontal, straight through flow.
7. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Hose-Connection Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Conbraco Industries, Inc.
   b. Watts Industries, Inc.; Water Products Div.
   c. Woodford Manufacturing Company.

2. Standard: ASSE 1052.
3. Operation: Up to back pressure.
4. Inlet Size:3/4".
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least flow.

2.3 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:

   a. Taco, Inc.
   b. Watts Industries, Inc.; Water Products Div.
   c. NIBCO INC.

4. Type: Ball valve with two readout ports and memory setting indicator.
5. Body: Bronze,
6. Size: Same as connected piping, but not larger than.
7. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: minimum, unless otherwise indicated.
2. Body: Bronze for and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for and larger.
3. End Connections: Threaded and smaller; flanged for and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Drain: Factory-installed, hose-end drain valve.

2.5 HOSE BIBBS

A. Hose Bibbs HB-1

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc,
    c. Zurn Plumbing Products Group; Light Commercial Operation

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Operation: Loose Key.
4. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
5. Box: Deep, flush mounting with cover.
6. Box and Cover Finish: Chrome plated.
7. Outlet: Expsed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7
8. Nozzle and Wall-Plate Finish: Polished nickel bronze.
9. Operating Key(s): Two with each wall hydrant.

B. Hose Bibbs HB-2:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 (DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.6 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: minimum CWP.

3. Body: Copper alloy.
4. Ball: Chrome-plated brass.
5. Seats and Seals: Replaceable.
6. Handle: Vinyl-covered steel.
7. Inlet: Threaded or solder joint.
8. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.7 WATER HAMMER ARRESTERS

A. Water Hammer Arresters WH-A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   b. PPP Inc.
   c. MIFAB, Inc.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.8 TRAP-SEAL PRIMER VALVES

A. Supply-Type (Single), Trap-Seal Primer Valves TP-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. MIFAB, Inc.
   b. PPP Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

2. Standard: ASSE 1018.
3. Pressure Rating: minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Supply-Type (Multiple), Trap-Seal Primer Valves TP-2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. MIFAB, Inc.

b. PPP Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

2. Standard: ASSE 1018.
3. Pressure Rating: minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: 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 23 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.

C. Install balancing valves in locations where they can easily be adjusted.

D. Install Y-pattern strainers for water on supply side of each solenoid valve, and pump.

E. Install water hammer arresters in water piping according to PDI-WH 201.

F. 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.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.
2. Double-check backflow-prevention assemblies.
3. Calibrated balancing valves.
4. Supply-type, trap-seal primer valves.

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 23 Section "Mechanical Identification."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 11 19

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SECTION 22 11 23.21 – INLINE, DOMESTIC-WATER PUMPS

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. In-line, sealless centrifugal pumps.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Detail pumps and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which pumps will be attached.
2. Size and location of initial access modules for acoustical tile.

B. Seismic Qualification Data: Certificates, for inline, domestic-water pumps, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written instructions for handling.

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.

B. UL Compliance: UL 778 for motor-operated water pumps.

C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

D. Seismic Performance: Inline, domestic-water pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Component Importance Factor: 1.0.

2.2 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grundfos Pumps Corp.
2. TACO Comfort Solutions, Inc.

C. Capacities and Characteristics:

1. Capacity: 3 gpm.
2. Total Dynamic Head: 17 feet.

3. Inlet and Outlet Size: 3/4 NPS.
4. Pump Speed: 1750 rpm.
5. Pump Control: Thermostat.
6. Motor Horsepower: 1/12 HP.
7. Electrical Characteristics:

    a. Volts: 120 V.
    b. Phase: Single phase.
    c. Hertz: 60 Hz.

D. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Minimum Working Pressure: 125 psig (860 kPa).
3. Maximum Continuous Operating Temperature: 220 deg F (104 deg C).
4. Casing: Bronze, with threaded or companion-flange connections.
5. Impeller: stainless steel.
6. Motor: Single speed.

2.3 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 65 to 200 deg F (18 to 93 deg C).
3. Enclosure: NEMA 250.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 120 V ac.
7. Settings: Start pump at 115 deg F (46 deg C) and stop pump at 120 deg F (49 deg C).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for domestic-water-piping system to verify actual locations of piping connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Mount pumps in orientation complying with manufacturer's written instructions.

C. Pump Mounting:

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Install continuous-thread hanger rods and vibration isolation of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

E. Install thermostats in hot-water return piping.

3.3 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.

C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for strainers specified in Section 22 11 19 "Domestic Water Piping Specialties." Comply with requirements for valves specified in the following:

1. Section 22 05 23 "General Duty Valves for Plumbing Piping."
2. Install pressure gauge at suction of each pump and pressure gauge at discharge of each pump. Install at integral pressure-gauge tappings where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring between temperature controllers and devices.

C. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections with the assistance of a factory-authorized service representative.

E. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set thermostats for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.

c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.8 ADJUSTING

A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 22 11 23.21

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SECTION 22 13 16 – SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

1.3 DEFINITIONS

A. PE: Polyethylene plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures.".

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, 4 stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) Husky.
2) Clamp-All Corp.
3) Mission Rubber Co.

2.4 PVC PIPE AND FITTINGS

A. 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 and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

E. Solvent Cement: ASTM D 2564.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, condensate drain piping shall be any of the following:

1. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, drawn temper.

3.2 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 23 Section "Basic Materials and Methods."

B. Install seismic restraints on piping.

C. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

D. Install underground PVC piping according to ASTM D 2321.

E. 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.

F. 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.

G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for all piping.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. 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 23 Section "Basic Mechanical Materials and Methods."

B. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

C. Plastic, Nonpressure-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. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

    a. 100 Feet 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 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

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.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.

H. Install supports for vertical PVC piping every 48 inches (1200 mm).

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 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.

3.6 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.

3.7 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.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.8 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

C. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

D. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be the following:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Aboveground, condensate drain piping shall be any of the following:

1. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, drawn temper.

END OF SECTION 22 13 16

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SECTION 22 13 19 – SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following plumbing specialties:

1. Cleanouts.
2. Floor drains.
3. Floor sinks.
4. Drain Receptors.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig.
2. Sanitary Waste and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Balancing valves, water filters, and strainers.
2. Thermostatic water mixing valves and water tempering valves.
3. Water hammer arresters, air vents, and trap seal primer valves and systems.
4. Drain valves, hose bibbs, hydrants, and hose stations.
5. Sleeve penetration systems.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field test reports.

D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Water filters.

2. Thermostatic water mixing valves and water tempering valves.
3. Trap seal primer valves and systems.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

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. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.6 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. Water Filter Cartridges: Equal to 200 percent of amount installed for each type and size indicated.
2. Operating Key Handles: Equal to 100 percent of amount installed for each key-operated hose bibb and hydrant installed.

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. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 CLEANOUTS

A. Cleanouts, WCO: Comply with ASME A112.36.2M or ASME A112.3.1.

1. Application: Wall cleanout.
2. Products:

    a. Josam Co.
    b. Smith, Jay R. Mfg. Co.
    c. Zurn Industries, Inc., Specification Drainage Operation

3. Body or Ferrule Material: Cast iron.
4. Clamping Device: Required.
5. Outlet Connection: Threaded.
6. Closure: Brass plug with straight threads and gasket.
7. Adjustable Housing Material: Cast iron with threads.
8. Frame and Cover Material and Finish: Polished bronze.
9. Frame and Cover Shape: Round.

2.3 FLOOR DRAINS

A. Floor Drains, FD-1: Comply with ASME A112.21.1M.

1. Application: Shower drain.
2. Products:

    a. Josam Co.; Model 30000-Z-A.
    b. Smith, Jay R. Mfg. Co.; Fig. 2005-A.
    c. Zurn Industries, Inc., Specification Drainage Operation; Model Z-415.

3. Body Material: Gray iron.
4. Seepage Flange: Required.
5. Clamping Device: Required.
6. Outlet: Bottom.
7. Exposed Surfaces and Interior Lining: Not required.
8. Sediment Bucket: Not required.
9. Top or Strainer Material: Nickel bronze.
10. Top of Body and Strainer Finish: Chrome.
11. Top Shape: Round.
12. Dimensions of Top or Strainer: 5-inches diameter.
13. Top Loading Classification: Light Duty.
14. Trap Material: Cast iron.
15. Trap Pattern: Standard P-trap with trap primer connection.
16. Trap Features: Not required.
17. Provide min. 3-inch waste connection.

2.4 FLOOR SINKS

A. Floor Sinks, FS-1: Comply with ASME A12.21.1M.

1. Application: Floor Sink.
2. Products:

    a. Josam Co.
    b. Smith, Jay R. Mfg. Co.; Fig 3100.
    c. Zurn Industries, Inc., Specification Drainage Operation; Model No. Z-1910.

3. Body Material: Gray iron.
4. Seepage Flange: Required.
5. Clamping Device: Required.
6. Outlet: Bottom.
7. Exposed Surfaces and Interior Lining: Acid-resistant enamel.
8. Sediment Bucket: Not required.
9. Top Material: Gray iron.
10. Top Shape: Square.
11. Dimensions of Top or Strainer: 8-1/2 inch square.
12. Top Loading Classification: Medium Duty.
13. Trap Material: Cast iron.
14. Trap Pattern: Standard P-trap.
15. Trap Features: Trap seal primer valve drain connection.
16. Provide min. 3-inch waste connection.

B. Drain Receptor, DR-1: Comply with ASME A112.21.2M.

1. Applications: Drain receptor.
2. Products:

    a. Smith, Jay R. Mfg. Co.; Fig. 3970.
    b. Or approved equal.

3. Body Material: Cast iron.
4. Dimensions of Body: 10 ½ inches diameter.
5. Combination Flashing Ring and Gravel Stop: Required.
6. Outlet: Bottom.
7. Solid Water Dam.
8. Extension Collars: Required.
9. Underdeck Clamp: Required.
10. Sump Receiver: Required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install expansion joints on vertical risers, stacks, and conductors if indicated.

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. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

E. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

F. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

G. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

H. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

I. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

J. Fasten recessed-type plumbing specialties to reinforcement built into walls.

K. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

M. 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 pipefittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 22 Sections.

D. Ground equipment.

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.

F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer, thermostatic water mixing valve, and trap seal primer system.

1. Text: 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.
2. Refer to Division 23 Section "Identification for HVAC Piping and Equipment" for nameplates and signs.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.

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.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain trap seal primer systems. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 22 13 19

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SECTION 22 34 00 – FUEL-FIRED, DOMESTIC-WATER HEATERS

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. Gas-fired, high-efficiency, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of commercial, gas-fired, gas-fired, tankless, domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Residential, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: Two years.

PART 2 - PRODUCTS

2.1 GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS WH-1

A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:

1. AO Smith
2. Lochinvar
3. Or approved equal
4. Standard: ANSI Z21.10.1/CSA 4.1.
5. Storage-Tank Construction: Steel.

a. Tappings: ASME B1.20.1 pipe thread.
b. Pressure Rating: 150 psig (1035 kPa).
c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.

6. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
e. Jacket: Steel with enameled finish.
f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
g. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
h. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.

i. Temperature Control: Adjustable thermostat.
j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4-M. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

7. Draft Hood: Low-profile-type draft diverter, complying with ANSI Z21.12.
8. Automatic Damper: ANSI Z21.66/CSA 6.14-M, electrically operated automatic-vent-damper device with size matching draft hood.

B. Capacity and Characteristics:

1. Capacity: 74 gal.
2. Recovery: 81 gph at 90 deg F temperature rise.
3. Temperature Setting: 140 deg F.
4. Fuel Gas Demand: 75.1 cfh.
5. Fuel Gas Input: 75,100 Btu/h.
6. Minimum Vent Diameter: 4 inches.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks ET-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMTROL Inc.
b. Flexcon Industries.
c. Taco, Inc.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig (1035 kPa).
b. Capacity Acceptable: 4 gal. (15.1 L) minimum.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not

less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig (3.5-kPa) pressure rating as required to match gas supply.

G. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

H. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

I. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

J. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

K. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater a minimum of 18 inches (457 mm) above the floor.

L. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

M. Provide neutralization trap for drain discharge.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 01 40 00 "Quality Requirements" for retesting and

reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base.

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23 "General Duty Valves for Plumbing Piping,"

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 23 11 23 "Facility Natural-Gas Piping."

D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Domestic Water Piping Specialties."

H. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

I. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 22 05 23.12 “Ball Valves for Plumbing Piping," Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

J. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

K. Fill domestic-water heaters with water.

L. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 22 11 16 "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 23 11 23 "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION 22 34 00

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SECTION 22 42 13.13 – COMMERCIAL WATER CLOSETS

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. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

1.6 PLUMBING FIXTURES

A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Sections 11B-213.3.

B. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.

C. Heights and location of all accessible fixtures shall be mounted according to CBC Section 11B-602 through 11B-612.

D. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-604.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.

E. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7

F. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets WC-1: Floor mounted, bottom outlet, top spud (Accessible).

1. American Standard.
2. Kohler
3. Toto
4. Bowl:

    a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    b. Material: Vitreous china.
    c. Type: Siphon jet.
    d. Style: Flushometer valve.
    e. Height: Accessible.
    f. Rim Contour: Elongated.
    g. Water Consumption: 1.28 gal. (4.8 L) per flush.
    h. Spud Size and Location: NPS 1-1/2 (DN 40); top.

5. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.
6. Flushometer Valve: WC-1.
7. Toilet Seat: WC-1.

2.2 FLUSHOMETER VALVES

A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves WC-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Sloan Valve Company.
    b. TOTO USA, INC.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig (860 kPa).
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 1.28 gal. (4.8 L) per flush.
12. Minimum Inlet: NPS 1 (DN 25).
13. Minimum Outlet: NPS 1-1/4 (DN 32).

2.3 TOILET SEATS

A. Toilet Seats WC-1:

1. Olsonite.
2. Church.
3. Bemis.
4. Standard: IAPMO/ANSI Z124.5.
5. Material: Plastic.
6. Type: Commercial (Heavy duty).
7. Shape: Elongated rim, open front.
8. Hinge: Self-sustaining, check.
9. Hinge Material: Noncorroding metal.
10. Seat Cover: Not required.
11. Color: White.

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 water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.

B. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install actuators in locations that are easy for people with disabilities to reach.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 13.13

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SECTION 22 42 16.13 – COMMERCIAL LAVATORIES

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. Lavatories.
2. Faucets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

1.7 PLUMBING FIXTURES

A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Sections 11B-213.3.

B. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.

C. Heights and location of all accessible fixtures shall be mounted according to CBC Section 11B-602 through 11B-612.

D. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-604.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.

E. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7

F. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Accessible plumbing fixtures shall comply with all of the requirements of 2019 CBC Division 6.

B. Heights and location of all fixtures shall be according to 2019 CBC Sections 11B-602 through 11B-612 and DSA Check List Fig. 15-A.

C. Fixture controls shall comply with 2019 CBC Sections 11B-601.3 for drinking fountains, 11B-604.6 for water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-604.9.5 for children's water closets, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.

D. Each accessible sink shall be a maximum of 6-1/2" deep. Sinks shall be mounted with the counter or rim no higher than 34" above the finish floor. 2019 CBC Section 11B-213.3.

E. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

F. Lavatory L-1: Ledge back, vitreous china, wall mounted.

1. American Standard
2. Kohler
3. Or approved equal.
4. Fixture:

    a. Standard: ASME A112.19.2/CSA B45.1.
    b. Type: For wall hanging.
    c. Nominal Size:Rectangle, 20 inches by 18 inches..
    d. Faucet-Hole Punching: Three holes, 2-inch (51-mm) centers.
    e. Faucet-Hole Location: Top.
    f. Color: White.
    g. Mounting Material: Chair carrier.

5. Faucet: L-1.
6. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier.

2.2 AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Lavatory Faucets - Automatic Type: Battery Powered Electronic Sensor Operated, Mixing, L-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Chicago Faucets; Geberit Company.
    b. Sloan Valve Company.
    c. Zurn Industries, LLC.

2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. 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.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole.
6. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.

7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).
9. Mounting Type: Deck, concealed.
10. Spout: Rigid type.
11. Spout Outlet: Aerator.
12. Drain: Grid.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2 (DN 15).
2. Chrome-plated, soft-copper flexible tube riser.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2 (DN 15).
2. Chrome-plated, soft-copper flexible tube riser.

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 (DN 32) offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4 (DN 40 by DN 32).
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-(0.83-mm-) thick brass tube to wall; and chrome-plated, brass or steel wall flange.

D. Lavatory Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. MIFAB, Inc.
c. WATTS.

2. Standard: ASME A112.6.1M.

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 lavatory installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.5 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch (13 mm) high.

3.6 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.7 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.13

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SECTION 22 42 16.16 – COMMERCIAL SINKS

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. Service sinks.
2. Sink faucets.
3. Supply fittings.
4. Waste fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

1.7 PLUMBING FIXTURES

A. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Sections 11B-213.3.

B. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.

C. Heights and location of all accessible fixtures shall be mounted according to CBC Section 11B-602 through 11B-612.

D. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-604.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.

E. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7

F. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5

PART 2 - PRODUCTS

2.1 SERVICE SINKS

A. Service Sinks MS-1: Enameled, cast iron, trap standard mounted.

1. American Standard
2. Kohler
3. Or Approved Equal.
4. Fixture:

    a. Standard: ASME A112.19.1/CSA B45.2.
    b. Style: With front apron and raised back.
    c. Nominal Size: 28 by 28 inches (710 by 710 mm).
    d. Color: White.
    e. Drain: Grid with NPS 3 (DN 80) outlet.
    f. Rim Guard: Coated wire.

5. Faucet: MS-1.

2.2 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets MS-1: Manual type, two-lever-handle mixing valve.

1. Commercial, Solid-Brass Faucets.

    a. Chicago Faucets
    b. Speakman
    c. Or Approved Equal.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: Widespread.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 2.2 gpm (8.3 L/min.).
8. Handle(s): Wrist blade, 4 inches (102 mm).
9. Mounting Type: Back/wall, exposed.
10. Spout Type: Rigid, solid brass with wall brace.
11. Vacuum Breaker: Required for hose outlet.
12. Spout Outlet: Hose thread according to ASME B1.20.7.

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 sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Set floor-mounted sinks in leveling bed of cement grout.

D. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 22 05 23 "General Duty Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

F. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.16

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SECTION 22 45 00 – EMERGENCY 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.

1.2 SUMMARY

A. Section Includes:

1. Combination units.
2. Water-tempering equipment.

1.3 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Tepid: Moderately warm.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

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.

B. ISEA Standard: Comply with ISEA Z358.1.

C. NSF Standard: Comply with NSF 61 and NSF 372, for fixture materials that will be in contact with potable water.

D. Regulatory Requirements: Comply with requirements in ICC A117.1; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

2.2 COMBINATION UNITS

A. Accessible, Plumbed Emergency Shower with Eyewash Combination Units, ESH-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Guardian Emergency Equipment.
    b. Haws Corp.
    c. Or Approved Equal.

2. Piping:

    a. Material: Galvanized steel.
    b. Unit Supply: NPS 1-1/4 (DN 32) minimum.
    c. Unit Drain: Outlet at back or side near bottom.

3. Shower:

    a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
    b. Supply Piping: NPS 1 (DN 25) with flow regulator and stay-open control valve.
    c. Control-Valve Actuator: Pull rod.
    d. Shower Head: 8-inch- (200-mm-) minimum diameter, plastic.
    e. Mounting: Pedestal.

4. Eyewash Unit:

    a. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
    b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
    c. Control-Valve Actuator: Paddle.
    d. Spray-Head Assembly: Two receptor-mounted spray heads.
    e. Receptor: Chrome-plated brass or stainless-steel bowl.
    f. Mounting: Attached shower pedestal.

2.3 WATER-TEMPERING EQUIPMENT

A. Hot- and Cold-Water, Water-Tempering Equipment, MX-2:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Guardian Emergency Equipment.
b. Haws Corp.
c. Or Approved Equal.

2. Description: Factory-fabricated equipment with thermostatic mixing valve.

a. Thermostatic Mixing Valve: Designed to provide 85 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
b. Supply Connections: For hot and cold water.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures, to facilitate maintenance of the equipment. Use ball or gate valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and Section 22 05 23.15 "Gate Valves for Plumbing Piping."

1. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 22 11 16 "Domestic Water Piping."

F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

G. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.3 CONNECTIONS

A. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 22 11 16 "Domestic Water Piping."

B. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 22 45 00

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SECTION 22 66 00 – CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall pipe and fittings.
2. Joining materials.
3. Piping specialties.
4. Neutralization tanks.
5. Manholes - holding tanks.

1.2 DEFINITIONS

A. FPM: Vinylidene fluoride (hexafluoropropylene copolymer rubber).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For neutralization system and leak-detection system.

1. Include plans, elevations, sections, and attachment details.

C. Delegated Design Submittal: For seismic restraints of aboveground piping.

1. Include design calculations for selecting seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Pipe sizes, locations, and elevations.
2. Other piping in same trench and clearances from sewerage system piping.
3. Interface and spatial relationship between piping and proximate structures.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For chemical-waste specialties and neutralization tanks to include in emergency, operation, and maintenance manuals.

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. Neutralization-Tank Limestone: Equal to 200 percent of amount required for each tank sump initial charge. Furnish limestone in 50-lb (22.7-kg) bags.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties with sealing plugs in ends or with end protection.

B. Do not store plastic pipe or fittings in direct sunlight.

C. Protect pipe, fittings, and seals from dirt and damage.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Single-Wall Piping Pressure Rating: 10 feet head of water for 30 minutes.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design seismic restraints for aboveground piping.

2.2 SINGLE-WALL PIPE AND FITTINGS

A. CPVC Drainage Pipe and Fittings: ASTM F2618, pipe and drainage-pattern fittings.

1. Source Limitations: Obtain pipe and fittings from single source from single manufacturer.

B. Adapters and Transition Fittings: Assemblies with combinations of clamps, couplings, adapters, and gaskets; compatible with piping and system liquid; made for joining different piping materials.

2.3 JOINING MATERIALS

A. Couplings: Assemblies with combinations of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.

B. Adapters and Transition Fittings: Assemblies with combinations of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.

C. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.

D. Solvent Cement for Joining CPVC Piping: ASTM F493. Include primer in accordance with ASTM F656.

2.4 PIPING SPECIALTIES

A. Corrosion-Resistant Traps:

1. Type: P-trap or drum trap.
2. Size: NPS 1-1/2 or NPS 2 (DN 40 or DN 50), as required to match connected piping.
3. High-Silicon Iron: ASTM A861, with horizontal outlet and hub-and-plain or plain ends to match connecting piping.
4. PP: ASTM D4101, with mechanical-joint pipe connections.
5. PVDF: ASTM D3222, with mechanical-joint pipe connections.
6. Glass: ASTM C1053, with coupling pipe connections.

B. Stainless Steel Floor Drains:

1. Source Limitations: Obtain floor drains from single source from single manufacturer.
2. Standard: ASME A112.3.1; ASTM A666, Type 316L.
3. Body: With 8.5-by-8.5-inch (215-by-215-mm) top with grate.
4. Outlet: Bottom, of size indicated.

C. PP Sink Outlets:

1. Description: NPS 1-1/2 (DN 40), with clamping device, stopper, and 7-inch- (178-mm-) high overflow fitting.

2.5 NEUTRALIZATION TANKS

A. Plastic Neutralization Tanks NT-1:

1. Description: Corrosion-resistant plastic materials; with removable, gastight cover; interior, sidewall, dip-tube inlet; outlet; vent; and threaded or flanged, sidewall pipe connections.
2. Source Limitations: Obtain tanks from single source from single manufacturer.
3. Material: HDPE.
4. Tank Capacity:
5. Dip Tube: On outlet pipe instead of inlet pipe.
6. Extension: HDPE, PE, or PP.
7. Traffic Cover: Heavy-duty pedestrian or light-duty vehicular, steel plate over plastic, bolted.

8. Limestone: Chips or lumps, with more than 90 percent calcium carbonate content and 1- to 3-inch (25- to 75-mm) diameter.

2.6 MANHOLES - HOLDING TANKS

A. Description: ASTM F1759, fabricated from PE components. Include bottom, sidewalls, and top sections; corrosion-resistant, tanks frame and cover; fusion or other watertight joints; and design to prohibit flotation.

B. Source Limitations: Obtain holding tanks from single source from single manufacturer.

C. Construction: Single wall.

D. Bottom: Channeled.

E. Connections: Inlets and outlet matching or suitable for piping.

F. Steps: Manufacturer's standard, fusion welded to sidewall. Omit steps for manholes less than 60 inches (1500 mm) deep.

G. Top: Include 24-inch (610-mm) nominal-diameter frame and cover.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.2 CONCRETE BASES

A. Comply with requirements for vibration isolation and seismic-control devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for vibration isolation devices specified in Section 22 05 48.13 "Vibration Controls for Plumbing Piping and Equipment."

3.3 PIPING INSTALLATION

A. Chemical-Waste Sewerage Outside the Building:

1. Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground chemical-waste sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

2. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for using lubricants, cements, and other installation requirements.
3. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
4. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
5. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.
6. Install drainage piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
7. Install CPVC drainage piping in accordance with ASTM D2321 and ASTM F1668.
8. Install field-fabrication containment piping over new and existing carrier piping. Use containment piping manufacturer's fastening system.
9. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain a swab or drag inside piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

B. Chemical-Waste Piping Inside the Building:

1. Install piping adjacent to equipment, accessories, and specialties, to allow space for service and maintenance.
2. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used unless otherwise indicated.
3. Flanges may be used on aboveground piping unless otherwise indicated.
4. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
5. 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.
6. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
7. Install piping at indicated slopes.
8. Install piping free of sags and bends.
9. Install fittings for changes in direction and branch connections.
10. Verify final equipment locations for roughing-in.

3.4 PIPING SPECIALTY INSTALLATION

A. Embed floor drains in 4-inch- (100-mm-) minimum depth of concrete around bottom and sides. Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for concrete.

B. Fasten grates to drains if indicated.

C. Set floor drains with tops flush with pavement surface.

D. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use fittings of same material as sewer pipe at branches for cleanouts and riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in pipe.

1. Set cleanout bodies in earth in cast-in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding grade. Set cleanout plugs in concrete pavement, with tops flush with pavement surface. Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for formwork, reinforcement, and concrete requirements.

3.5 JOINT CONSTRUCTION

A. Chemical-Waste Sewerage Outside the Building:

1. Plastic-Piping Fusion Joints: Make PP drainage-piping joints in accordance with ASTM F1290.
2. Join dissimilar pipe materials with adapters compatible with pipe materials being joined.

B. Chemical-Waste Piping Inside the Building:

1. Plastic-Piping Fusion Joints: Make PP drainage-piping joints in accordance with ASTM F1290.
2. Dissimilar-Material Piping Joints: Make joints using adapters compatible with both system materials.

3.6 HANGER AND SUPPORT INSTALLATION

A. Pipe sizes in this article refer to aboveground single-wall piping and carrier piping of containment piping.

B. Comply with requirements in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

C. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or MSS Type 42 riser clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52 spring hangers.

D. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for installation of supports.

E. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.

F. Support vertical piping and tubing at base and at each floor.

G. Rod diameter may be reduced one size for double-rod hangers, to minimum of 3/8 inch (10 mm).

H. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 36 inches (910 mm) with 3/8-inch (10-mm) rod.
2. NPS 2-1/2 and NPS 3 (DN 65 and DN 80): 42 inches (1070 mm) with 1/2-inch (13-mm) rod.

I. Install supports for vertical CPVC piping every 48 inches (1220 mm).

3.7 NEUTRALIZATION TANK INSTALLATION

A. Install exterior neutralization tanks, complete with appurtenances indicated.

1. Set tops of tank covers flush with finished surface where covers occur in pavements. Set covers 3 inches (75 mm) above finished surface elsewhere unless otherwise indicated.
2. Include initial fill of limestone for neutralization tanks.

3.8 MANHOLE - HOLDING TANK INSTALLATION

A. General: Install tanks, complete with appurtenances and accessories indicated. Comply with requirements in Section 22 13 13 "Facility Sanitary Sewers."

B. Set tops of tank frames and covers flush with finished surface where tanks occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.

3.9 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make connections to existing piping, so finished Work complies as nearly as practical with requirements specified for new Work.

C. Use commercially manufactured wye fittings for sewerage piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

D. Protect existing piping to prevent concrete or debris from entering while making connections. Remove debris or other extraneous material that may accumulate.

E. Where installing piping adjacent to equipment, allow space for service and maintenance.

3.10 LABELING AND IDENTIFICATION

A. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for labeling of equipment and piping.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 CLEANING

A. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Clean piping by flushing with potable water.

3.12 FIELD QUALITY CONTROL

A. Inspect interior of sewerage piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place and again at completion of Project.

1. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between inspection points.
b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Crushed, broken, cracked, or otherwise damaged piping.
d. Hydrostatic Tests for Drainage Piping:

1) Allowable leakage is a maximum of 50 gal./inch of nominal pipe size per mile (4.6 L/mm of nominal pipe size per kilometer) of pipe during 24-hour period.
2) Close openings in system and fill with water.
3) Purge air and refill with water.
4) Disconnect water supply.
5) Test and inspect joints for leaks.

e. Air Tests for Drainage Piping: Comply with UNI-B-6.

2. Leaks and loss in test pressure constitute defects that must be repaired.

3. Submit separate reports for each test.

B. Replace leaking sewerage piping using new materials, and repeat testing until leakage is within allowances specified.

C. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

D. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

E. Perform tests and inspections with the assistance of a factory-authorized service representative:

F. Chemical-waste piping will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.13 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below unless otherwise indicated.

B. Single-Wall, Chemical-Waste Sewerage Piping: Use the following piping materials for each size range:

1. NPS 1-1/2 to NPS 4 (DN 40 to DN 100) CPVC: Drainage pipe and fittings and solvent-cemented joints.

END OF SECTION 22 66 00

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model 7360BTWC

AXION® MSR Barrier-Free Eye/Face Wash

FEATURES & BENEFITS

QUALITY CONTROL

Eye/face wash and valve assembly is pre-built and fully water/pressure tested to ensure no leaks and proper function which ultimately reduces installation time and gives the end contractor an added peace of mind. Unit also ships with pre-assembled cast-aluminum wall bracket to assist in the installation process.

BOWL

The 11" (27.9 cm) round stainless steel receptor is supplied with a No. 2L bright finish on its exterior.

BALL VALVE

Valve is designed to make the flushing of fluid occur with the push of a stainless steel flag, and is equipped with a stainless steel ball and stem to provide added protection against corrosion and breakage.

IN-LINE STRAINER

Chrome-plated brass in-line 50 x 50 mesh water strainer prevents debris from reaching the eyewash so the unit stays functioning at its best. Strainer is easily serviceable.

EYE/FACE WASH HEAD

AXION® MSR eye/face wash head uses an inverted directional laminar flow to sweep contaminants away from the vulnerable nasal cavity.

OPTIONS

- Scald Protect Bleed Valve: Model SP157A, stainless steel scald protection bleed valve. Automatic thermal actuator bleed valve opens when internal water temperature reaches 98° F (36.7° C) and closes at 95° F (35° C).
- Thermostatic Mixing Valve: Model 9201EW AXION® Emergency Tempering Valve thermostatically mixes hot and cold water to provide a safe fluid supply for a single emergency eye/face wash, with a flow rate of 10 gpm (38.8 L).
- Emergency Alarm System : Model 9001.5, 1/2" 120 VAC emergency alarm and light system. Buzzer and flashing light are activated by a 1/2" IPS double pole, double throw flow switch.
- Dust Cover: Model 9102 is a stainless steel cover that protects the eyewash head as well as the bowl.

For more information, visit www.hawsco.com or call (888) 640-4297.



SPECIFICATIONS

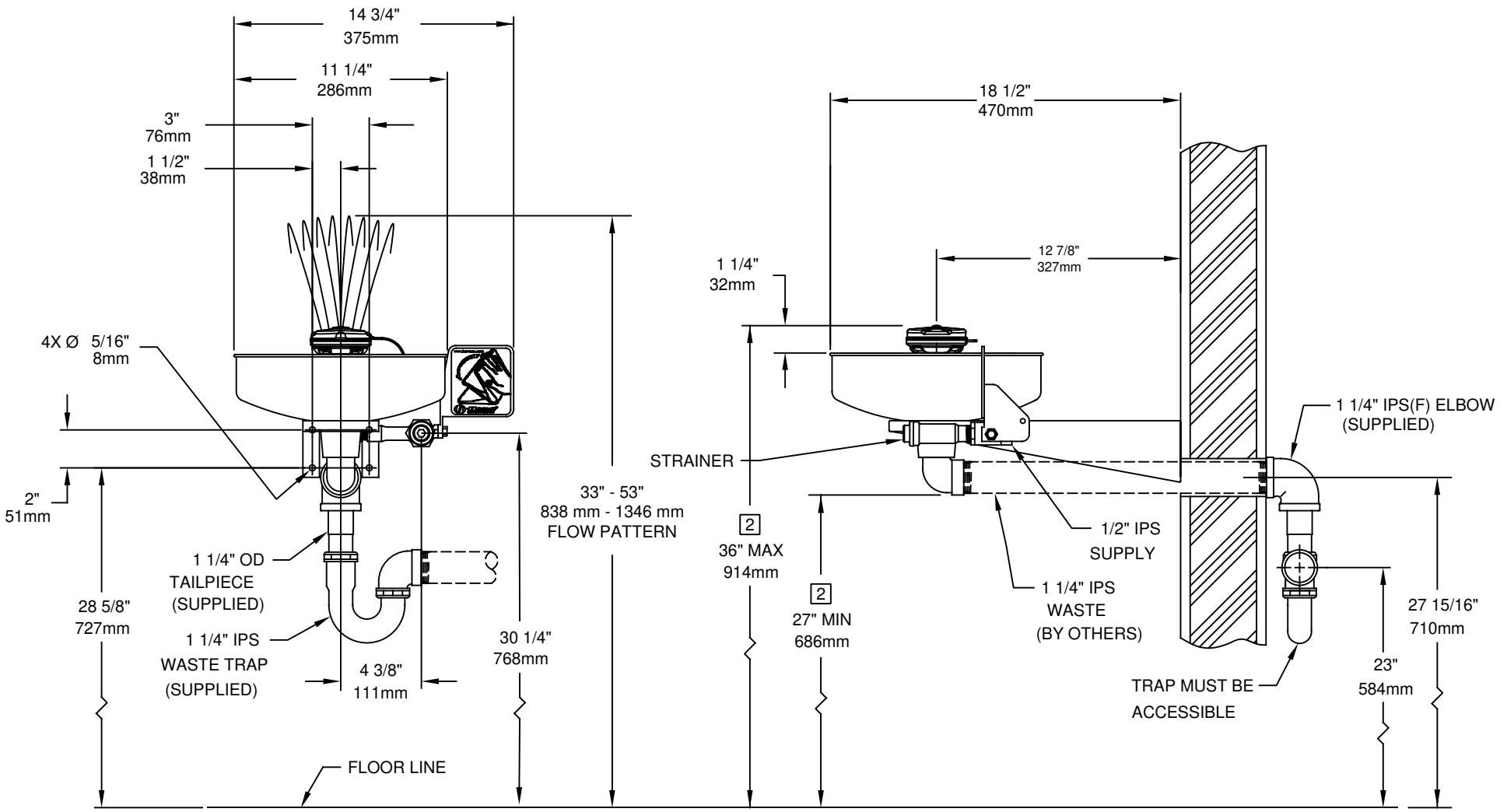
Model 7360BTWC barrier-free wall mounted eye/face wash shall include a stainless steel 11″ (27.9 cm) round bowl, an AXION® MSR eye/face wash head shall feature inverted directional laminar flow which achieves Zero Vertical Velocity™ supplied by an integral 3.7 gpm flow control, wheelchair accessibility, chrome-plated brass stay-open ball valve equipped with stainless steel ball and stem, chrome-plated brass in-line 50 x 50 mesh water strainer, and chrome-plated brass trap and tailpiece. Unit shall also include 16 gauge stainless steel wall bracket, universal sign, 1/2″ NPT inlet, and 1-1/4″ NPT waste.

APPLICATIONS

Where the eyes and face of any person may be exposed to injurious or corrosive materials, suitable facilities for quick flushing of the eyes and face be provided within the work area for immediate emergency use. Emergency eye/face wash facilities shall be in unobstructed and accessible locations that require no more than 10 seconds for the injured person to reach. Model 7360BTWC is certified by CSA to meet the ANSI/ISEA Z358.1 Standard for Emergency Eyewash and Shower Equipment.

DISCLAIMER: Continued product improvements make specifications subject to change without notice. Check www.hawsco.com for the latest product information and updates.

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SEE SHT. 2 FOR ALTERNATE INSTALLATIONS

NOTES:

1. TO COMPLY WITH ANSI Z358.1-2014 FOR EMERGENCY EYEWASH OR EYE/FACE WASH AND SHOWER EQUIPMENT: EYEWASH OR EYE/FACE WASH SHALL BE POSITIONED SUCH THAT FLUSHING FLUID PATTERN IS NOT LESS THAN 33" (838 mm) AND NO GREATER THAN 53" (1346 mm) FROM SURFACE ON WHICH USER STANDS; AND 6.0" (153 mm) MINIMUM FROM WALL OR NEAREST OBSTRUCTION.

[2] THESE DIMENSIONS MUST BE MAINTAINED TO MEET WHEELCHAIR ACCESSIBILITY REQUIREMENTS AND STILL COMPLY WITH ANSI REQUIREMENTS STATED ABOVE.

3. WHEN INSTALLING THIS UNIT, LOCAL , STATE, OR FEDERAL CODES SHOULD BE ADHERED TO FOR INSTALLATION DIMENSIONS (LOCATIONS), WASTE AND SUPPLY REQUIREMENTS OTHER THAN SHOWN.

4. DIMENSIONS MAY VARY ±1/2" [12.7mm].

Haws®
1455 KLEPPE LANE
SPARKS, NEVADA 89431
(775) 359-4712 FAX (775) 359-7424
E-MAIL: HAWS@HAWSCO.COM
WEBSITE: WWW.HAWSCO.COM

ECN NO.	REVISED PER ECN: 5175	BY: VWC
DRAWN: FV	DATE: 03/98	CHK'D.: VWC
APPROVED: FV	DATE: 11/23/17	

MODEL(S) 7360BTWC

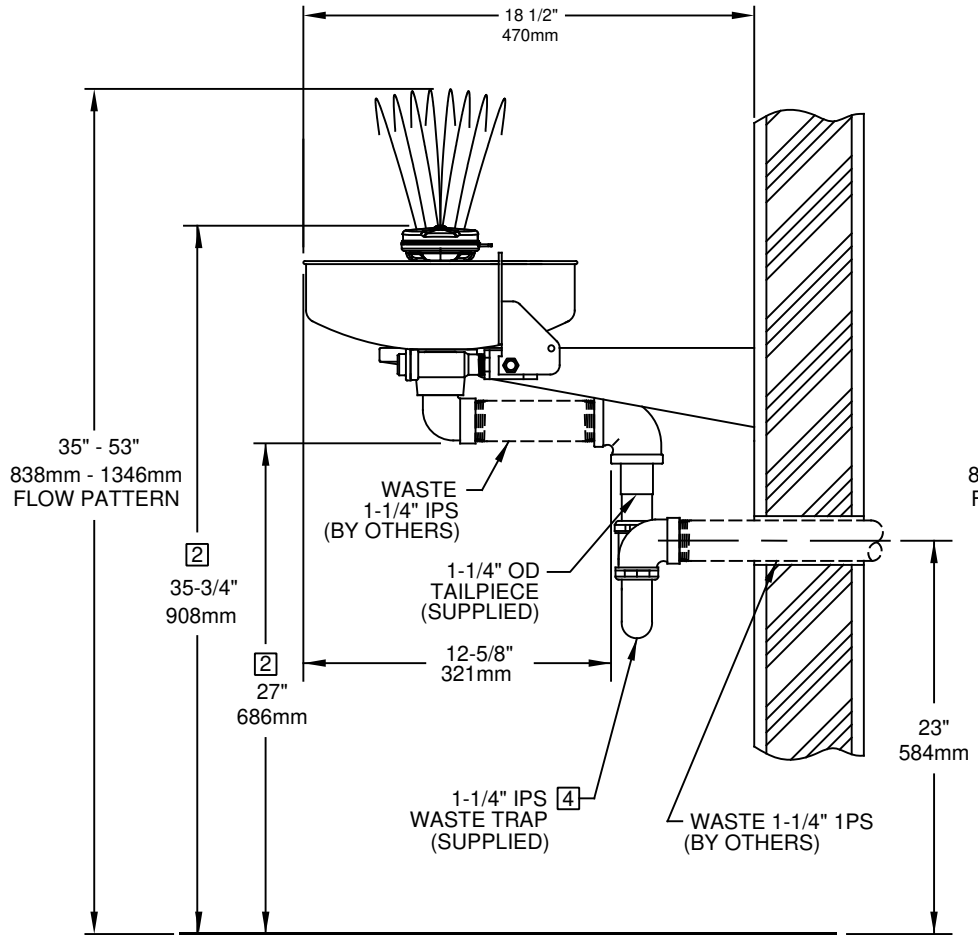
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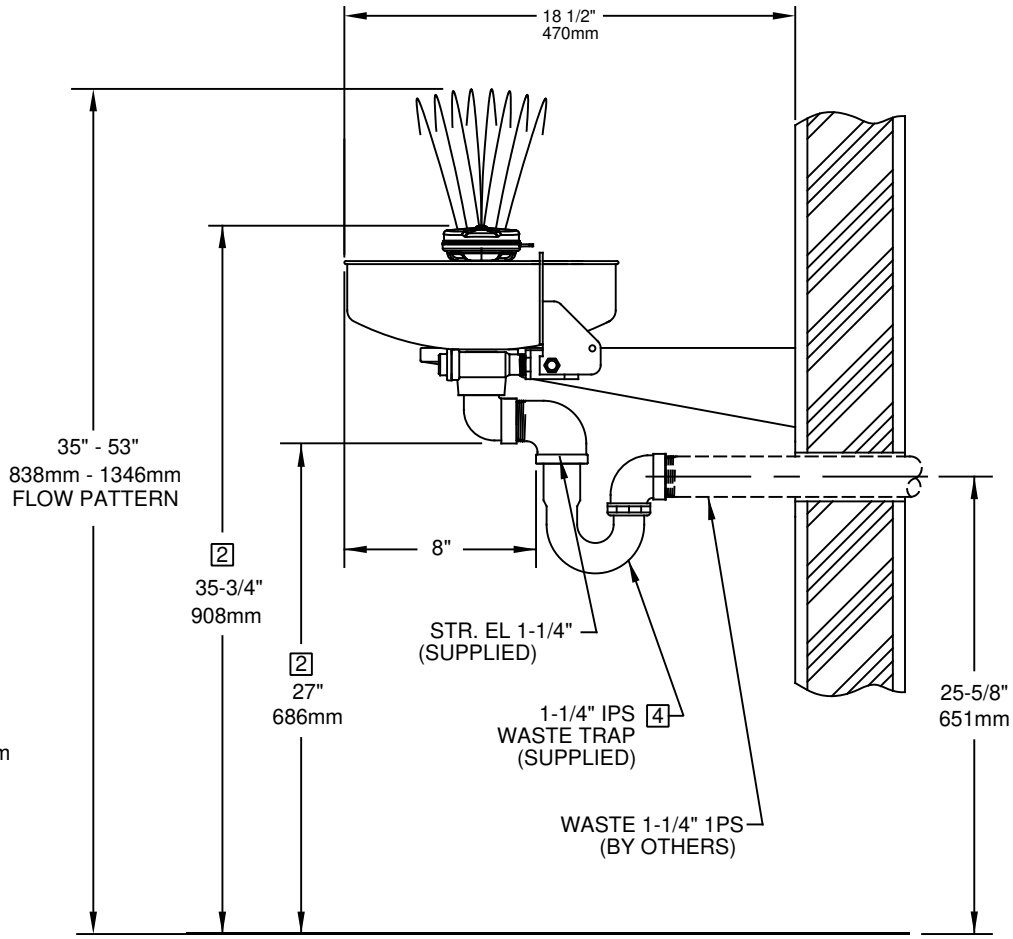
REVISION 9

SCALE: 1/8 | DRAWING TYPE: INSTALLATION | SIZE: A | SHEET 1 OF 2

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OPTION A ALTERNATE INSTALLATIONS OPTION B

NOTES:

1. TO COMPLY WITH ANSI Z358.1-2014 FOR EMERGENCY EYEWASH OR EYE/FACE WASH AND SHOWER EQUIPMENT: EYEWASH OR EYE/FACE WASH SHALL BE POSITIONED SUCH THAT FLUSHING FLUID PATTERN IS NOT LESS THEN 33" (838mm) AND NO GREATER THAN 53" (1346 mm) FROM SURFACE ON WHICH USER STANDS, AND 6.0" (153 mm) MINIMUM FROM WALL OR NEAREST OBSTRUCTION.

2 THESE DIMENSIONS MUST BE MAINTAINED TO MEET WHEELCHAIR ACCESSIBILITY REQUIREMENTS AND STILL COMPLY WITH ANSI REQUIREMENTS STATED ABOVE.

3. WHEN INSTALLING THIS UNIT, LOCAL , STATE, OR FEDERAL CODES SHOULD BE ADHERED TO FOR INSTALLATION DIMENSIONS (LOCATIONS), WASTE AND SUPPLY REQUIREMENTS OTHER THAN SHOWN.

4. DIMENSIONS MAY VARY ±1/2" [12.7mm].

5. TRAP SHOULD BE WRAPPED TO PROVIDE ADDITIONAL USER PROTECTION.

Haws®
1455 KLEPPE LANE
SPARKS, NEVADA 89431
(775) 359-4712 FAX (775) 359-7424
E-MAIL: HAWS@HAWSCO.COM
WEBSITE: WWW.HAWSCO.COM

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MODEL(S) 7360BTWC

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SCALE: 1/8 | DRAWING TYPE: INSTALLATION | SIZE: A | SHEET 2 OF 2

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model 8309WC

AXION® MSR Combination Shower and Eye/Face Wash

FEATURES & BENEFITS

EYE/FACE WASH HEAD

AXION® MSR eye/face wash head uses an inverted directional laminar flow to sweep contaminants away from the vulnerable nasal cavity.

SHOWERHEAD

AXION® MSR ABS plastic drench showerhead uses a hydrodynamic design to give equal distribution of water throughout the entire footprint of flow.

BALL VALVES

Eyewash and shower ball valves are designed to make the flushing of contaminants occur with the simple pull of a lever or push of a stainless steel flag. Both valves come equipped with stainless steel ball and stem to provide greater protection against corrosion and breakage.

BARRIER-FREE ACCESS

Barrier-free design offers a low profile eyewash assembly and a longer shower pull rod allowing for wheelchair access.

QUALITY CONTROL

Eye/face wash and valve assembly are pre-built and fully water/pressure tested to ensure no leaks and proper function which ultimately reduces installation time.

OPTIONS

- Scald Protect Bleed Valve: Model SP157A, stainless steel scald protection bleed valve. Automatic thermal actuator bleed valve opens when internal water temperature reaches 98° F (36.7° C) and closes at 95° F (35° C).
- Thermostatic Mixing Valve: Model 9201E AXION® Emergency Tempering Valve thermostatically mixes hot and cold water to provide a safe fluid supply for emergency showers and eyewash equipment, with a flow rate of 31 gpm (117.3 L).
- Emergency Alarm System: Model 9001, 1-1/4" 120 VAC emergency alarm and light system. Buzzer and flashing light are activated by an 1-1/4" double pole, double throw flow switch.
- AXION® MSR Showerhead: Model SP829SS, AXION® MSR stainless steel drench showerhead with integral 20 gpm (75.7 L) flow control.

For more information, visit www.hawsco.com or call (888) 640-4297.



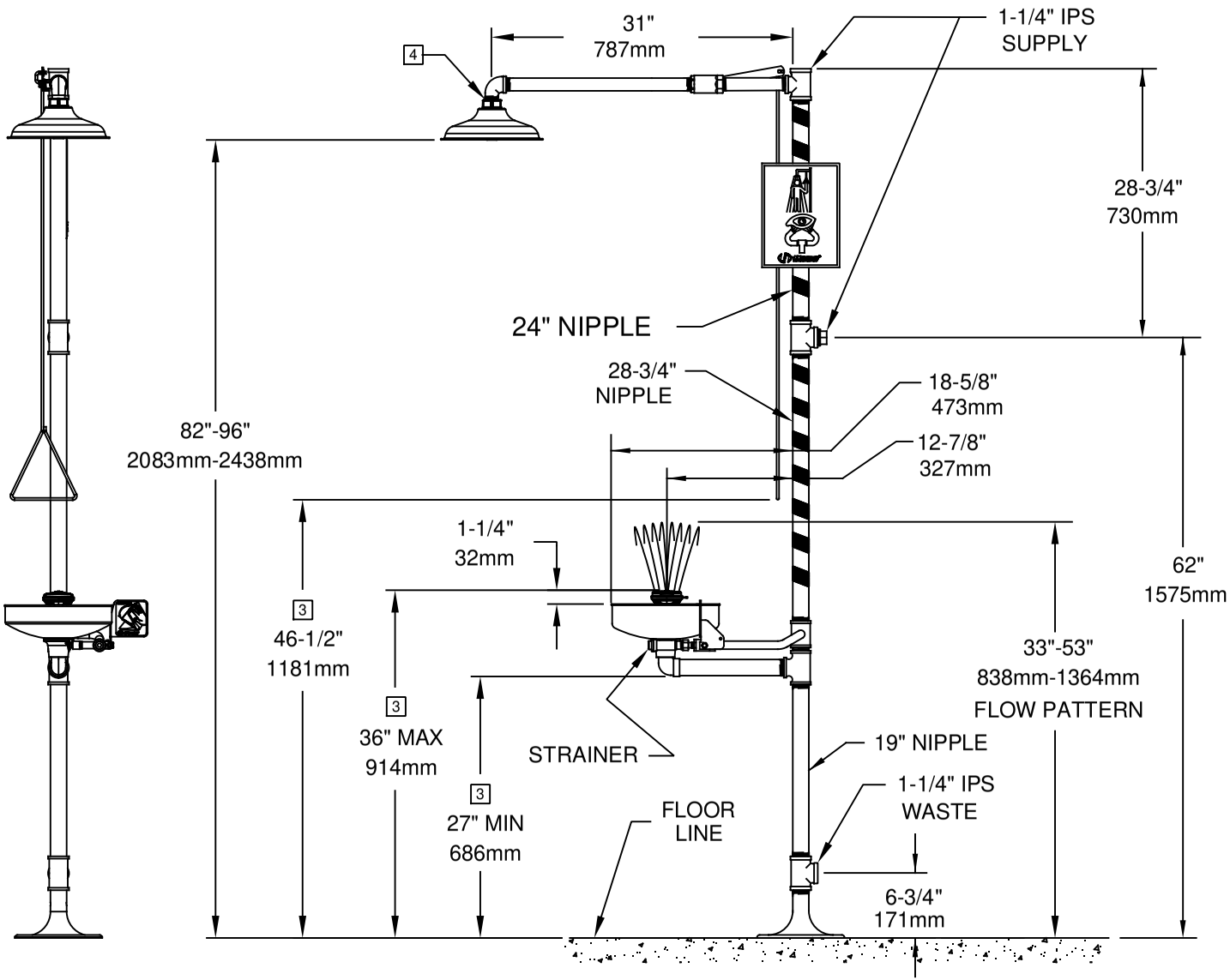
SPECIFICATIONS

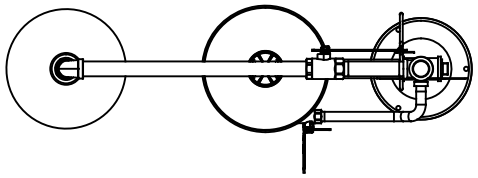
Model 8309WC barrier-free combination shower and eye/face wash shall include a stainless steel 11″ (27.9 cm) round bowl, an AXION® MSR eye/face wash head shall feature inverted directional laminar flow which achieves Zero Vertical Velocity™ supplied by an integral 3.7 gpm flow control. Unit shall also include the AXION MSR hydrodynamic designed ABS plastic showerhead with 20 gpm flow control, chrome-plated brass stay-open ball valve equipped with stainless steel ball and stem which requires less than 5lbs push force to operate, and wheel chair accessibility. Unit shall also include Schedule 40 hot-dipped galvanized steel pipe and fittings, powder-coated cast-iron 9″ (22.9 cm) diameter floor flange, yellow plastic pop-off dust cover for eyewash head, self-adhesive high visibility safety green and bright yellow stripes, universal sign, and 1-1/4″ NPT supply.

APPLICATIONS

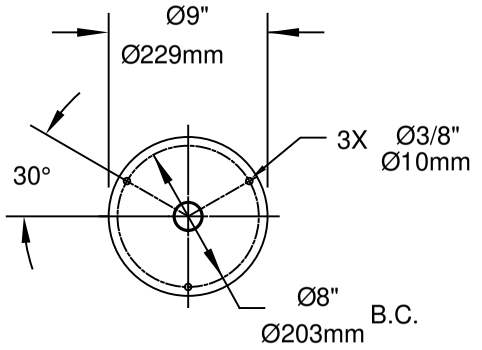
Where the eyes, face, or body of any person may be exposed to injurious or corrosive materials, suitable facilities for quick drenching or flushing of the eyes, face, and body shall be provided within the work area for immediate emergency use. Emergency eye/face wash facilities and deluge showers shall be in unobstructed and accessible locations that require no more than 10 seconds for the injured person to reach. Model 8309WC is certified by CSA to meet the ANSI/ISEA Z358.1 Standard for Emergency Eyewash and Shower Equipment.

THIS DOCUMENT IS TRUE AND CORRECT AT TIME OF PUBLICATION. CONTINUED PRODUCT IMPROVEMENTS MAKE SPECIFICATIONS AND MEASUREMENTS SUBJECT TO CHANGE WITHOUT NOTICE.





TOP VIEW



MOUNTING DETAIL

NOTES:

1. WHEN INSTALLING THIS UNIT, LOCAL , STATE, OR FEDERAL CODES SHOULD BE ADHERED TO FOR INSTALLATION DIMENSIONS (LOCATIONS), WASTE AND SUPPLY REQUIREMENTS OTHER THAN SHOWN.

2. TO COMPLY WITH ANSI Z358.1-2014 FOR EMERGENCY EYEWASH OR EYE/FACE WASH:
   - EYEWASH OR EYE/FACE WASH SHALL BE POSITIONED SUCH THAT FLUSHING FLUID PATTERN IS NOT LESS THAN 33" (838mm) AND NO GREATER THAN 53" (1346mm) FROM SURFACE ON WHICH USER STANDS; AND 6.0" (153mm) MINIMUM FROM WALL OR NEAREST OBSTRUCTION.
   - SHOWER SHALL BE POSITIONED SUCH THAT SHOWER HEAD IS NOT LESS THAN 82" (2083mm) AND NO GREATER THAN 96" (2438mm) FROM SURFACE ON WHICH USER STANDS.
   - SHOWER SPRAY PATTERN SHALL HAVE A MINIMUM DIAMETER OF 20" (508mm) AT 60" (1524mm) ABOVE SURFACE ON WHICH USER STANDS. CENTER OF SPRAY PATTERN SHALL BE LOCATED AT LEAST 16" (406mm) FROM ANY OBSTRUCTION.

[3] THESE DIMENSIONS MUST BE MAINTAINED TO MEET WHEELCHAIR ACCESSIBILITY REQUIREMENTS AND STILL COMPLY WITH ANSI REQUIREMENTS STATED ABOVE.

[4] DO NOT USE REGULAR PIPE SEALANT, IF NECESSARY, USE DOW CORNING 832 SEALANT. PLACING 5 SMALL BEADS ON THE MALE

5. DIMENSIONS MAY VARY BY ±1/2" (13 mm).

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1455 KLEPPE LANE
SPARKS, NEVADA 89431
(775) 359-4712 FAX (775) 359-7424
E-MAIL: HAWS@HAWSCO.COM
WEBSITE: WWW.HAWSCO.COM

ECN NO.	REVISED PER ECN: 5241	BY: VWC
DRAWN: D O	DATE: 07/96	CHK'D.: VWC
APPROVED: FV	DATE: 11/23/17	

MODEL(S)
8309WC BARRIER-FREE SHOWER AND EYE/FACE WASH

PART NUMBER 0002067461.D
REVISION 21

SCALE: 1:18 | DRAWING TYPE: INSTALLATION | SIZE: A | SHEET 1 OF 1

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THERM-X-TROL®

Thermal Expansion Tanks: Diaphragm ST-C Series ASME

150 PSIG Working Pressure

Construction

Shell	ST-5C through ST-42VC: Deep Drawn Steel ST-60VC through ST-210VC: Steel Head & Shell
Diaphragm	Heavy Duty Butyl NSF/ANSI 61
Liner	Antimicrobial Polypropylene w/Anti-Legionella Protection
System Connection	Stainless Steel
Finish	Red Oxide Primer
Water Circulator	Turbulator® (Deep Drawn Models)
Air Valve	Schrader Valve w/ EPDM Seat
Factory Precharge	55 PSIG (3.8 bar)

Performance

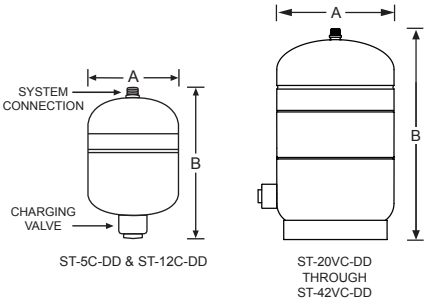
Maximum Operating Temperature	200°F (93°C)
Maximum Working Pressure	150 PSIG (10.3 bar)
Warranty	3-Years

Application

- For use in closed, domestic hot water systems to control pressure buildup.
- Fixed diaphragm construction.
- Designed and constructed per ASME Code Section VIII, Division 1.
- Tested to JIS Z 2801 for reduction of Legionella, Staphylococcus and E. coli.
- Follows ASHRAE 188 Anti-Legionella guidelines.
- All models available with optional sight glass.
- Seismic restraints available on stand models only.
- Deep drawn models are lighter, stronger and more compact than traditional head and shell construction.

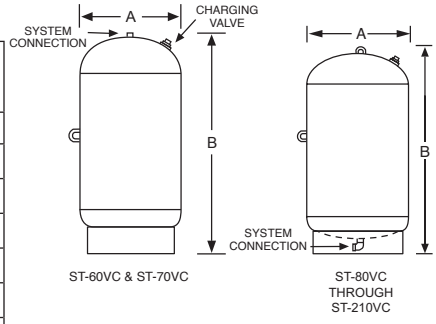
Deep Drawn In-Line & Stand Models

Model Number	Tank Volume		Max. Accept. Factor	A Tank Diameter		B Tank Height		System Conn. (NPTM)	Shipping Weight	
	Gal	Lit		In	mm	In	mm	In	Lbs	Kg
ST-5C-DD	2.0	8	.45	8	203	14	356	¾	10	5
ST-12C-DD	6.4	24	.50	12	305	18	457	¾	26	12
ST-20VC-DD	8.6	33	.37	12	305	22	559	¾	36	16
ST-30VC-DD	16.5	63	.68	15	381	25	636	¾	48	22
ST-42VC-DD	23.0	88	.49	15	381	33	838	¾	68	31



Head & Shell Stand Models

Model Number	Tank Volume		Max. Accept. Factor	A Tank Diameter		B Tank Height		System Conn. (NPTF)	Shipping Weight	
	Gal	Lit		In	mm	In	mm	In	Lbs	Kg
ST-60VC	25.0	95	.44	16	406	32	813	¾	85	39
ST-70VC	34.0	129	.32	16	406	45	1143	¾	99	45
ST-80VC	53.0	201	.66	24	610	37	940	1¼	224	102
ST-120VC	68.0	257	.51	24	610	44	1118	1¼	266	121
ST-180VC	77.0	291	.45	24	610	49	1245	1¼	285	129
ST-210VC	90.0	341	.39	24	610	57	1448	1¼	319	145



All dimensions and weights are approximate.

Job Name _____ Notes _____

Engineer _____ _____

Contractor _____ _____

P.O. No. _____ _____

Sales Rep. _____ _____

Model No. _____ _____

188 AntiLegionella. Antimicrobial.

NSF Certified to NSF/ANSI/CAN 61

Turbulator DEEP DRAWN MODELS

ISO 9001:2015 CERTIFIED

LEAD FREE IAPMO R&T

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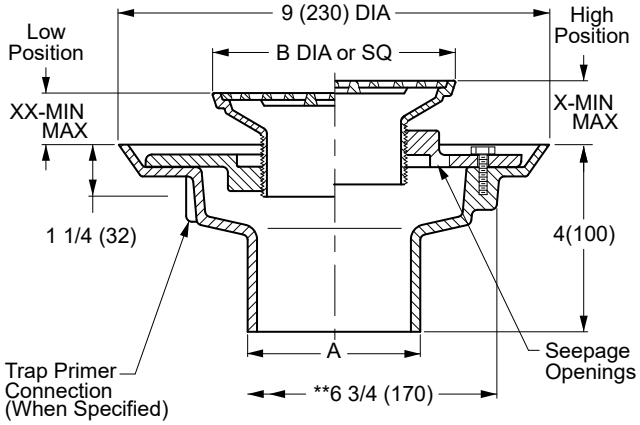
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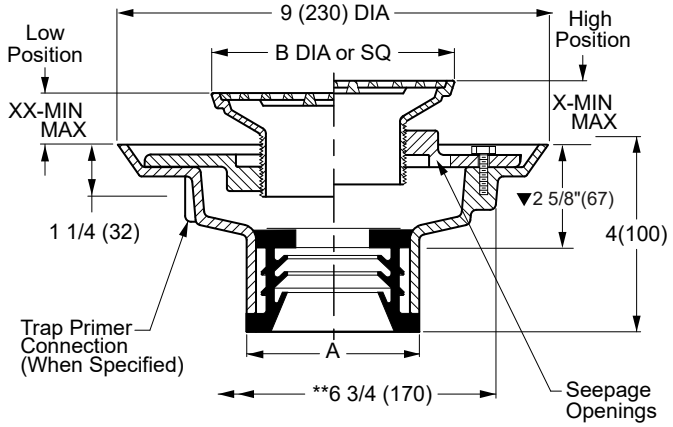
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MONTGOMERY, ALABAMA 36109-0237 (USA)
TEL: 334-277-8520 FAX: 888-377-7818 www.jrsmith.com
CUSTOMER DRIVEN SINCE 1926
MEMBER OF:

LOCATION

FLOOR OR SHOWER DRAINS
WITH ADJUSTABLE STRAINER HEADS

Load Rating: Light Duty having a Safe Live (Static) Load less than 2,000 lbs. (900 kg) per ASME A112.6.3 Floor Drain Standard.
For the specific Safe Live Load rating of any grate, contact the Smith representative or factory direct.





A (Pipe Size) = 02(50), 03(75), 04(100), 05(125) or 06(150)

NO-HUB OUTLET

☐ **Fig. 2005Y.....(A) ROUND TOP**
☐ **Fig. 2005Y.....(B) SQUARE TOP**

SPEEDI-SET® OUTLET

☐ **Fig. 2005L.....(A) ROUND TOP**
☐ **Fig. 2005L.....(B) SQUARE TOP**

	Outlet Size	Nickel Bronze Strainer Head
▲	02(50)	05(125) DIA or SQ
▲	03(75)	06(150) DIA or SQ
▲	04(100)	08(205) DIA or SQ

	Strainer Size B DIA or SQ	*Collar In High Position X MIN	X MAX	*Collar In Low Position XX MIN	XX MAX	Free Area SQ IN (SQ CM) ROUND	SQUARE
☐	05 (125)	1 1/4(32)	2 1/4(57)	3/4(19)	1 5/8(41)	7(45)	6.5(42)
☐	06 (150)	1 1/4(32)	2 1/4(57)	3/4(19)	1 5/8(41)	9(58)	12.5(81)
☐	07 (180)	1 1/4(32)	2 1/4(57)	7/8(22)	1 7/8(48)	14(90)	11(71)
☐	08 (205)	1 1/2(38)	2 1/2(64)	1(25)	1 7/8(48)	17(110)	14(90)
☐	•09 (230)	1 1/2(38)	2 3/8(60)	1(25)	1 7/8(48)	18(116)	16(103)
☐	•10 (255)	1 1/2(38)	2 3/8(60)	1(25)	1 7/8(48)	23(48)	16(103)

▼This dimension to internal stop of speedi-set® gasket.
• Add 3/8"(10) to all min/max dimensions for round strainers.
* Collar is reversible to obtain extreme high and low strainer positions.
•• Not available for 5"(125) size strainer.
** MIN 6 3/4"(170) hole required for core drilled application.

REGULARLY FURNISHED:
Duco Cast Iron Body with Flashing Collar and Adjustable Strainer Head as Indicated by Suffix Letter Selected.

NOTE: Dimensions shown in parentheses are in millimeters.

▲ **Meets ASME Standard A112.6.3-2001 02(50), 03(75) or 04"(100) sizes only.**

VARIATIONS:
☐ Flapper Type Backwater Valve -V **(NOTE 2)**
•• ☐ Hinged Grate -H **(NOTE 1)**
☐ L Speedi-Set® Service Weight 2(50), 3(75) & 4"(100) only
☐ LXH Speedi-Set® Extra Heavy 2(50), 3(75) & 4"(100) only
☐ Sediment Bucket -B
☐ Trap Primer Connection -P050 1/2" (13) & -P075 3/4" (19)
☐ Vandal Proof Screws -U
☐ Wide Flanged Strainer (Specify Fig. DX2005)
☐ T Threaded Outlet (Specify 2010T)
☐ Heelproof Grate -HP -AHP (Round) or -BHP (Square)
☐ Quad Close Trap Seal (Specify Fig. 2692)

OPTIONAL MATERIALS:
☐ Bronze Body -BB
☐ Chrome Plated Strainer -CP
☐ Galvanized Cast Iron Body -G
☐ Nickel Bronze Strainer -NB
☐ Polished Bronze Strainer -PB
☐ All Stainless Steel (Specify Fig. 9700)
☐ Stainless Steel Strainers -SS [Available in 05(125) & 06(150) sizes only]

NOTE 1: Sediment Bucket -B not provided for a Hinged Grate (-H)

NOTE 2: Sediment Bucket -B not provided for a Ball Float (-BFV) or a Flapper Type (-V)

SEE PM 0457 FOR OPTIONAL STRAINER HEADS.

REV.	DATE	DESCRIPTION	BY	CKD. BY
Y	8-9-23	Removed Function	HS	CL
X	3-10-23	Added ® to "Speedi-Set"	KK	CL
W	10-8-21	Added NOTE 1 & 2	KK	JM
V	8-27-21	Edited Variations	KK	JM

WEIGHT POUNDS | VOLUME CUBIC FEET | **FIGURE NUMBER 2005**

FIGURE NUMBER **2005** | DRAWN BY: PJ | CHECKED BY: TD | APPROVED BY: TD | DATE: 5-17-85 | SCALE: NONE | SIZE A | DRAWING NUMBER S2005 | Y

DIMENSIONS ARE SUBJECT TO MANUFACTURERS TOLERANCE AND CHANGE WITHOUT NOTICE
WE CAN ASSUME NO RESPONSIBILITY FOR USE OF SUPERSEDED OR VOID DATA

WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov

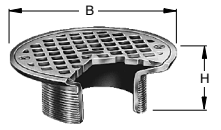
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MONTGOMERY, ALABAMA 36109-0237 (USA)
TEL: 334-277-8520 FAX: 888-377-7818 www.jrsmith.com
CUSTOMER DRIVEN SINCE 1926
MEMBER OF:

NOTE 1: Sediment Bucket -B not provided for a Hinged Grate (-H)

NOTE 2: Sediment Bucket -B not provided for a Ball Float (-BFV) or a Flapper Type (-V)

OPTIONAL STRAINER HEADS

ROUND STRAINER



MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB
Stainless Steel Strainers -SS [Available in 05(125) & 06(150) sizes only]

VARIATIONS:
*Hinged Grate (Specify Suffix -AH) (NOTE 1)
Sediment Bucket -B
Vandal Proof Screws -U

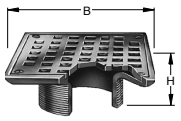
B DIA		05 (125)	06 (150)	07 (180)	08 (205)	09 (230)	10 (255)
H		2 (51)	2 (51)	2 1/4 (57)	2 1/2 (64)	2 1/2 (64)	2 3/4 (70)
X	MIN	1 1/4 (32)	1 1/4 (32)	1 1/4 (32)	1 1/2 (38)	1 1/2 (38)	1 1/2 (38)
	MAX	2 1/4 (57)	2 1/4 (57)	2 1/4 (57)	2 1/2 (64)	2 1/2 (64)	2 3/4 (70)

LIGHT DUTY

SUFFIX -A

Specify Type, Size & Finish eg: A05NB
*Not available for 05" (125) size

FLAPPER TYPE BACKWATER VALVE



FUNCTION: Provides backwater protection at point where protection is needed.

MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS
*Hinged Grate (Specify Suffix -AH)
Vandal Proof Screws -U

B SQ		05 (125)	06 (150)	07 (180)	08 (205)
H		2 (51)	2 (51)	2 1/4 (57)	2 1/2 (64)
X	MIN	1 1/4 (32)	1 1/4 (32)	1 1/4 (32)	1 1/2 (38)
	MAX	2 1/4 (57)	2 1/4 (57)	2 1/4 (57)	2 1/2 (64)

LIGHT DUTY

SUFFIX -AV

Specify Type, Size & Finish eg: AV05NB
*Not available for 05" (125) size

SQUARE STRAINER



MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS
Flapper Type Backwater Valve (Specify Suffix -BV) 05 (125), 06 (150), 07 (180) or 08" (205) sizes only (NOTE 2)
*Hinged Grate (Specify Suffix -BH) (NOTE 1)
Sediment Bucket -B
Vandal Proof Screws -U

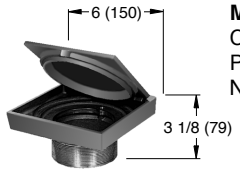
B SQ		05 (125)	06 (150)	07 (180)	08 (205)	09 (230)	10 (255)
H		2 (51)	2 (51)	2 1/4 (57)	2 1/2 (64)	2 1/4 (57)	2 1/4 (57)
X	MIN	1 1/4 (32)	1 1/4 (32)	1 1/4 (32)	1 1/2 (38)	1 1/2 (38)	1 1/2 (38)
	MAX	2 1/4 (57)	2 1/4 (57)	2 1/4 (57)	2 1/2 (64)	2 1/4 (57)	2 3/8 (60)

LIGHT DUTY

SUFFIX -B

Specify Type, Size & Finish eg: B05NB
*Not available for 05" (125) size

STRAINER HEAD w/SQUARE HINGED COVER



MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS:
Gasketed Water Tight Cover -GC
Secured Cover -SC
Secondary Strainer Grate-SG

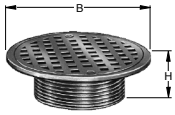
LIGHT DUTY

SUFFIX -BS

Specify Type, Size & Finish eg: BSNB

REINFORCED ROUND STRAINER

FUNCTION: Used in finished floors where light wheeled loads are anticipated.



MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS:
Flapper Type Backwater Valve (Specify Suffix -CV) (NOTE 2)
Sediment Bucket -B
Vandal Proof Screws -U

B DIA	05 (125)	06 (150)	08 (205)	10 (255)
H	2 (51)	2 (51)	2 1/2 (64)	2 3/4 (70)
MIN	1 1/4 (32)	1 1/4 (32)	1 1/2 (38)	1 7/8 (48)
MAX	2 1/4 (57)	2 1/4 (57)	2 1/2 (64)	2 3/4 (70)

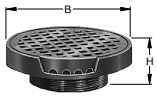
LIGHT DUTY

SUFFIX -C

Specify Type, Size & Finish eg: C06NB

REINFORCED TRACTOR STRAINER

FUNCTION: Used in finished floors where light weight wheeled loads are anticipated and loose set non-tilt tractor grate is desired.



MATERIALS:
Cast Iron -CI
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS:
Flapper Type Backwater Valve (Specify Suffix -DV or -EV) (NOTE 2)
Sediment Bucket -B
Vandal Proof Screws -U

SUFFIX	B DIA	H	X MIN	X MAX
-D	07 (180)	3 1/4 (83)	2 5/8 (67)	3 1/2 (89)
-E	09 (230)	3 1/2 (89)	2 3/4 (70)	3 1/2 (89)

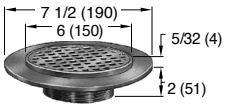
LIGHT DUTY

SUFFIX -D-E

Specify Type, Size & Finish eg: D07PB E09PB

TILE FLANGE

FUNCTION: Provides integral flange set 5/32"(4) below rim to receive floor covering. Flange may have option of tapped holes for securing pan and gasket.



MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS:
Flapper Type Backwater Valve (Specify Suffix -FV) (NOTE 2)
Holes in Flange -SH
Sediment Bucket -B
Vandal Proof Screws -U

X MIN	X MAX
1 1/4 (32)	2 1/8 (54)

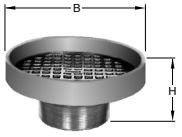
LIGHT DUTY

SUFFIX -F

Specify Type, Size & Finish eg: F06NB

ADJUSTABLE STRAINER HEAD

FUNCTION: Used in a non-traffic area when a funnel type strainer head is required and space does not allow use of the 3500 series funnel. The extended rim allows use as an anti-flood and anti-splash drip pan.



VARIATIONS:
Flapper Type Backwater Valve (Specify Suffix -F37V or F38V)

MATERIALS:
Cast Iron -CI
Chrome Plated -CP
Galvanized Cast Iron -G
Polished Bronze -PB
Nickel Bronze -NB

SUFFIX		-F37	-F38
B DIA		07 (180)	09 (230)
H		3 1/4 (83)	3 1/2 (89)
X	MIN	2 5/8 (67)	2 3/4 (70)
	MAX	3 1/2 (89)	3 1/2 (89)

NON-TRAFFIC

SUFFIX -F37-F38

Specify Type, Size & Finish eg: F37NB F38CP

REV.	DATE	DESCRIPTION	BY	CKD. BY
M	10-8-21	Added NOTE 1 & 2	KK	JM
L	10-26-20	Rev. Finish (Tractor Stainer)	MW	CL
K	7-29-19	Added Load Rating(s)	MW	JM

FIGURE NUMBER
2010 SERIES OPTIONAL STRAINER HEADS
1 0f 2

NOTE: Dimensions shown in parentheses are in millimeters.

WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov

M | DRAWING NUMBER: PM0457 SH 1 of 2 | SIZE: A | SCALE: NONE | DATE: 5-17-85 | APPROVED BY: TD | CHECKED BY: TD | DRAWN BY: PJ | 2010 SERIES OPTIONAL STRAINER HEADS | FIGURE NUMBER

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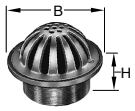
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LOCATION

OPTIONAL STRAINER HEADS

LOW DOME STRAINER

FUNCTION: Used in gutters and recessed areas where excessive debris build-up is expected. Dome insures drainage even when partly covered.



MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS:
Flapper Type Backwater Valve (Specify Suffix -GV)
Sediment Bucket -B
Vandal Proof Screws -U

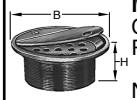
B DIA	05 (125)	06 (150)	08 (205)
H	2 (51)	2 (51)	2 1/2 (64)
MIN	1 1/4 (32)	1 1/4 (32)	1 1/2 (38)
MAX	2 1/4 (57)	2 1/4 (57)	2 1/2 (64)

NON-TRAFFIC

SUFFIX -G Specify Type, Size & Finish eg: G08PB

SOLID HINGED COVER

FUNCTION: Used in areas where intermittent drain use is required. Solid cover prevents intrusion of chips, saw-dust, etc., which are swept up before cover is opened for washdown. The secondary strainer prevents debris from entering the waste line.



MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS:
Flapper Type Backwater Valve (Specify Suffix -GV)
Vandal Proof Screws -U

B DIA	05 (125)	06 (150)	07 (180)	08 (205)
H	2 (51)	2 (51)	2 1/4 (57)	2 1/2 (64)
X MIN	1 1/4 (32)	1 1/4 (32)	1 1/4 (32)	1 1/2 (38)
X MAX	2 1/4 (57)	2 1/4 (57)	2 1/4 (57)	2 1/2 (64)

LIGHT DUTY

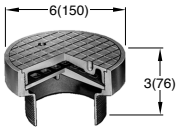
SUFFIX -H Specify Type, Size & Finish eg: H05CP

SPANNER WRENCH COVER

FUNCTION: Solid gas tight, vandal proof, threaded cover for areas where intermittent drain use is required.

MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS:
Flapper Type Backwater Valve (Specify Suffix -JV)
Sediment Bucket -B



MEDIUM DUTY

X MIN	X MAX
2 (51)	3 (76)

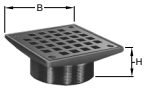
SUFFIX -J Specify Type, Size & Finish eg: J06NB

REINFORCED SQUARE STRAINER

FUNCTION: Used in finished floors where some light wheeled traffic is anticipated.

MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS:
Flapper Type Backwater Valve(Specify Suffix -KV)
Sediment Bucket -B
Vandal Proof Screws -U



B SQ	05 (125)	06 (150)	07 (180)	08 (205)
H	2 (51)	2 (51)	2 1/4 (57)	2 1/2 (64)
X MIN	1 1/4 (32)	1 1/4 (32)	1 1/4 (32)	1 1/2 (38)
X MAX	2 1/4 (57)	2 1/4 (57)	2 1/4 (57)	2 1/2 (64)

LIGHT DUTY

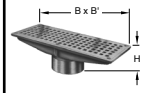
SUFFIX -K Specify Type, Size & Finish eg: K07CP

RECTANGULAR STRAINER

FUNCTION: Used in finished floors where light wheeled loads and or heavy foot traffic are anticipated.

MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS:
Sediment Bucket -B
Vandal Proof Screws -U



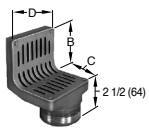
LIGHT DUTY

SUFFIX	L	M	N	P	R	T
B x B'	4 1/2(115)x8(205)	4(100)x12(305)	5(125)x9(230)	5(125)x13(330)	6(150)x10(255)	5(125)x17(430)
H	2 1/4 (57)	2 1/2 (64)	2 1/4 (57)	3 (76)	2 1/4 (57)	3 (76)
X MIN	1 3/8 (35)	1 7/8 (48)	1 3/8 (35)	2 1/8 (54)	1 3/8 (35)	2 1/4 (57)
X MAX	2 3/8 (60)	2 3/4 (70)	2 3/8 (60)	3 (76)	2 3/8 (60)	3 1/8 (79)

SUFFIX -L-M-N-P-R-T Specify Type,Size & Finish eg: LNB

ANGLE STRAINER

FUNCTION: Shower room drain set at wall and floor junction. Vertical grate openings prevent drain stoppage should flat surface become covered.



MATERIALS:
Chrome Plated -CP
Polished Bronze -PB
Nickel Bronze -NB

VARIATIONS:
Vandal Proof Screws -U

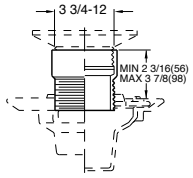
SUFFIX	B	C	D	X MIN	X MAX
-V	3 1/2 (89)	3 1/2 (89)	4 1/2 (115)	1 5/8 (41)	2 5/8(67)
-W	6 3/4 (170)	6 3/4 (170)	6 1/2 (165)	1 5/8 (41)	2 5/8(67)

LIGHT DUTY

SUFFIX -V -W Specify Type, Size & Finish eg: VPB, WNB

EXTENSION ADAPTOR

FUNCTION: Used when a strainer head must be raised to accommodate deeper floor fill.



REGULARLY FURNISHED:
Duco Cast Iron -CI

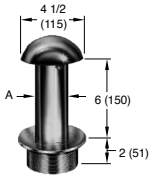
MATERIALS:
Cast Bronze -CB
Galvanized Cast Iron -G

NOTE: Extension can be stacked for increased maximum adjustment.

SUFFIX -X

OVERFLOW WITH STANDPIPE

FUNCTION: Used as overflow drain in decorative pools, fish ponds or similar areas. Dome prevents floating objects from entering drain line.



MATERIALS:
Chrome Plated -CP
Nickel Bronze -NB
Polished Bronze -PB

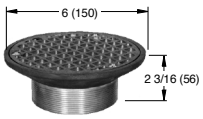
VARIATIONS:
Less Dome -LD
Standpipe Height other than 6" (150) (Specify Height)

SUFFIX	A SIZE	X MIN	X MAX
-Y	2 (51)	3/4 (19)	2 1/8 (54)
-Z	3 (76)	3/4 (19)	2 1/8 (54)

SUFFIX -Y-Z Specify Type, Size & Finish eg: YCP, ZCP

HEAVY DUTY ADJUSTABLE

FUNCTION: Used in finished floors where light wheeled loads and or heavy foot traffic are anticipated.



MATERIALS:
Polished Bronze -PB
Rough Bronze -RB
Nickel Bronze -NB

VARIATIONS:
Flapper Type Backwater Valve(Specify Suffix -69V)
Sediment Bucket -B
Vandal Proof Screws -U

MEDIUM DUTY

SUFFIX -69 eg: A06NB-69

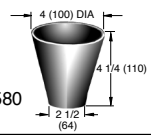


Fig. 3580

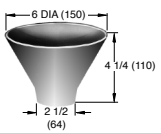


Fig. 3581

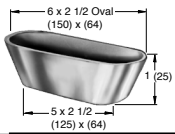


Fig. 3590

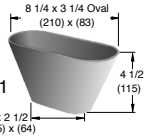


Fig. 3591

REV.	DATE	DESCRIPTION	BY	CKD. BY
L	7-29-19	Added Load Rating(s)	MW	JM
K	10-20-17	Rev. Materials Suffix -H, -V-W	TBW	CL
J	1-17-12	Rev. Variations of Suffix -J	TBW	AM
H	8-24-99	Revised	TBW	BS
G	6-11-99	Revised Tables	CMD	

FIGURE NUMBER
2010 SERIES OPTIONAL STRAINER HEADS
2 of 2

NOTE: Dimensions shown in parentheses are in millimeters.

WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov

L | DRAWING NUMBER: PM0457 SH 2 of 2 | SIZE: A | SCALE: NONE | DATE: 5-17-85 | APPROVED BY: TD | CHECKED BY: TD | DRAWN BY: PJ | 2010 SERIES OPTIONAL STRAINER HEADS | FIGURE NUMBER

DIMENSIONS ARE SUBJECT TO MANUFACTURERS TOLERANCE AND CHANGE WITHOUT NOTICE
ASSUME NO RESPONSIBILITY OR USE OF SUPERSEDED OR VOID DATA

Metering Faucets
3501-E2805ABCP

CHICAGO FAUCETS
Geberit Group

Product Type

Deck-mounted metering faucet, single-hole mounting

Features & Specifications

- Single-hole
- Vandal Proof Pressure compensating Econo-Flo™ non-aerating laminar spray 0.5 GPM
- Vandal Proof 1-5/8" MVP metering push handle
- Actuator Assembly
- ECAST® design provides durable cast brass construction with total lead content equal to or less than 0.25% by weighted average
- CFNow! Item Ships in 3 Days

Performance Specification

- Rated Operating Pressure: 20-125 PSI
- Rated Operating Temperature: 40-140°F

Warranty

- 5-Year Limited Cartridge Warranty
- Lifetime Limited Faucet Warranty
- 1-Year Limited Finish Warranty

Codes & Standards

- ASME A112.18.1/CSA B125.1
- ADA ANSI/ICC A117.1
- Complies with CALGreen requirements
- NSF/ANSI 372 Low Lead Content
- NSF/ANSI/CAN 61: Q ≤ 1

Job Name _____

Item Number _____

Section/Tag _____

Model Specified _____

Architect _____

Engineer _____

Contractor _____

[ ] Submitted as Shown [ ] Submitted with Variations

Date _____



ECAST

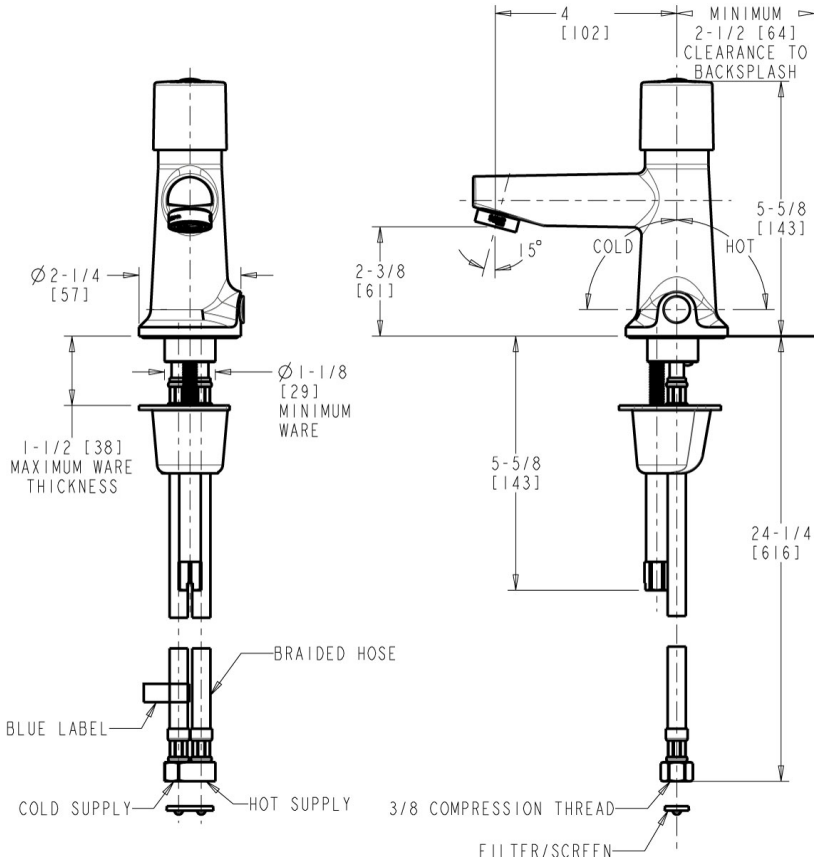
ECAST products are intended for installation where state laws and local codes mandate lead content levels or in any location where lead content is a concern.

2100 South Clearwater Drive
Des Plaines, IL
P: 847/803-5000
F: 847/803-5454
Technical: 800/TEC-TRUE
www.chicagofaucets.com

3501-E2805ABCP

Architect/Engineer Specification

Chicago Faucets No. 3501-E2805ABCP, Sink Faucet for hot and cold water, metering, single-hole deck mount, chrome plated. Integral, cast brass spout, 4" center-to-center. 0.5 GPM (1.9 L/min) vandal-proof, pressure compensating, Econo-Flo, non-aerating spray. MVP self-closing, auto-timed metering cartridge, adjustable run time from 2 to 25 seconds, opens with push, 0.20 max gallon/cycle. Dual supply for hot and cold water service. Flexible supply hoses included. Concealed, internal temperature control mixer with hot water adjustment limit stop. ECAST® construction with less than 0.25% lead content by weighted average. CALGreen compliant. This product meets ADA ANSI/ICC A117.1 requirements and is tested and certified to industry standards: ASME A112.18.1/CSA B125.1, Certified to NSF/ANSI 61, Section 9, California Health and Safety Code 116875 (AB1953-2006), Vermont Bill S.152, NSF/ANSI 372 Low Lead Content, and California Green Building Standards Code (CALGreen).



Operation and Maintenance

Installation should be in accordance with local plumbing codes. Flush all pipes thoroughly before installation. After installation, remove spout outlet or flow control and flush faucet thoroughly to clear any debris. Care should be taken when cleaning the product. Do not use abrasive cleaners, chemicals or solvents as they can result in surface damage. Use mild soap and warm water for cleaning and protecting the life of Chicago Faucet products. For specific operation and maintenance refer to the installation instructions and repair parts documents that are located at www.chicagofaucets.com.

Chicago Faucets, member of the Geberit Group, is the leading brand of commercial faucets and fittings in the United States, offering a complete range of products for schools, laboratories, hospitals, office buildings, food service, airports and sport facilities. Call 1.800.TECTRUE or 1.847.803.5000 Option 1 for installation or other technical assistance.

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900 Series Lab Fittings
928-317SAM

CHICAGO FAUCETS
Geberit Group

Product Type

Deck-mounted manual laboratory faucet, single-hole, single-supply

Features & Specifications

- Single-hole
- 6" rigid/swing gooseneck spout with atmospheric vacuum breaker
- Laboratory nozzle with 10 serrations for laboratory hose
- Vandal Proof 4" wristblade handle
- Quaturn™ compression operating cartridge, right-hand
- Vacuum breaker assembly
- Complies with the requirements of the Buy American Act of 1933.

Performance Specification

- Rated Operating Pressure: 20-125 PSI
- Rated Operating Temperature: 40-140°F

Warranty

- 5-Year Limited Faucet Warranty
- Lifetime Limited Faucet Warranty
- 1-Year Limited Finish Warranty
- 5-Year Limited Mechanical Warranty

Codes & Standards

- ASME A112.18.1/CSA B125.1
- ADA ANSI/ICC A117.1
- ASSE 1001 Compliant
- NSF/ANSI 372 Low Lead Content

Job Name _____

Item Number _____

Section/Tag _____

Model Specified _____

Architect _____

Engineer _____

Contractor _____

[ ] Submitted as Shown [ ] Submitted with Variations

Date _____

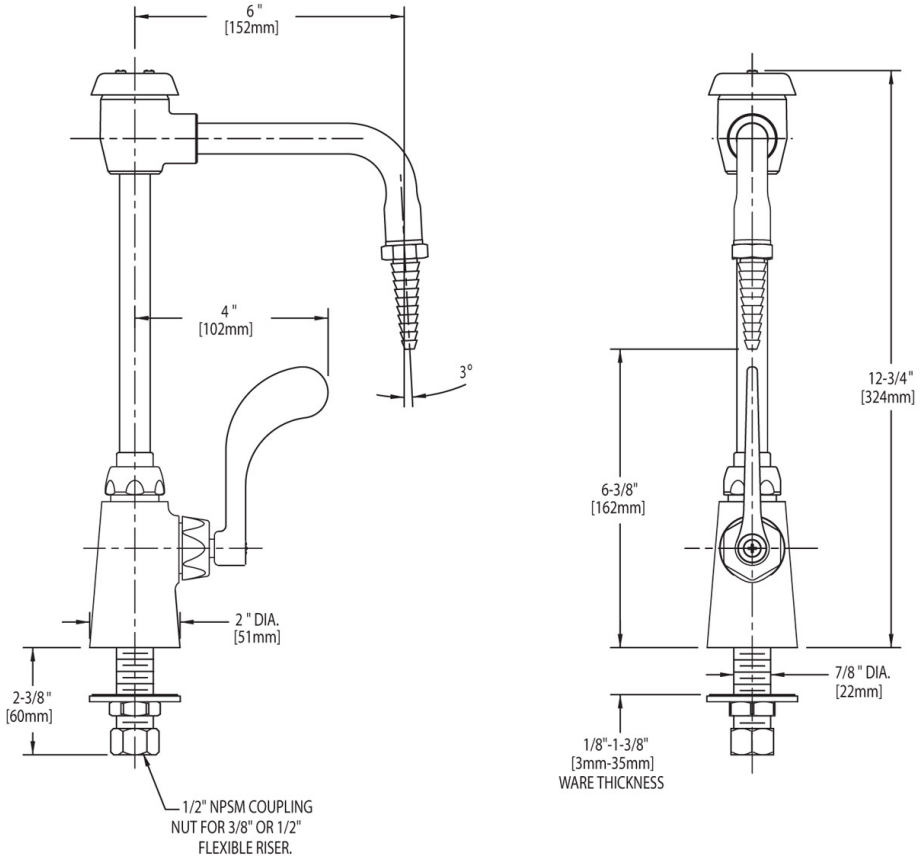


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928-317SAM

Architect/Engineer Specification

Chicago Faucets No. 928-317SAM, Cold Water Faucet with vacuum breaker, single-inlet, single-hole deck mount, chrome plated, with chemical-resistant Satin Antimicrobial (SAM) finish. Rigid/swing gooseneck spout with atmospheric vacuum breaker, 6" center-to-center. Serrated, full-flow laboratory nozzle. 4" metal, vandal-proof, wristblade handle with sixteen-point, tapered broach and secured, blue index button. Quaturn™ rebuildable compression cartridge, opens and closes 90°, closes with water pressure, features square, tapered stem. 1/2" NPSM supply inlets and coupling nut for 3/8" or 1/2" flexible riser. NOTE: Atmospheric vacuum breaker is NOT intended for continuous pressure applications.



Operation and Maintenance

Installation should be in accordance with local plumbing codes. Flush all pipes thoroughly before installation. After installation, remove spout outlet or flow control and flush faucet thoroughly to clear any debris. Care should be taken when cleaning the product. Do not use abrasive cleaners, chemicals or solvents as they can result in surface damage. Use mild soap and warm water for cleaning and protecting the life of Chicago Faucet products. For specific operation and maintenance refer to the installation instructions and repair parts documents that are located at www.chicagofaucets.com.

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www.chicagofaucets.com

ZER6000PL-CPM

Sensor Operated Battery Powered Flush Valve For Water Closets

TAG _____

Architectural/Engineering Specification:

Exposed, quiet diaphragm-type, chrome plated flushometer valve with a polished exterior. Complete with chloramine resistant, dual seal diaphragm with a clog resistant by-pass. The valve incorporates a 6VDC motor actuator, a battery powered automatic sensor, high impact resistant polycarbonate housing and chrome plated metal cover with manual override push button and 10 degree angled sensor.

Product Features:

- Control stop with internal siphon-guard protection, vandal resistant stop cap, sweat solder kit, and cast wall flange with set screw
- High back pressure Vacuum Breaker with one piece hex
- Chloramine-resistant internal seals
- Adjustable tailpiece
- Spud coupling and flange for top spud connection

Compliance and Certification:

- Complies with ASSE 1037/ASME A112.1037/CSA B125.37
- ADA Compliant

*This product should be used with a WaterSense labeled counterpart with a compatible flow volume to ensure that the entire system meets the requirements for water efficiency and performance.



Flow Options:

	Flush Volume	WaterSense* Labeled
☐ **-ONE**	1.1 gpf	✓
☐ **-HET**	1.28 gpf	✓
☐ **-WS1**	1.6 gpf	
☐ **-Standard**	3.5 gpf	

Suffix Options:

☐ **-TFB**	Floor Mount 12” Rough In
☐ **-YJ**	Split Ring Pipe Support
☐ **-YK**	Solid Ring Pipe Support
☐	Other

Architectural/Engineering Approval

The information contained in this document is subject to change without notice.
Please contact Zurn for most up to date information.

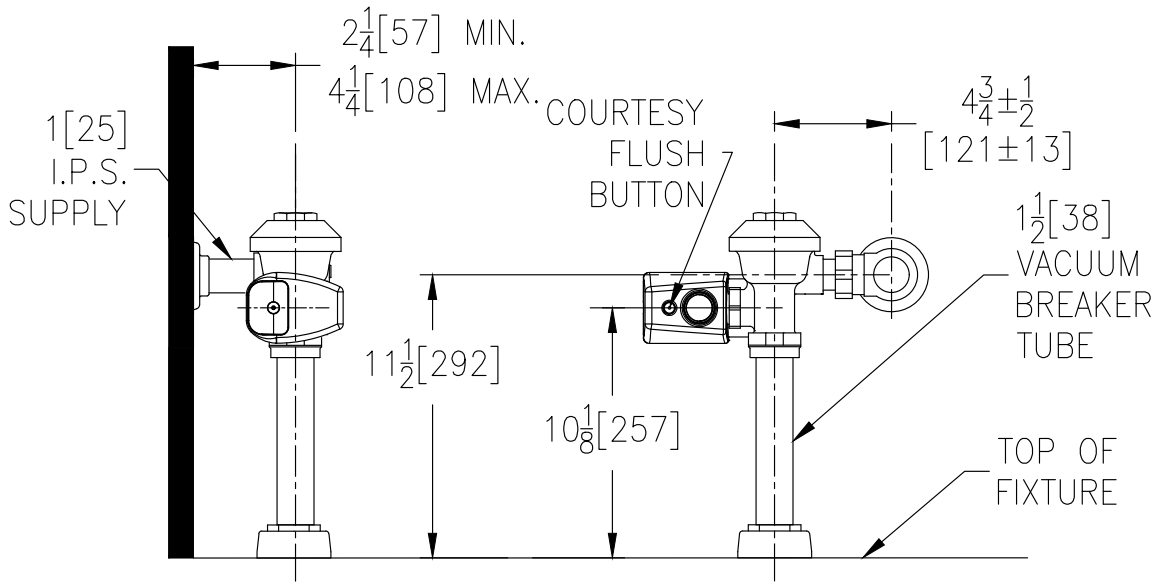
Rev. A | Date: 11/09/22 | C.N. No. 144844 | Prod./Dwg. No. SS ZER6000PL-CPM

ZER6000PL-CPM

Sensor Operated Battery Powered Flush Valve For Water Closets

TAG _____

Rough-in/Overview dimensions



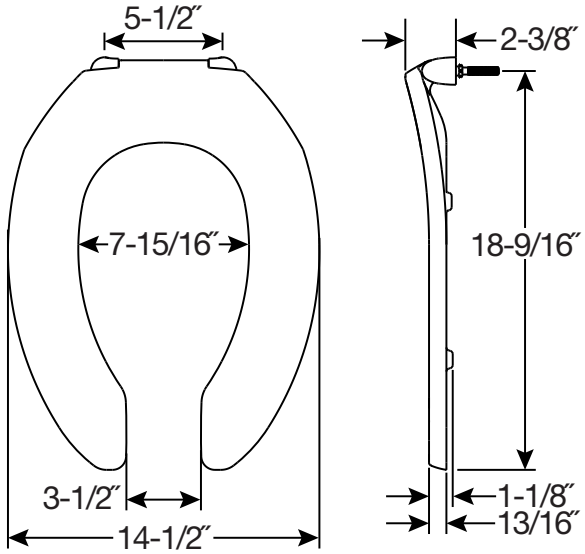
Patent zurn.com/patents
US 1.855.ONE.ZURN **CANADA** 1.877.892.5216
ZURN.COM

by zurn ELKAY Water Solutions

10CT / 10SSCT

COMMERCIAL HEAVY-DUTY
PLASTIC TOILET SEAT







FEATURES:

- **STA-TITE®**
  Commercial Fastening System™
  Eliminates callbacks for loosened seats

SPECIFICATIONS:

Size: Elongated

Material: Plastic

Style: Open Front less Cover

Ring Bumpers: Four

Hinges: Plastic Non Self-Sustaining Check Hinges (10CT) or Plastic Self-Sustaining Check Hinges (10SSCT) with Non-Corroding 300 Series Stainless Steel Posts and Pintles

Hardware: STA-TITE® Commercial Fastening System™

Codes & Standards: Complies with IAPMO/ANSI Z124.5 Performance Standards Heavy-Duty Commercial

Proudly Made in the USA

Eco-Friendly

Bemis Manufacturing Co., Sheboygan Falls, WI 53085 | ToiletSeats.com | ph: 800.558.7651 | fx: 800.292.3647
Bemis Manufacturing Co. reserves the right to make revisions without notice to product specifications.
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L Series Lab Fittings
LGF1-A11C-25

CHICAGO FAUCETS
Geberit Group

Product Type

Deck-mounted laboratory turret with fine needle valve

Features & Specifications

- Laboratory nozzle with 10 serrations for laboratory hose
- Vandal Proof 2-1/2" cross handle

Performance Specification

- Rated Operating Pressure: 7.25 PSI max.

Warranty

- 5-Year Limited Faucet Warranty
- Lifetime Limited Faucet Warranty
- 1-Year Limited Finish Warranty
- 5-Year Limited Mechanical Warranty

Codes & Standards

- ANSI Z21.15b/CSA 9.1b

Job Name _____

Item Number _____

Section/Tag _____

Model Specified _____

Architect _____

Engineer _____

Contractor _____

[ ] Submitted as Shown [ ] Submitted with Variations

Date _____

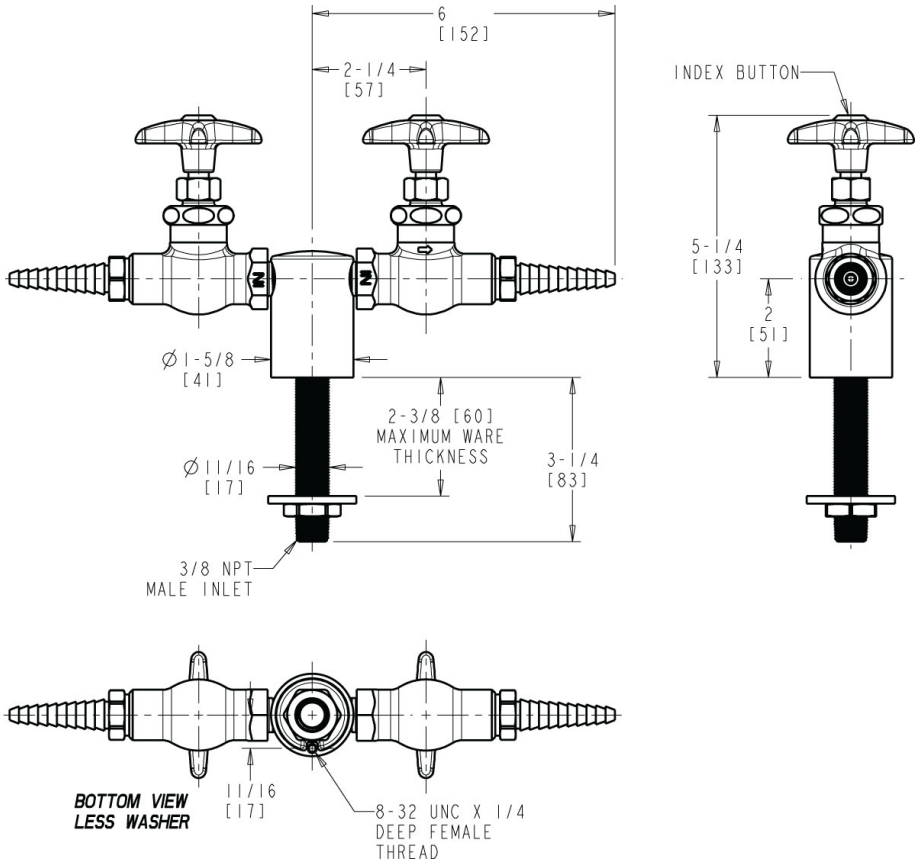


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P: 847/803-5000
F: 847/803-5454
Technical: 800/TEC-TRUE
www.chicagofaucets.com

LGF1-A11C-25

Architect/Engineer Specification

Chicago Faucets No. LGF1-A11C-25 Deck-mounted laboratory turret with fine needle valve, polished chrome finish. Laboratory nozzle with 10 serrations for laboratory hose. 2-1/2" cross handle. Laboratory index button, dark blue with white letters, GAS.



Operation and Maintenance

Installation should be in accordance with local plumbing codes. Flush all pipes thoroughly before installation. After installation, remove spout outlet or flow control and flush faucet thoroughly to clear any debris. Care should be taken when cleaning the product. Do not use abrasive cleaners, chemicals or solvents as they can result in surface damage. Use mild soap and warm water for cleaning and protecting the life of Chicago Faucet products. For specific operation and maintenance refer to the installation instructions and repair parts documents that are located at www.chicagofaucets.com.

Chicago Faucets, member of the Geberit Group, is the leading brand of commercial faucets and fittings in the United States, offering a complete range of products for schools, laboratories, hospitals, office buildings, food service, airports and sport facilities. Call 1.800.TECTRUE or 1.847.803.5000 Option 1 for installation or other technical assistance.

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Lucerne™ Wall-Hung Lavatory

- Wall-hung sink
- Vitreous china
- Front overflow
- D-shaped bowl
- Self-draining deck area with contoured back and side splash shields
- Faucet ledge
- Compliant with Texas Accessibility Standard (TAS) for children age group 13 and up

Faucet holes on 203 mm (8") centers:

❏ **0356.028** For exposed bracket support (by others)

❏ **0356.015** For wall hanger (included) or concealed arms support (by others)

❏ **0356.915** For wall hanger (included) or concealed arms support (by others) less overflow

❏ **0356.037** For wall hanger (included) or concealed arms support (by others) with extra 35 mm (1-3/8") hole for soap/lotion dispenser (by others) on right-hand side

Faucet holes on 102 mm (4") centers:

❏ **0355.027** For exposed bracket support (by others)

❏ **0355.012** For wall hanger (included) or concealed arms support (by others)

❏ **0355.912** For wall hanger (included) or concealed arms support (by others) less overflow

❏ **0355.056** For wall hanger (included) or concealed arms support (by others) with extra 35 mm (1-3/8") hole for soap/lotion dispenser (by others) on left-hand side

❏ **0355.034** For wall hanger (included) or concealed arms support (by others) with extra 35 mm (1-3/8") hole for soap/lotion dispenser (by others) on right-hand side

❏ **0355.041** With two holes spaced 343 mm (13-1/2") in back splash for 10 mm (3/8") bolts (by others)

Single center faucet hole:

❏ **0356.041** For exposed bracket support (by others)

❏ **0356.421** For wall hanger (included) or concealed arms support (by others)

❏ **0356.921** For wall hanger (included) or concealed arms support (by others) less overflow

❏ **0356.439** For wall hanger (included) or concealed arms support (by others) with single faucet hole on right

❏ **0356.066** For exposed bracket support (by others) with single faucet hole on right

❏ **0356.115** For wall hanger (included) or concealed arms support (by others) with extra 35 mm (1-3/8") hole for soap/lotion dispenser (by others) on left-hand side

❏ **0356.137** For wall hanger (included) or concealed arms support (by others) with extra 35 mm (1-3/8") hole for soap/lotion dispenser (by others) on right-hand side



0355.012



0356.041

SEE FOLLOWING PAGES FOR ROUGHING-IN DIMENSIONS

Compliance Certifications -
Meets or Exceeds the Following Specifications:

- ASME A112.19.2 / CSA B45.1 for Vitreous China Fixtures

Nominal Dimensions:
540 x 464 mm
(21-1/4" x 18-1/4")

Bowl sizes:
379 mm (14-7/8") wide
254 mm (10") front to back
165 mm (6-1/2") deep

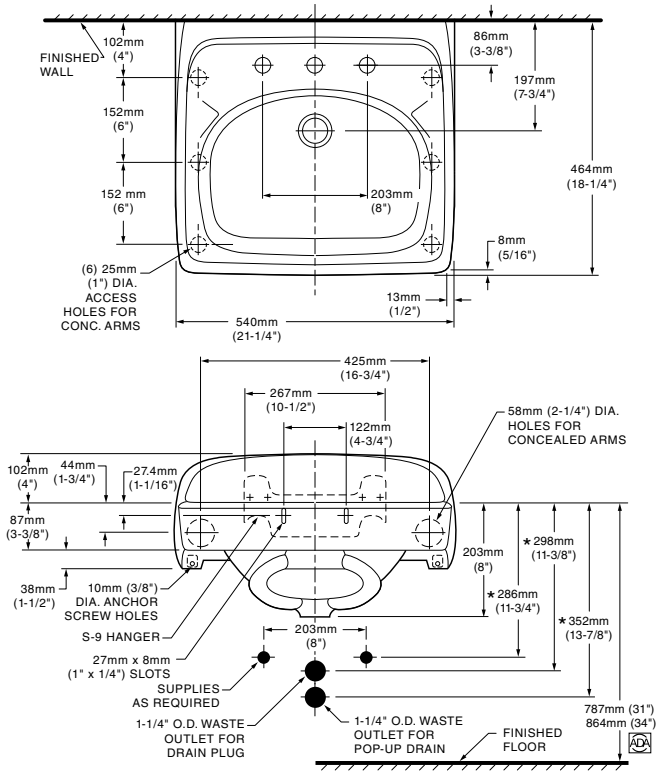
To Be Specified:

❏ Color: ❏ White
❏ Faucet:
❏ Faucet Finish:
❏ Supplies:
❏ 1-1/4" Trap:
❏ Bracket Support (by others):
❏ Concealed Arms Support (by others):

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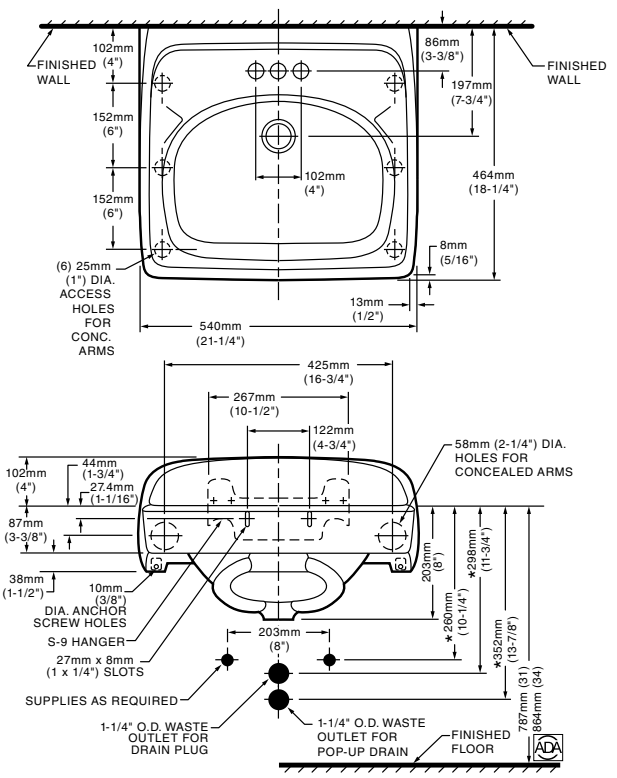
8" CENTER CONFIGURATIONS

All Wall Hanger (included) or Concealed Arm Configurations

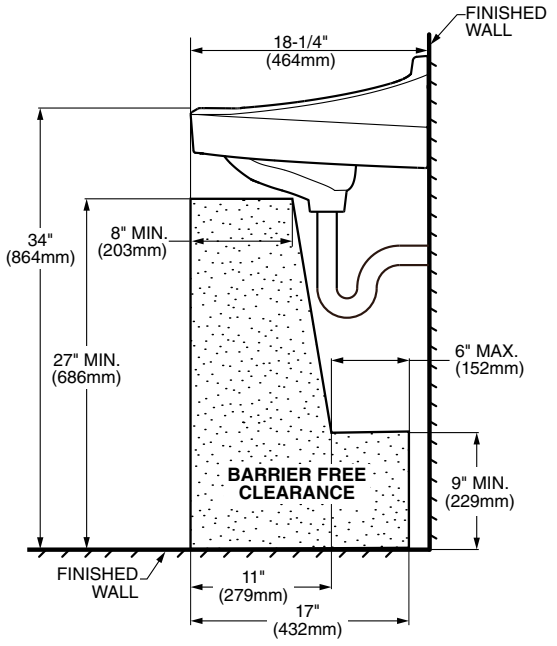


4" CENTER CONFIGURATIONS

All Wall Hanger (included) or Concealed Arm Configurations



SIDE VIEW - ALL CONFIGURATIONS



NOTES:

* DIMENSIONS SHOWN FOR LOCATION OF SUPPLIES AND "P" TRAP ARE SUGGESTED. PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORTS. FITTINGS NOT INCLUDED AND MUST BE ORDERED SEPARATELY. CONCEALED ARM SUPPORT AS REQUIRED TO BE FURNISHED BY OTHERS.

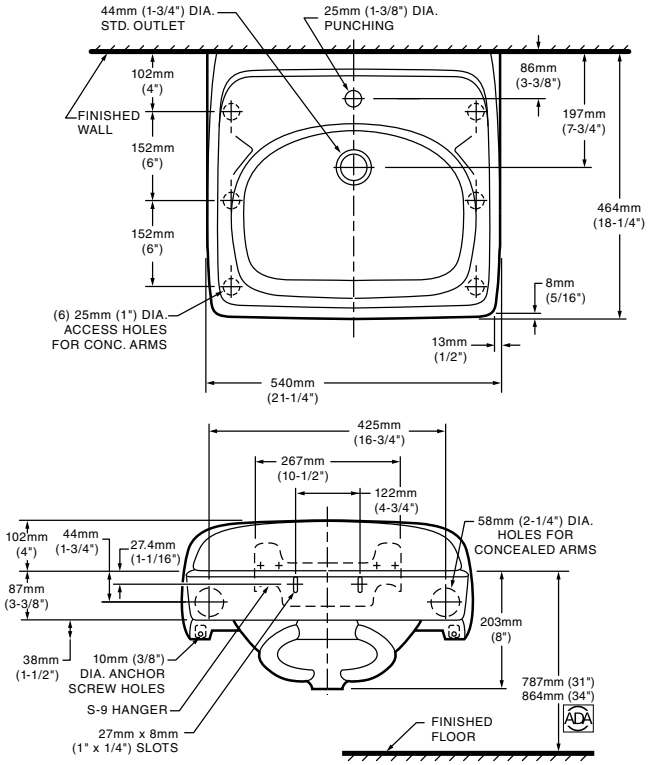
IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

ADA **MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 ACCESSIBLE AND USABLE BUILDINGS AND FACILITIES - CHECK LOCAL CODES.**
Top of front rim mounted 864mm (34") from finished floor.

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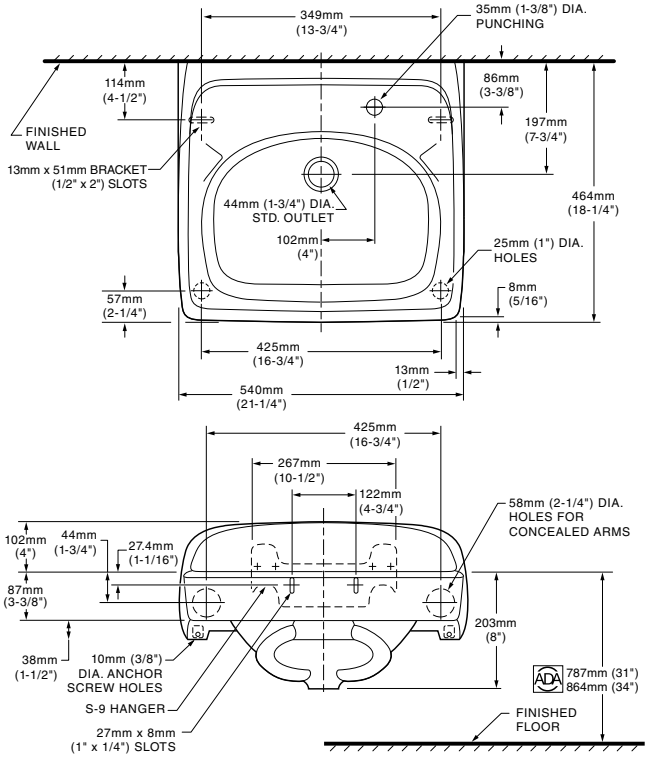
SINGLE CENTER HOLE CONFIGURATIONS

All Wall Hanger (included) or Concealed Arm Configurations



SINGLE CENTER HOLE ON RIGHT CONFIGURATIONS

All Wall Hanger (included) or Concealed Arm Configurations



NOTES:

***** DIMENSIONS SHOWN FOR LOCATION OF SUPPLIES AND “P” TRAP ARE SUGGESTED. PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORTS. FITTINGS NOT INCLUDED AND MUST BE ORDERED SEPARATELY. CONCEALED ARM SUPPORT AS REQUIRED TO BE FURNISHED BY OTHERS.

IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 ACCESSIBLE AND USABLE BUILDINGS AND FACILITIES - CHECK LOCAL CODES.
Top of front rim mounted 864mm (34") from finished floor.

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Just Mfg Stainless Steel 22" x 19-1/2" x 5-1/2" Single Bowl Drop-in ADA Sink

SPECIFICATIONS

Model(s) SLADA1921A55-J

PRODUCT SPECIFICATIONS

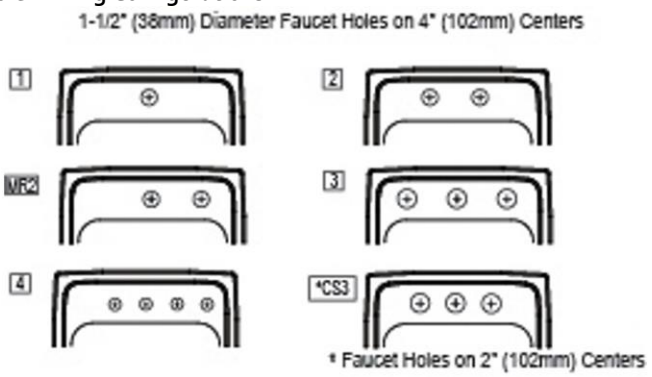
Just Mfg Stainless Steel 22" x 19-1/2" x 5-1/2" Single Bowl Drop-in ADA Sink. Sink is manufactured from 18 gauge 304 Stainless Steel with a Lustrous Satin finish, Rear Center drain placement, and Bottom only pads.

Installation Type:	Drop-in
Material:	304 Stainless Steel
Finish:	Lustrous Satin
Gauge:	18
Sound Deadening:	Bottom only pads
Number of Bowls:	1
Sink Dimensions:	22" x 19-1/2" x 5-1/2"
Bowl 1 Dimensions:	18" x 14" x 5-3/8"
Drain Size:	3-1/2" (89mm)
Drain Location:	Rear Center
Minimum Cabinet Size:	27"
Cutout Template #:	1000001255

Template is available for download at justmfg.com. CAD software will be required to open the template.

Cutout Dimensions for Drop-in Installation:
21-3/8" x 18-7/8" (543mm x 479mm) with 1-1/2" (38mm) corner radius

Hole Drilling Configurations:



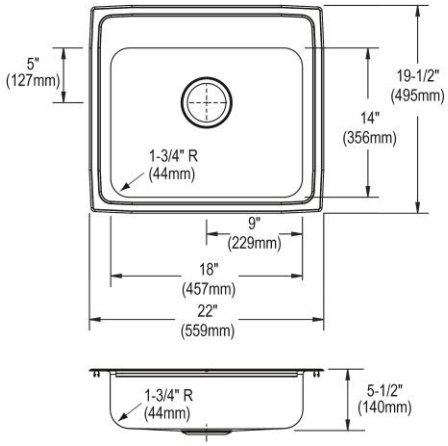


Quality Grade Plumbing Products.
Since 1933 we have become the industry standard for designing and producing quality grade plumbing products and fixtures. Our role as an industry leader remains unsurpassed.

Product Compliance: ASME A112.19.3/CSA B45.4
ADA & ICC A117.1

Complies with ADA & ICC A117.1 accessibility requirements when installed according to the requirements outlined in these standards.

Clean and Care Manual (PDF)
Installation Instructions (PDF) - 2000000856
Warranty (PDF)



PART:_____QTY: _____

PROJECT:_____

CONTACT:_____

DATE:_____

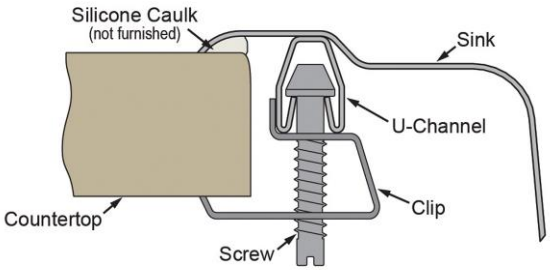
NOTES:_____

APPROVAL:_____

In keeping with our policy of continuing product improvement, Just Mfg reserves the right to change product specifications without notice. Please visit justmfg.com for the most current version of Just Mfg product specification sheets. This specification describes a product with design, quality, and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

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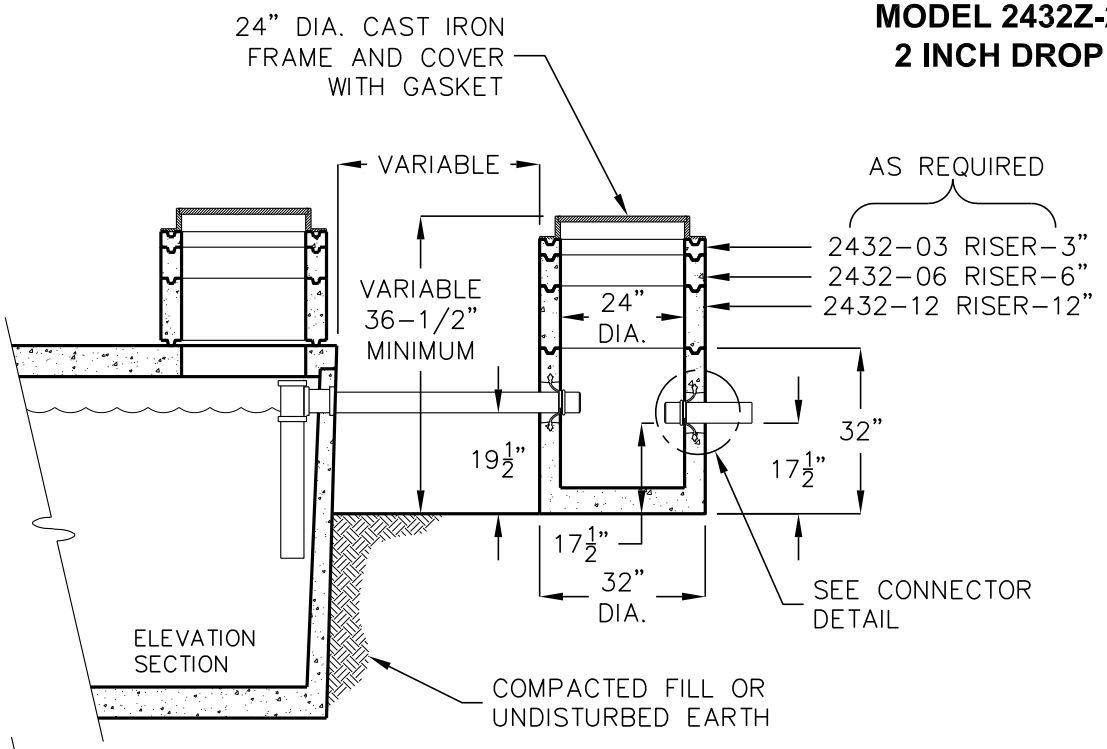
Installation Profile:

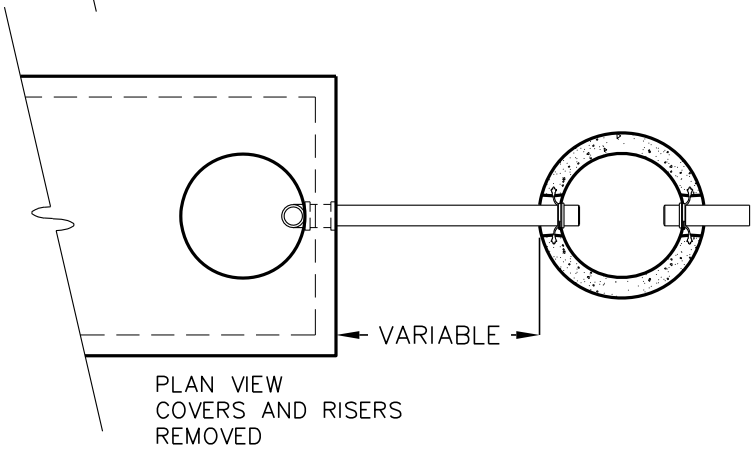


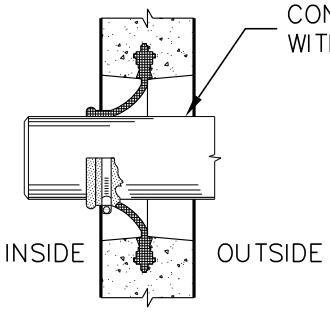
In keeping with our policy of continuing product improvement, Just Mfg reserves the right to change product specifications without notice. Please visit justmfg.com for the most current version of Just Mfg product specification sheets. This specification describes a product with design, quality, and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

24" DIA. SAMPLE BOX WITH PIPE CONNECTORS

MODEL 2432Z-2
2 INCH DROP







PIPE CONNECTOR (Z-LOK) DETAIL

PIPE CONNECTOR CAST INTEGRALLY IN WALL.
PIPE O.D. (INCHES)
4.25" MINIMUM TO 6.25" MAXIMUM

SEE Z-LOK PIPE CONNECTOR PAGE FOR ADDITIONAL INFORMATION

SAMPLE BOX WEIGHT: 1,250 LBS.
BOX DESIGN LOAD: H-20 TRAFFIC

SAMPLE BOX MUST BE PLACED ON SUITABLE BASE OF COMPACTED SOIL OR UNDISTURBED EARTH IN TRAFFIC CONDITION.

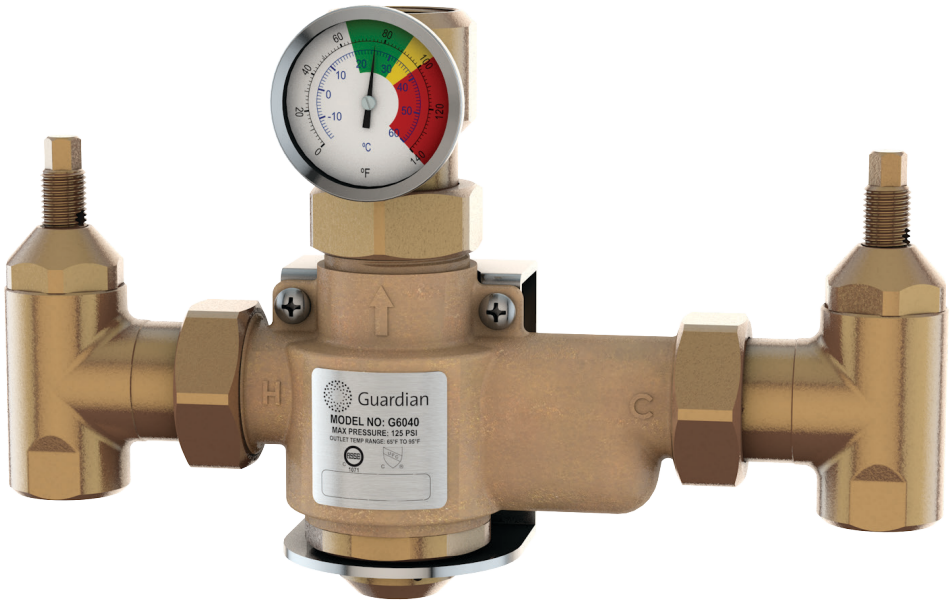
FOR COMPLETE DESIGN AND PRODUCT INFORMATION CONTACT JENSEN PRECAST.

A Jensen Precast reserves the right to make changes to product design and/or dimensions without notice. Please contact Jensen Precast whenever necessary for confirmation or advice on product design.

5/13/2020
D2432Z-2 SAMPLE BOX_A.DWG
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JENSEN PRECAST EST. 1968

G6040 Thermostatic Mixing Valve, 50 Gallon/189 Liter Capacity



Application: Thermostatic mixing valve to blend hot and cold water to deliver tepid water. Valve has flow capacity of 50 gallons (189 liters) per minute at 30 PSI (2.1 bar) pressure drop. Valve can be used to supply emergency shower or combination safety station. Depending on water supply size and pressure, valve can supply multiple units.

Mounting: Valve inlets can be positioned on top, back or bottom of valve. Outlet can be on top or bottom. Valve can be configured in the field for any mounting position. Furnished with heavy duty stainless steel mounting bracket.

Temperature Control: Valve has precision thermal actuator that senses incoming water temperature and automatically blends water to preset temperature. Valve is factory set to deliver 85°F (29°C) water. Temperature of tepid water can be adjusted as required and then locked. Furnished with dial temperature gauge as standard to monitor temperature of tepid water.

Cold Water Bypass: If the supply of hot water is restricted or interrupted, an internal bypass allows the valve to deliver cold water only. In bypass mode, the valve delivers 38 GPM (144 L/min) at 30 PSI (2.1 bar) pressure drop.

Hot Water Shutoff: Valve has internal PTFE valve seat. If the supply of cold water is interrupted, the valve will close completely and *not deliver any water at all,* eliminating any possibility of scalding.

Flow Capacity: Refer to table below for flow capacity of valve at specified pressure drops.

Checkstops/Filters: Each inlet has a lockable shutoff valve for maintenance, internal check valve to prevent backflow and stainless steel basket filter to remove debris from the water flow.

Construction: Valve meets the requirements of the U.S. Safe Drinking Water Act as lead-free.

Inlet/Outlet: 1" NPT female inlets and 1-1/4" NPT female outlet as standard.

Quality Assurance: Valve is ASSE certified under ANSI/ASSE 1071. Valve is fully assembled and factory tested prior to shipment.

Water Pressure/Temperature Requirements

Supply Pressure: Maximum incoming water pressure is 125 PSI (8.6 bar). Pressure of hot and cold water supplies can vary up to 25% and still deliver the flow and temperature required by ANSI/ASSE 1071.

Hot Water Supply Temperature: Incoming hot water temperature range is 120° - 180°F (49° - 82°C). Guardian recommends that the hot water temperature not exceed 140°F (60°C).

Cold Water Supply Temperature: Incoming cold water temperature range is 40° - 70°F (4° - 21°C). Cold water temperature must be at least 10°F (5.6°C) less than the temperature of the delivered tepid water.

Tepid Water Temperature: Temperature of tepid water is adjustable within a range of 65° - 95°F (18° - 35°C) and then locks in position. High temperature limit stop is set at 90°F (32°C) to prevent misadjustment.

G6040 Thermostatic Mixing Valve, 50 Gallon/189 Liter Capacity

Pressure Drop (PSI)	1	5	10	15	20	25	30	35	40
Flow Rate (GPM)	0.5	17	28	34	41	46	50	55	59
Bypass Flow Rate (GPM)	0.5	13	20	25	30	34	38	41	45

Pressure Drop (Bar)	0.1	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.8
Flow Rate (L/min)	2	64	106	129	155	174	189	208	223
Bypass Flow Rate (L/min)	2	49	76	95	114	129	144	155	170

Ordering Information

Models

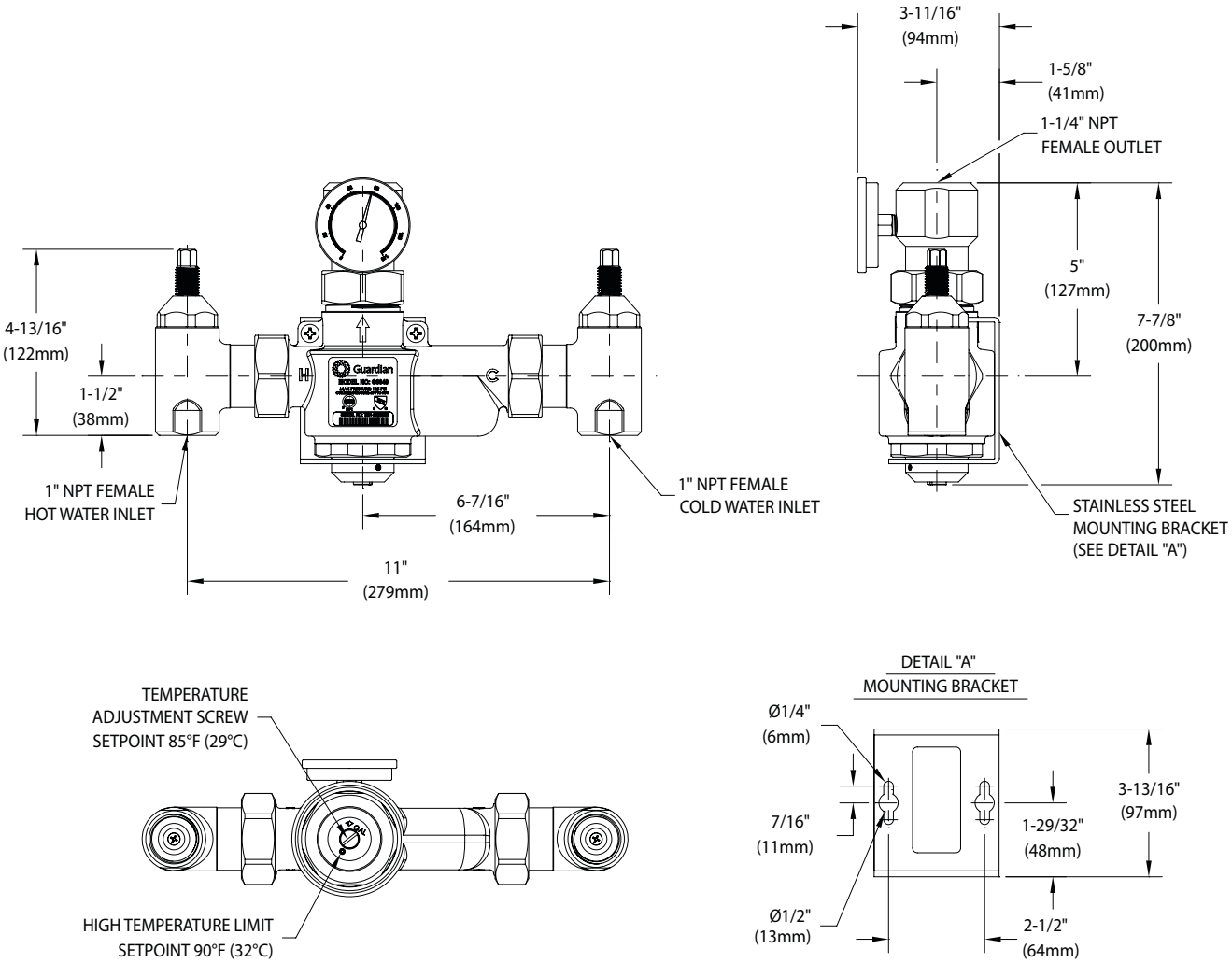
☐	G6040	Thermostatic Mixing Valve, 50 Gallon/189 Liter Capacity
☐	G6041-XXX	G6040 valve installed in surface mounted powder coated steel cabinet
☐	G6042-XXX	G6040 valve installed in surface mounted stainless steel cabinet
☐	G6043-XXX	G6040 valve installed in recess mounted powder coated steel cabinet
☐	G6044-XXX	G6040 valve installed in recess mounted stainless steel cabinet

Available Options

☐	Finish	Chrome plated finish in place of raw brass (add suffix “CP”)
☐	Inlet/Outlet Threads	G1 female thread on inlets and G1-1/4 female thread on outlet (add suffix “G”)
☐	Temperature Gauges	Temperature gauges on hot and cold water inlets (add suffix “IT”)
☐	Pressure Gauges	Pressure gauges on hot and cold water inlets (add suffix “IP”)
☐	Temperature/Pressure Gauges	Temperature and pressure gauges on hot and cold water inlets (add suffix “ITP”)

Note: *Installation of temperature and/or pressure gauges will change rough-in dimensions of valve. Contact factory for catalog drawing.*

G6040 Thermostatic Mixing Valve, 50 Gallon/189 Liter Capacity



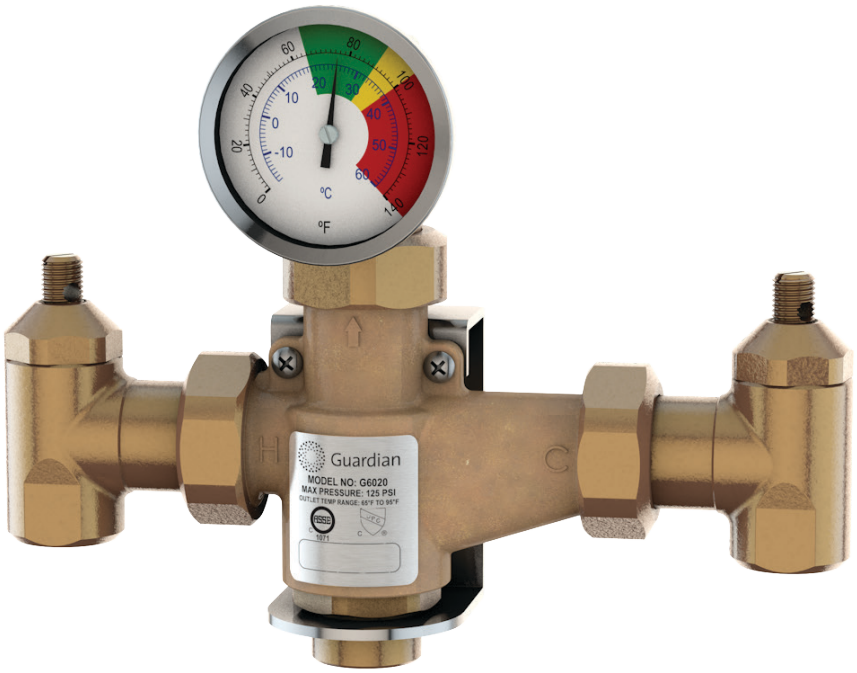
Notes:

1. ANSI Z358.1-2014 states that the water temperature delivered by emergency equipment should be “tepid”. Tepid is defined as 60°F - 100°F (16°C - 38°C). However, in circumstances where a chemical reaction can be accelerated by water temperature, a medical professional should be consulted to determine the optimum water temperature for the application.
2. For thermostatic mixing valves to deliver the required water temperature and volume, the system must be sized correctly. Please refer to the flow capacity, pressure and temperature requirements herein when designing the tepid water system.
3. Valve is factory set to deliver 85°F (29°C) tepid water. Depending on pressure and temperature of the incoming water supplies, this setting may require adjustment in the field. The adjustment screw is locked in position after adjusting.
4. Thermostatic mixing valves, like all emergency equipment, must be installed in accordance with the manufacturer’s instructions and maintained on a regular basis. Per ANSI Z358.1-2014, all emergency equipment should be activated weekly and inspected at least annually. Thermostatic mixing valves should be treated the same.
5. Per ANSI Z358.1-2014, plumbed emergency equipment must be connected to a potable water supply. This valve meets the requirements of the U.S. Safe Drinking Water Act as lead-free and is safe for use with potable water.
6. This valve is supplied with shutoff valves. Per ANSI Z358.1-2014, if shutoff valves are installed on the water supply to emergency equipment, the valves must be lockable to prevent unauthorized shutoff. Accordingly, each shutoff valve stem on this valve has a hole for installing a lock to secure the stem in the open position.

THIS SPACE FOR ARCHITECT/ENGINEER APPROVAL

Due to continuing product improvement, the information contained in this document is subject to change without notice. All dimensions are ± 1/4” (6mm). Rev. 022420

G6020 Thermostatic Mixing Valve, 13 Gallon/49 Liter Capacity



Application: Thermostatic mixing valve to blend hot and cold water to deliver tepid water. Valve has flow capacity of 13 gallons (49 liters) per minute at 30 PSI (2.1 bar) pressure drop. Valve can be used to supply emergency eyewash, eye/face wash or drench hose unit. Depending on water supply size and pressure, valve can supply multiple units.

Mounting: Valve inlets can be positioned on top, back or bottom of valve. Outlet can be on top or bottom. Valve can be configured in the field for any mounting position. Furnished with heavy duty stainless steel mounting bracket.

Temperature Control: Valve has precision thermal actuator that senses incoming water temperature and automatically blends water to preset temperature. Valve is factory set to deliver 85°F (29°C) water. Temperature of tepid water can be adjusted as required and then locked. Furnished with dial temperature gauge as standard to monitor temperature of tepid water.

Cold Water Bypass: If the supply of hot water is restricted or interrupted, an internal bypass allows the valve to deliver cold water only. In bypass mode, the valve delivers 9 GPM (34 L/min) at 30 PSI (2.1 bar) pressure drop.

Hot Water Shutoff: Valve has internal PTFE valve seat. If the supply of cold water is interrupted, the valve will close completely and *not deliver any water at all*, eliminating any possibility of scalding.

Flow Capacity: Refer to table below for flow capacity of valve at specified pressure drops.

Checkstops/Filters: Each inlet has a lockable shutoff valve for maintenance, internal check valve to prevent backflow and stainless steel basket filter to remove debris from the water flow.

Construction: Valve meets the requirements of the U.S. Safe Drinking Water Act as lead-free.

Inlet/Outlet: 1/2" NPT female inlets and outlet as standard.

Quality Assurance: Valve is ASSE certified under ANSI/ASSE 1071. Valve is fully assembled and factory tested prior to shipment.

Water Pressure/Temperature Requirements

Supply Pressure: Maximum incoming water pressure is 125 PSI (8.6 bar). Pressure of hot and cold water supplies can vary up to 25% and still deliver the flow and temperature required by ANSI/ASSE 1071.

Hot Water Supply Temperature: Incoming hot water temperature range is 120° - 180°F (49° - 82°C). Guardian recommends that the hot water temperature not exceed 140°F (60°C).

Cold Water Supply Temperature: Incoming cold water temperature range is 40° - 70°F (4° - 21°C). Cold water temperature must be at least 10°F (5.6°C) less than the temperature of the delivered tepid water.

Tepid Water Temperature: Temperature of tepid water is adjustable within a range of 65° - 95°F (18° - 35°C) and then locks in position. High temperature limit stop is set at 90°F (32°C) to prevent misadjustment.

G6020 Thermostatic Mixing Valve, 13 Gallon/49 Liter Capacity

Pressure Drop (PSI)	1	5	10	15	20	25	30	35	40
Flow Rate (GPM)	3	5	7	8	10	11	13	13	14
Bypass Flow Rate (GPM)	3	4	5	6	7	8	9	9	10

Pressure Drop (Bar)	0.1	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.8
Flow Rate (L/min)	11	19	26	30	38	42	49	49	53
Bypass Flow Rate (L/min)	11	15	19	23	26	30	34	34	38

Ordering Information

Models

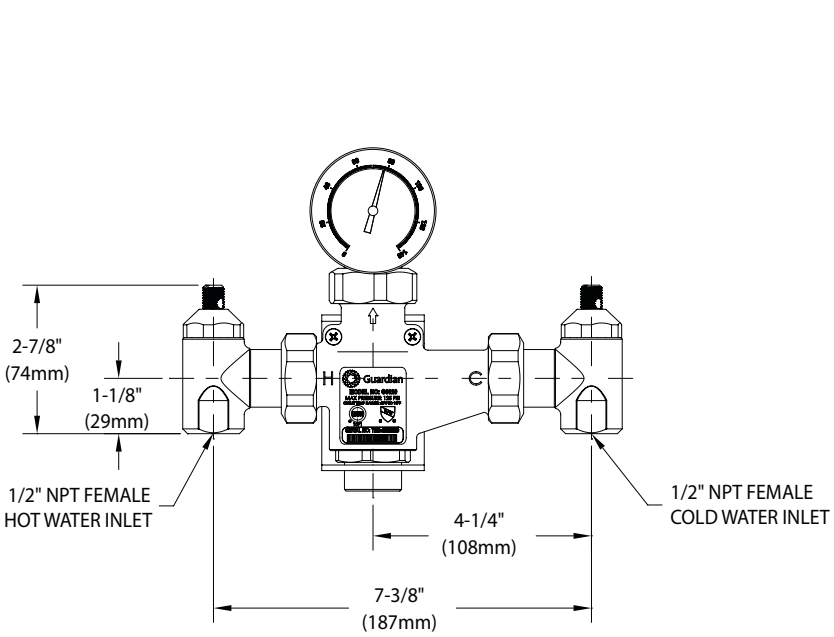
☐	G6020	Thermostatic Mixing Valve, 13 Gallon/49 Liter Capacity
☐	G6021-XXX	G6020 valve installed in surface mounted powder coated steel cabinet
☐	G6022-XXX	G6020 valve installed in surface mounted stainless steel cabinet
☐	G6023-XXX	G6020 valve installed in recess mounted powder coated steel cabinet
☐	G6024-XXX	G6020 valve installed in recess mounted stainless steel cabinet

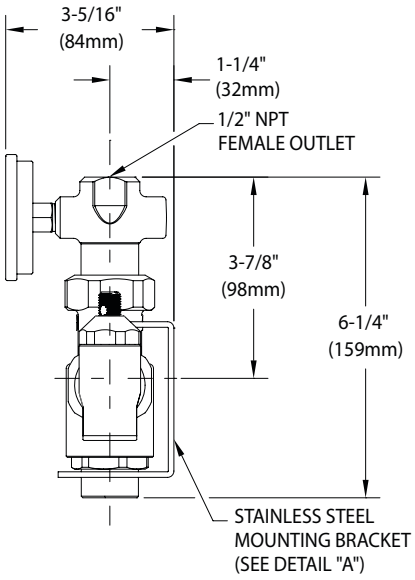
Available Options

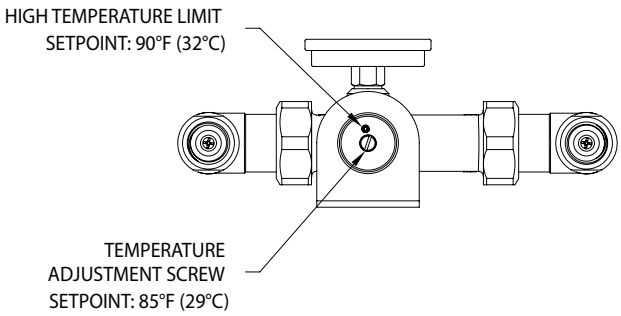
☐	Finish	Chrome plated finish in place of raw brass (add suffix “CP”)
☐	Inlet/Outlet Threads	G1/2 female thread on inlets and outlet (add suffix “G”)
☐	Temperature Gauges	Temperature gauges on hot and cold water inlets (add suffix “IT”)
☐	Pressure Gauges	Pressure gauges on hot and cold water inlets (add suffix “IP”)
☐	Temperature/Pressure Gauges	Temperature and pressure gauges on hot and cold water inlets (add suffix “ITP”)

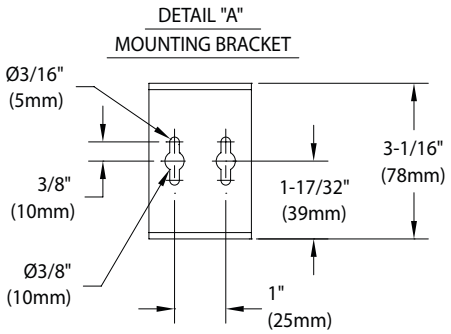
Note: *Installation of temperature and/or pressure gauges will change rough-in dimensions of valve. Contact factory for catalog drawing.*

G6020 Thermostatic Mixing Valve, 13 Gallon/49 Liter Capacity









Notes:

1. ANSI Z358.1-2014 states that the water temperature delivered by emergency equipment should be “tepid”. Tepid is defined as 60°F - 100°F (16°C - 38°C). However, in circumstances where a chemical reaction can be accelerated by water temperature, a medical professional should be consulted to determine the optimum water temperature for the application.
2. For thermostatic mixing valves to deliver the required water temperature and volume, the water system must be sized correctly. Please refer to the flow capacity, pressure and temperature requirements herein when designing the tepid water system.
3. Valve is factory set to deliver 85°F (29°C) tepid water. Depending on pressure and temperature of the incoming water supplies, this setting may require adjustment in the field. The adjustment screw is locked in position after adjusting.
4. Thermostatic mixing valves, like all emergency equipment, must be installed in accordance with the manufacturer’s instructions and maintained on a regular basis. Per ANSI Z358.1-2014, all emergency equipment should be activated weekly and inspected at least annually. Thermostatic mixing valves should be treated the same.
5. Per ANSI Z358.1-2014, plumbed emergency equipment must be connected to a potable water supply. This valve meets the requirements of the U.S. Safe Drinking Water Act as lead-free and is safe for use with potable water.
6. This valve is supplied with shutoff valves. Per ANSI Z358.1-2014, if shutoff valves are installed on the water supply to emergency equipment, the valves must be lockable to prevent unauthorized shutoff. Accordingly, each shutoff valve stem on this valve has a hole for installing a lock to secure the stem in the open position.

THIS SPACE FOR ARCHITECT/ENGINEER APPROVAL

Due to continuing product improvement, the information contained in this document is subject to change without notice. All dimensions are ± 1/4” (6mm). Rev. 022420

Madera™ FloWise® 16-1/2" Height Elongated Flushometer Toilet

VITREOUS CHINA with EVERCLEAN®

BARRIER FREE

Madera™ FloWise® 16-1/2" Height Elongated with EverClean®

- Floor mount flushometer valve toilet
- Vitreous china
- High Efficiency, Low Consumption. Operates in the range of 1.1 gpf to 1.6 gpf (4.2 Lpf to 6.0 Lpf)
- Meets definition of HET (High Efficiency Toilet) when used with a high efficiency flush valve (1.1 gpf, 1.28 gpf or 1.6 / 1.1 gpf dual flush)
- Permanent EverClean® surface inhibits the growth of stain and odor-causing bacteria, mold, and mildew on the surface
- Fully glazed 2-1/8" trapway
- Elongated bowl
- 10" or 12" roughing-in
- 16-1/2" rim height for accessible application
- Condensation channel prevents water from dripping on the floor
- Powerful direct-fed siphon jet action
- 10" x 12" water surface area
- 1-1/2" inlet spud
- 2 bolt caps included
- Tested to support static weight load of 2,500 lbs. (1,134kg)

❏ **3461.001** Elongated bowl only, top spud
❏ **3462.001** Elongated bowl only, top spud with slotted rim for bedpan holding
❏ **3465.001** Elongated bowl only, top spud with 4 bolts
❏ **3466.001** Elongated bowl only, top spud with slotted rim for bedpan holding with 4 bolts
❏ **3463.001** Elongated bowl only, back spud
❏ **3464.001** Elongated bowl only, back spud with slotted rim for bedpan holding

Component Parts:
❏ **047007-0070A** Inlet Spud (furnished with bowl)
❏ **034783-0200A** Bolt caps with retainers (furnished with bowl)

Nominal Dimensions:
718 x 356 x 419mm
(28-1/4" x 14" x 16-1/2")

Fixture only, less seat and flush valve

Compliance Certifications - Meets or Exceeds the Following Specifications:
- ASME A112.19.2 / CSA B45.1 for Vitreous China Fixtures

MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USABLE BUILDING FACILITIES - CHECK LOCAL CODES.



SEE REVERSE FOR ROUGHING-IN DIMENSIONS

System MaP* Score:
- 1,000 grams of miso @ 1.1 gpf, 1.28 gpf or 1.6 gpf when used with an American Standard flush valve

* Maximum Performance (MaP) testing performed by IAPMO R&T Lab. MaP Report conducted by Veritec Consulting, Inc. and Koeller and Company.

OPERATING PRESSURE:
25 psi (flowing) - 80 psi (static)

FLOW REQUIREMENT:
25 gpm (94.6 L/min.)

To Be Specified:
❏ Color: ❏ White
❏ Seat:
- ❏ American Standard #5901.100 Heavy duty open front less cover
- ❏ American Standard #5901.100SS Heavy duty open front less cover with EverClean®

❏ Flushometer Valve:

ENVIROMENTAL PRODUCT DECLARATION

When used with **1.1 or 1.28 gpf** toilet flush valves

EVERCLEAN

WATER EFFICIENT

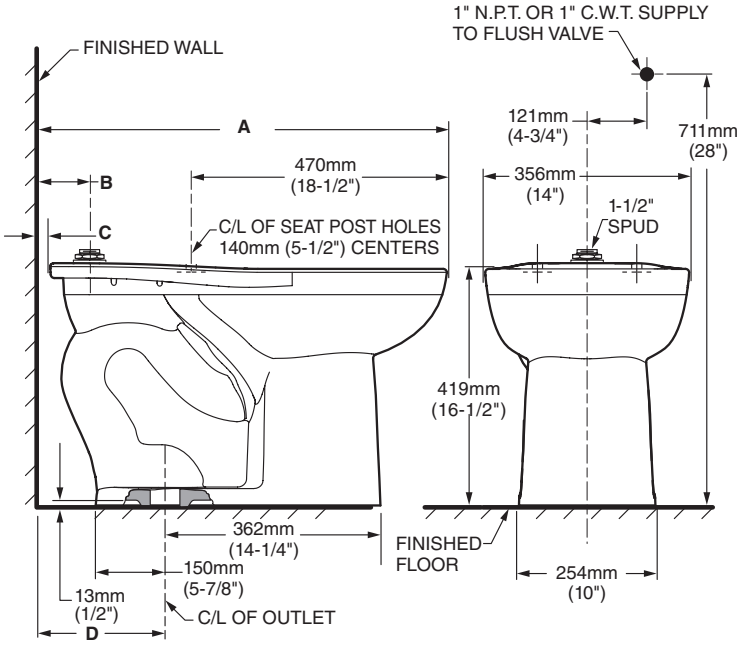
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Madera™ FloWise® 16-1/2" Height Elongated Flushometer Toilet

VITREOUS CHINA with EVERCLEAN®

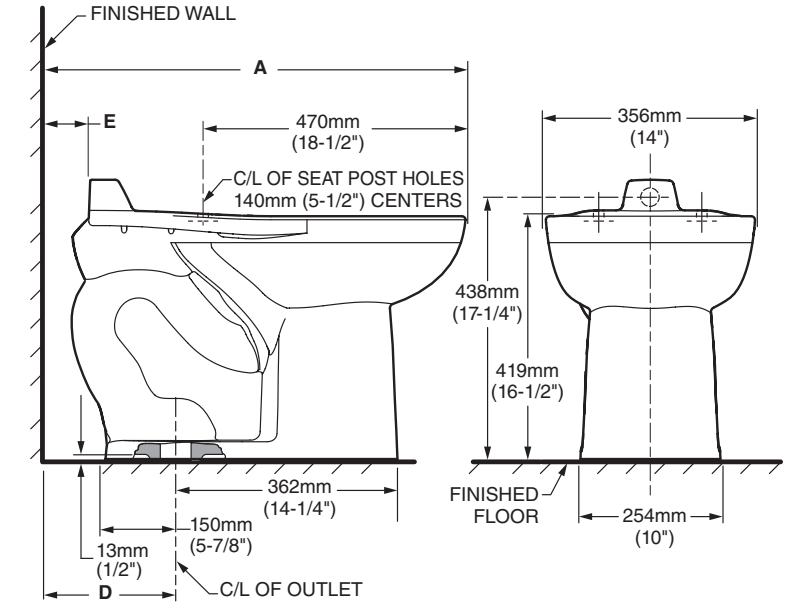
BARRIER FREE

3461.001/3462.001

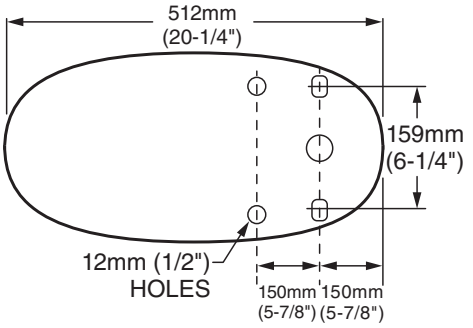


Dimension	10" (254mm) Rough	12" (305mm) Rough
A	718mm (28-1/4")	768mm (30-1/4")
B	102mm (4")	152mm (6")
C	25mm (1")	76mm (3")
D	254mm (10")	305mm (12")
E	76mm (3")	380mm (5")

3463.001/3464.001



3465.001/3466.001
4-BOLT ANCHOR DETAIL
(Bottom View of Bowl)



NOTES:

PRODUCT 3461 AND 3463 SHOWN, 3462 AND 3464 SAME EXCEPT WITH SLOTTED RIM FOR BED PAN HOLDING.

TO COMPLY WITH AREA CODE GOVERNING THE HEIGHT OF VACUUM BREAKER ON THE FLUSHOMETER VALVE, THE PLUMBER MUST VERIFY DIMENSIONS SHOWN FOR SUPPLY ROUGHING.

THIS TOILET DESIGNED TO ROUGH-IN AT A MINIMUM DIMENSION OF 254MM (10") AND A MAXIMUM DIMENSION OF 305MM (12") FROM FINISHED WALL TO C/L OF OUTLET.

FLUSHOMETER VALVE NOT INCLUDED WITH FIXTURE AND MUST BE ORDERED SEPARATELY. FLUSHOMETER VALVE REQUIREMENTS FOR 12" (305MM) ROUGH-IN: SWEAT EXTENSION NIPPLE IS REQUIRED. REFER TO VALVE MANUFACTURER AND LOCAL CODES.

IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

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PART OF LIXIL

WH-1

Commercial Gas Water Heaters

CONSERVATIONIST® ULTRA-LOW NOX

CODE COMPLIANCE

- The Ultra-Low Nox atmospheric vent commercial gas water heater which meets the thermal efficiency and standby loss requirements of the U. S. Department of Energy and Current Edition ASHRAE/IESNA 90.1.

FULLY AUTOMATIC CONTROLS WITH SAFETY SHUTOFF

- Accurate, dependable control system requires no electric connections. Fixed automatic gas shutoff device for added safety. Not recommended for 180°F sanitizing.

HEAVY GAUGE STEEL JACKET

- Finished with baked enamel over bonderized undercoat.

GLASSLINED TANK

- Maximizes tank life.

FOAM INSULATION

- Saves fuel, helps reduce standby heat loss.

ULTRA-LOW NOX EMISSIONS

- Complies with SCAQMD Rule 1146.2 and other Air Quality Management Districts with similar requirements of 14 ng/J or 20 ppm.

EASY-TO-INSTALL

- Completely factory-assembled. Only gas, water and vent connections need to be made. All connections are located in front and top of heaters for ease-of-installation and service.

DRAFT HOOD

- Low profile draft hood furnished as standard equipment.

COREGARD™ ANODE ROD

- Our anode rods have a stainless steel core that extends the life of the anode rod allowing superior tank protection far longer than standard anode rods.

MAXIMUM WORKING PRESSURE

- 150 psi.

MAXIMUM GAS INLET PRESSURE

- 14" W.C.

HANDHOLE CLEANOUT

- Allows easy tank cleaning.

FEATURES

- Anodic protection
- Equipped with gas pressure regulator
- Integral automatic gas shutoff system prevents excessive water temperature
- CSA Certified and ASME Rated T&P Relief Valve

3-YEAR LIMITED TANK / 1-YEAR LIMITED PARTS WARRANTY

- For complete warranty information, consult written warranty or contact A. O. Smith.



Low Lead Content

GAS-FIRED

LISTED

AHRI CERTIFIED

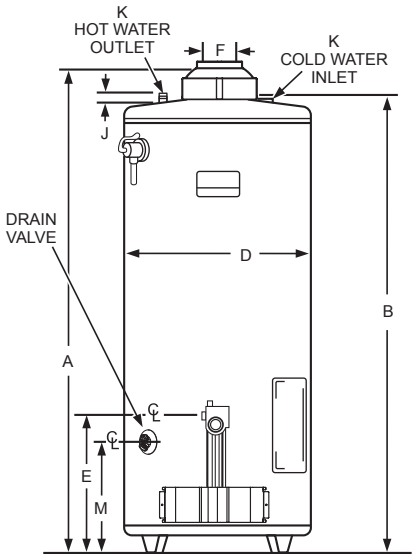
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Commercial Gas Water Heaters

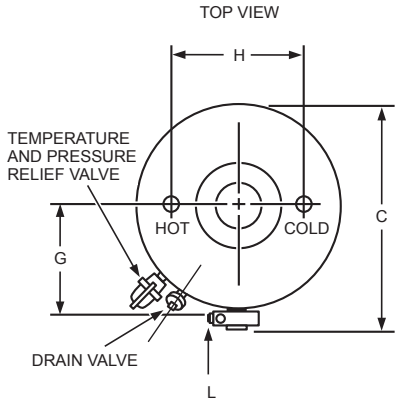
Recovery Ratings														
Model	Input Rate	Recovery in US Gallons/hr or Liters/he at Indicated Temperature Rise in Fahrenheit or Celsius												
BL-80**	75,100 BTU/h	°F	30	40	50	60	70	80	90	100	110	120	130	140
		GPH	243	182	146	121	104	91	81	73	66	61	56	52
	22 kW	°C	17	22	28	33	39	44	50	56	61	67	72	78
		LPH	919	689	551	459	394	345	316	276	251	230	212	197
BL-100*	75,100 BTU/h	°F	30	40	50	60	70	80	90	100	110	120	130	140
		GPH	246	184	147	123	105	92	82	74	67	61	57	53
	22 kW	°C	17	22	28	33	39	44	50	56	61	67	72	78
		LPH	930	698	558	465	399	349	310	279	254	233	215	199

* Recovery rating based on 81% thermal efficiency
** Recovery rating based on 80% thermal efficiency

Dimensions														
Model	Units	A	B	C	D	E	F	G	H	J	K	L	M	Approx. Shipping Weight
BL-80	Inches	62-1/16	58	29-1/2	25-1/4	15-7/8	4	15-1/4	16	2	1	1/2	12-1/2	285 lbs
	CM	157.6	147.3	74.9	64.1	40.3	10.2	38.7	40.6	5.1	NPT	NPT	31.8	129.2 kg
BL-100	Inches	70-1/2	66-1/2	30-15/16	27-3/4	15-3/16	4	15-3/4	16	1-1/4	1-1/4	1/2	11-15/16	350 lbs
	CM	179.1	168.9	78.6	70.5	38.6	10.2	40	40.6	3.2	NPT	NPT	30.3	158.8 kg



FRONT VIEW



GAS INLET

SPECIFICATION

Water heater(s) shall be Model _____ as manufactured by A. O. Smith or an approved equal. Water heater(s) shall be of glasslined design, equipped to burn _____ gas and design certified by UL. Heaters must meet all applicable energy codes and comply with ultra-low NOx emissions of 14 ng/J or 20 ppm. Heaters shall have an input rating of _____ BTU/H and a recovery capacity of _____ GPH at a temperature rise of 100°F with a storage capacity of _____ gallons. Heater shall be equipped with a 2-3/4" x 3-3/4" boiler-type handhole cleanout and shall have a working pressure of 150 psi. Heater(s) shall be provided with an automatic gas shutoff device and safety shutoff in event pilot flame is extinguished; a gas pressure regulator set for the type of gas supplied; an approved draft hood, and extruded anode rod rigidly supported for cathodic protection. A CSA Certified and ASME Rated T&P Relief Valve shall be furnished and installed by the manufacturer. The tank shall be foam insulated. The outer jacket shall have a baked enamel finish over a bonderized undercoating. Fully illustrated instruction manual and parts list to be included. All internal surfaces of the heater(s) exposed to water shall be glasslined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature range of 1400° to 1600°F. Heater shall have a three year limited tank and one year limited parts warranty against corrosion and tank failure due to sediment build-up as outlined in the written warranty. Heater(s) shall be design certified by UL. Operation of the heater in a closed system where thermal expansion has not been compensated for with a properly sized expansion tank will void the warranty.

For technical information, call 800-527-1953. A. O. Smith Corporation reserves the right to make product changes or improvements without prior notice.

SECTION 23 00 10 – MECHANICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions and Supplementary Conditions shall apply to and form part of this Division.

1.2 SUMMARY

A. Work includes, but is not limited to, the following:

1. Labor, material, equipment and transportation to complete the Work as shown on the drawings, specified herein and/or implied thereby.
2. A requirement of the plumbing sections shall be to provide make-up water and drain final connections to systems and equipment.
3. It is the intent of the project that the installation be coordinated to provide a complete and usable facility.

B. Work not included in this division:

1. Painting, except as hereinafter specified. See Division 9 for painting.
2. Electrical, except for controls hereinafter specified. See Division 26 for electrical.

C. Related Sections include the following:

1. Division 1 Section 01 91 13 “General Commissioning Requirements.”
2. Division 23 Section 23 00 50 “Basic Mechanical Materials and Methods.”

1.3 DEFINITIONS

A. Unless otherwise specified, "all clarification from," "field direction by," "submittals to," "approved by," "processed by," "permission from," and like mentioned herein shall mean from/by/to Architect.

B. "Provide" means furnish and install referenced item with all appurtenances.

C. "Shall" indicates a mandatory requirement.

D. "Air conditioning" is defined as the treatment and/or handling of any air to any degree by the systems shown on the drawings and herein specified and is not restricted to refrigerated cooling.

1.4 DELIVERY AND STORAGE OF MATERIALS

A. Provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage from any cause whatever, and provide adequate and proper storage facilities during the progress of the work. Replace all damaged and defective work, material or equipment prior to filing application for final acceptance. Properly protect all openings to equipment, piping, ductwork, accessories, etc. from dirt, dust, and debris prior to and during installation of the work. Ductwork stored at the jobsite shall be covered to protect from dirt, dust, debris, fire proofing, etc.

1.5 CODES AND STANDARDS

A. Work and materials shall be in full accordance with the latest rules and regulations of the State Fire Marshal; the California Electric Code (CEC); the California Plumbing Code; California Administrative Code, Title 24, (CAL/OSHA); the California Mechanical Code; Volume I and II of the California Building Code; SMACNA “Guidelines for Seismic Restraints of Mechanical Systems”; and other applicable codes, laws or regulations of bodies lawfully empowered and having jurisdiction over this project. Nothing in the plans or specifications shall be construed to permit work not conforming to these codes. When codes conflict with one another, provide larger, higher or more restrictive standards without additional costs.

1.6 PERMITS

A. Obtain all permits, patent rights, and licenses that are required for the performing of this work by all laws, ordinances, rules and regulations, or orders of any officer and/or body. Provide all notices necessary in connection therewith, and pay all fees relating thereto and all costs and expenses incurred on account thereof. No work shall be covered before inspection by the jurisdictional authorities and observation by the Architect or the owner’s designated representatives.

1.7 EXPLANATION AND PRECEDENCE OF DRAWINGS

A. Drawings and specifications are intended to be read together so that any work mentioned in one and not the other shall be executed the same as if mentioned in both.

B. For purposes of clearness and legibility, drawings are essentially diagrammatic. The size and location of equipment is drawn to scale wherever possible. Contractor shall make use of data in the contract documents and shall verify this information at the building site.

C. Where the contract specifications and/or drawings are in conflict, obtain clarification of such during bidding. Where addenda for clarification of such is not timely, base the bid on the higher standards or more restrictive requirements; prior to fabrication, obtain written clarification.

D. The drawings indicate required size and points of termination of pipes, and suggest proper routes to conform to structure, avoid obstructions and preserve clearances. It is not intended that drawings indicate necessary offsets. The Contractor shall make the installation in such a

manner as to conform to the structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or costs to the Owner.

E. It is intended that apparatus be located symmetrical with architectural elements. Refer to architectural details in completing the correlating work.

F. The Contractor shall study drawings and specifications including, and not limited to, architectural, structural, mechanical, plumbing, fire protection, and electrical to determine conflict with ordinances and statutes. Errors or omissions shall be reported in writing, and changes shall be included in the as-built drawings and the additional work performed at no cost to the Owner.

G. Submittal of bid shall indicate the Contractor has examined the site and drawings and has included required allowances in his bid. No allowance shall be made for any error resulting from Contractor's failure to visit job site and to review drawings and specifications. Bid shall include costs for required drawings and changes as outline above, all at no cost to owner.

1.8 RECORD DRAWINGS

A. In addition for requirements for shop drawings specified elsewhere, provide and maintain on the job one complete set of blue line prints of the record drawings for all the mechanical and plumbing work. Carefully record on this set of prints, work including piping, valves, etc., which is installed differently from that indicated in the specifications and on the drawings; locate dimensionally from fixed points. The depth shall be indicated for all plugged wyes, tees and capped lines.

B. These record drawings shall be continuously kept up-to-date, and shall be available for inspection at all times. Existing lines discovered shall be indicated on these drawings.

C. At completion of work, provide a neat and legible reproducible set of these up-to-date record drawings which shall be individually signed and dated by the Contractor and the job inspector as to their accuracy.

D. Record drawings shall be submitted for acceptance and approval to the Architect and Mechanical Engineer before final certificate of acceptance will be issued.

E. Record drawings shall show the exact location of all control sensor devices.

1.9 CUTTING AND PATCHING

A. Perform all cutting and fitting required for work of this section in rough construction of the building. Obtain permission of the Structural Engineer prior to cutting any structural building elements.

B. All patching of finished construction of building shall be performed under the sections of specifications covering these materials by the trades at no additional cost to the Owner.

C. All cutting of concrete work by Contractor shall be by core drilling or concrete saw. No cutting or coring shall be done without first obtaining the permission of the Architect and Owner.

D. All patching of existing surfaces shall match existing material and finish.

1.10 DAMAGE BY LEAKS

A. Contractor shall be responsible for damage to the grounds, walks, roads, buildings, finishes, surfaces, materials, equipment, piping systems, electrical systems and their equipment and contents, caused by leaks in the piping systems being installed or having been installed herein. He shall repair at his expense all damage so caused. All repair work shall be done as directed by the Architect and Owner.

1.11 EMERGENCY REPAIRS

A. The Owner reserves the right to make emergency repairs as required to keep equipment in operation without voiding the Contractor's guarantee bond nor relieving the Contractor of his responsibilities.

1.12 LOCATIONS

A. Coordinate in advance of the work, requirements for openings, equipment maintenance clearances, recesses and chases in the walls, partitions, equipment housekeeping pads, framing or openings. Should furnishing this information be neglected, delayed or incorrect and additional cutting is found to be required, the cost of same shall be borne by the Contractor. Nothing in this paragraph shall be construed to relieve the Contractor of the responsibility for providing and paying for the required core drilling and openings in existing work.

B. Diagrammatic Indications on Drawings are:

1. Approximate only.
2. At various locations shown distorted for clarity.

C. Exact Locations Shall:

1. Be as required for proper installation in available space.
2. Avoid interference with architectural, electrical and structural features.
3. Be coordinated with the work of other trades toward the general purpose of having the work progress rapidly and smoothly with a minimum interference between one trade and another.
4. Preserve headroom and keep openings and passageways clear.
5. Have a neat arrangement symmetrical to the building lines, light and tile pattern.
6. Be reasonably accessible for hung ceiling areas for maintenance from the floor below. Equipment, valves, and other items requiring maintenance, adjustment and/or observation shall be accessible.

1.13 SUPPORTS, EQUIPMENT PADS, STAGING, ETC.

A. Construction supports required for the proper installation of equipment shall be in accordance with the drawings, manufacturer's requirements, seismic requirements, and applicable codes. Check architectural and structural drawings for equipment pads by others. Provide staging, scaffolds, platforms, ladders or similar facilities required to properly install the work.

1.14 INTERRUPTION OF UTILITIES

A. The Contractor shall schedule and coordinate all interruptions of utilities with the Architect and Owner within 30 days after award of contract. The Contractor shall submit to the Owner a schedule of proposed interruptions. At least 72 hours prior to the interruption, the contractor shall submit a request indicating the proposed date and duration of interruption, the work to be accomplished, the areas which will be affected and a proposed contingency plan to be followed in the event that normal service or facilities cannot be restored on schedule. Do not commence work until the time, date, and contingency have been approved in writing by the Architect and Owner.

B. Provide any labor and materials necessary to restore services on a contingency basis should normal service or facilities not be restored on schedule.

C. Preparatory work associated with each interruption shall be performed during normal work hours. The actual interruption required for tie-in shall be performed between 8 P.M. and 5 A.M. Maximum shutdown during this period of any system shall be 4 hours.

1.15 SUBSTITUTIONS

A. If substitutions of controls or equipment requires any changes in the architectural, structural, mechanical, plumbing or electrical work from that shown on the drawings(including all environmental characteristics), the extra cost of the equipment or architectural, structural, mechanical, plumbing or electrical work shall be responsibility of the Contractor requesting the substitution. All substitutions shall be approved by the Architect before purchase by the contractor.

B. If the Contractor proposes substitutions of any equipment specified herein or on the drawings, it shall be the Contractor's responsibility to obtain approval from the Architect for such equipment as well as approval for anchorage of such equipment from the Architect, Structural Engineer, and governing approval agencies (Department of the State Architects - DSA),. All costs required for such approval shall be the responsibility of the Contractor requesting the substitution.

1.16 PREPARATION OF SUBMITTALS

A. Refer to Division 1. In addition to the requirements of Division 1, provide the requirements specified herein.

B. Prior to commencement of work and in accordance with the General Requirements, submit for review six copies of proposed equipment and material submittals. The Contractor shall verify the delivery dates are compatible with the specified construction schedule; and verify the equipment is sized to accommodate the conditions specified. Submittals shall include manufacturer's names and model numbers and shall comply with specifications and drawings. The Contractor shall bear the cost of changes necessary to accommodate substitutions if substitution is approved.

C. Provide formal submittal to Architect. Review of the formal submittal is only for general conformance with design concept of project and general compliance with the information given in the contract documents. The Contractor is responsible for confirmation and correlation of the dimensions, quantities and sizes, for information that pertains to fabrication methods or construction techniques, and for coordination of work of all trades. Deviations from Drawings and Specifications shall be clearly and completely indicated (by a separate letter) in the formal submittals. Reviewed Submittals shall not relieve the Contractor of responsibility for errors or deviations.

1. Where specific model numbers and/or manufacturers are specified or shown, it is the intent of the contract documents to procure the specified item(s). Alternate equipment may not be used unless data is submitted for consideration as a substitution in accordance with General Requirements and this section.
2. Model numbers used may not indicate all features or options required for this specific installation. Modify the specified models to comply with the requirements, as specified or shown.
3. Product Data for Proposed Substitutions:

    a. Submit copies of complete data, with drawings and samples as appropriate, including:

        1) Comparison of the qualities of the proposed substitution with that specified.
        2) Changes required in other elements of the work because of the substitution.
        3) Affect on construction schedule.
        4) Cost data comparing the proposed substitution with the product specified.
        5) Availability of maintenance service and source of replacement materials.
        6) Reference to three (3) projects similar to this where such equipment is installed and operating to two (2) or more years.

    b. Acceptance of substitutions is entirely at the discretion of the Architect.

D. Formal submittals shall be complete with catalog data and information properly marked to indicate equality of material (where substitution is allowed and desired), adequacy in capacity and performance to meet minimum capacities or performance as specified or indicated. Arrange the submittals in the same sequence as these Specifications and indicate the Section and Paragraph number (in the upper right-hand side with tabs) for which each submittal is intended. Incomplete submittals shall be rejected.

E. Do not fabricate order or deliver materials or equipment until formal submittals have been approved. Where material or equipment is used without such permission, it is deemed that the material or equipment shall be in complete compliance with drawings and specifications,

without additional cost where such compliance is lacking and may be required to be altered in the field.

F. Submittals shall be bound and shall include, at a minimum, the following:

1. Complete bill of materials listing equipment furnished.
2. Catalog cut sheets of every component being provided (highlighted).
3. Provide completed blue-line shop drawings of the packaged equipment detailing all field connection points.
4. Dimensions, clearance requirements, weights, and capacities.
5. Wiring diagrams showing control interface as applicable.
6. Warranty sheets.
7. Pressure drops as applicable.

G. Contractor shall incur all costs for time spent by Engineer for review of more than two submittals on each item. Costs shall be based on Engineer's hourly billing rate schedule at the time of review. Rate schedule available upon request. Engineer shall invoice the contractor upon completion of review and shall be paid by the contractor within 30 days of date of invoice. Failure to remit will withdraw approval (if any) of submittals in question.

1.17 SHOP DRAWINGS:

A. Proceed with preparation of shop drawings immediately upon receiving an authorization to proceed for the project. Shop drawings shall be originally prepared by the contractor. Provide minimum 1/4" scale shop drawings in electronic format. Submit a complete set in one package prior to material fabrication, order and installation.

B. Include:

1. Duct and pipe elevations and sizes.
2. Double line ductwork and piping (4” and larger).
3. Actual size of purchased equipment from certified shop drawings.
4. Access panels including ceiling panels.
5. Access clearances for equipment.
6. Actual locations of ceiling diffusers/ supply registers ad return registers.
7. Actual locations of manual volume dampers.
8. Locations of structural penetrations such as beams.
9. Actual location of control panels and power connections to equipment.
10. Color coded duct and piping based on material used.
11. Label and tag schedule for equipment.
12. Duct transitions to clear beams or tight areas.
13. Room temperature sensor locations.
14. Point of connection to utilities outside the building.
15. Sections or 3-dimensional drawings of congested areas.
16. Gridlines.
17. Duct and piping supports on roof.

C. Coordinate with other trades in preparation of shop drawings.

D. Submit a copy of coordinated shop drawings to General Contractor for distribution to other trades, including electrical and fire sprinkler contractor.

E. Submit to commissioning agent for approval to assure design intent is met.

F. Prior to fabrication and upon receiving approval from commissioning agent, submit a complete set of shop drawings at one time to the mechanical engineer.

1.18 ELECTRICAL REQUIREMENTS

A. Coordinate the following items with Division 26:

1. Power wiring
2. Power Supply Voltage Requirements
3. Safety switches
4. Combination controllers
5. Disconnect switches
6. Motor starters
7. Circuit breakers
8. Motor-control equipment forming part of motor control centers or switchgear assemblies
9. Electrical connections of the mechanical equipment to the electrical power source shall be coordinated with and provided under Division 26.

1.19 MOTORS

A. Before order is placed for electrical devices, the Contractor shall check with the Electrical contractor and verify requirements as to type, mounting and current characteristics as well as to any special delivery instructions. Motors provided under Division 23 shall be minimum of 10% normal rating above brake horsepower (BHP) rating of equipment driven.

1.20 TESTS

A. Contractor shall make tests required by legally constituted authorities and as listed below.

1. Tests shall be made in the presence of the Owner or his representative and a duly authorized inspector. The Owner or his representative shall be notified 5 days before tests are made.
2. Concealed work and insulated work shall remain uncovered until required testing has been performed and approved by the Owner. If work to be tested is covered before the approval of the Owner or his authorized representative has been obtained, it shall be uncovered for testing at the Contractor's expense.
3. Obtain required documents of certification indicating approval, acceptance and compliance with the requirements of all administrative authorities having jurisdiction over the work. No final payment shall be made until all such certificates are delivered to the Owner.
4. Furnish labor, materials, instruments and bear other costs in connection with all tests.

5. Piping systems, except as hereinafter noted, shall be given hydrostatic (with water) test of a least 150% of the maximum operating pressure but no less than 150 psig.
6. Before making test, remove or valve off from the system, gauges, traps, and other apparatus or equipment which may be damaged by test pressure.
7. Install a calibrated test pressure gauge in the system to observe any loss in pressure. Maintain the required test pressure for a sufficient length of time to enable an inspection to be made of all joints and connections. Perform tests after installation and prior to acceptance.
8. Final pressures at the end of the test period shall be no more or less than that caused by expansion or contraction of the test medium due to temperature changes.
9. After tests have been made and leaks repaired, clean and flush systems as hereinafter specified. Water piping shall be left under supply main pressure for the balance of the construction period.
10. Tests for mechanical, plumbing, and fire protection systems are specified within their own section. Equipment and ductwork system tests are specified in the test and balance section.
11. Provide necessary provisions and tests for maintaining the operational condition and cleanliness of existing systems.

1.21 LABOR AND MATERIALS

A. Labor shall be carefully skilled for this kind of work, and under the direction of a competent foreman.

B. Materials shall be new, in perfect condition and of domestic manufacturer. Materials for similar uses to be of same type and manufacturer.

C. Equipment shall bear the manufacturer's label showing performance characteristics. Identifying size number shall be given only when it is not practicable or customary to show performance characteristics.

D. Valves, pipe, fittings, etc., shall bear the manufacturer's name or trademark.

E. Unless otherwise specified herein, equipment and fixtures shall be installed in accordance with the manufacturer's recommendations, including recommended service and removal clearances.

1.22 PROTECTION AND CLEAN-UP

A. Protection: Provide for the safety and good condition of materials and equipment until final acceptance of the Architect. Protect materials and equipment from dirt, dust, debris, and damage from any cause whatever, and provide adequate and proper storage facilities during the progress of the work and replace all damaged and defective material, equipment or work precedent to filing application for final acceptance.

B. Cleaning:

1. Unless a more stringent requirement is specified, thoroughly clean all parts of the piping, ductwork, fixtures, apparatus and equipment. All parts shall be thoroughly cleaned of dirt, dust, debris, cement, plaster and other materials, and all grease and oil spots removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Clean all systems, including piping and ductwork prior to test.
2. Exposed rough metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left in clean condition to receive painter's finish. Where factory prime coat has been damaged, this Contractor shall be responsible for restoration of same.

1.23 ACCESS PANELS

A. Access Doors and Panels:

1. Wherever volume dampers, fire dampers, smoke fire dampers, controls, valves or other items or parts of the installation which require periodic inspection or adjustments are concealed by permanent non-removable construction, an access door shall be provided. Rating of access panel shall be determined by rating of wall or ceiling in which panel is installed. Types to be as approved and as appropriate for the surface and construction in which it is installed. Verify all locations with Architect and other trades.
2. Access doors and panels shall be of sufficient size and shall be located properly to assure service to the intended item.

1.24 MAINTENANCE, OPERATION INSTRUCTION

A. General: Thoroughly instruct the Owner's operators in every detail of operation of the system. Provide the Owner with a list of all equipment, giving the manufacturer's name, model number, serial number, parts list and complete internal wiring diagrams. All directions for operation furnished by the manufacturer shall be carefully saved and turned over to the Owner, together with written sequence of operation, operating and maintenance instructions for each system and its equipment. Instruction shall consist of a minimum of four 8-hour periods over consecutive days and shall be 30% classroom and 70% at site location. Coordinate scheduling of instruction times with Owner's operators.

B. Specific Data: Submit four complete sets of the following data to the Owner for approval and commissioning agent for review prior to acceptance of the installation, complete and at one time; (partial or separate data will not be accepted) data shall consist of the following:

1. Valve Directory: Indicating valve number, location, function and normal operating position for each.
2. Color code schedule.
3. Equipment: List of name plates, including name plate data.
4. Manufacturer's Literature: Copies of manufacturer's instructions for operation and maintenance of all mechanical equipment, including replacement parts lists and drawings. Mark or highlight brochure literature indicating the models, sizes, capacities, curve operating points, etc., in a manner to clearly indicate the equipment installed. Remove all pages or sheets from the bulletin and catalogs that do not pertain to equipment installed on the project.

5. Written Instructions: Typewritten instructions for operation and maintenance of the system composed of OPERATING INSTRUCTIONS, MAINTENANCE INSTRUCTIONS and a MAINTENANCE SCHEDULE.

    a. OPERATING INSTRUCTIONS shall contain a brief description of the system. Adjustments requiring the technical knowledge of the service agency personnel shall not be included in the operating instructions. The fact such adjustments are required, however, shall be noted.
    b. MAINTENANCE INSTRUCTIONS shall list each item of equipment requiring inspection, lubrication or service and describe the performance of such maintenance.
    c. MAINTENANCE SCHEDULE shall list each item of equipment requiring maintenance, shall show the exact type of maintenance on every component of each item of equipment, and shall show when each item of equipment should be inspected or services.

6. Instructions: Operating personnel shall be instructed in the operation of the system in accordance with typewritten, approved instructions.

C. Binders: Provide complete sets of the above data in loose-leaf ring-type binders with permanent covers, with identification on front and on spine.

1.25 SPECIAL REQUIREMENTS

A. During the guarantee period and as directed by the Owner, make any additional tests, adjustment, etc., that may be required and correct any defects or deficiencies arising from operation of the systems. Operational tests shall be made during both heating and cooling seasons and on all systems.

B. Completion:

1. The entire mechanical system shall be commissioned in accordance with ASHRAE Guideline 1-1996 and the requirements of this specification. A final commissioning report shall be approved by the Owner, Architect, and Mechanical Engineer prior to final acceptance of the work.
2. When the installation is complete and adjustments specified herein have been made, the system, shall be operated for a period of one week, during which time it shall be demonstrated to the Owner or his representative as being completed and operating in conformance with these specifications. The Contractor shall schedule all work so that this time period, which is to confirm a "bug-free" system, will occur before the total project is accepted for substantial completion by Owner.
3. The work hereunder shall not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, valve directories, piping identification code directory, and nameplates specified herein have been approved and properly posted in the building.

1.26 WARRANTY/GUARANTEE

A. The contractor shall warranty/guarantee that materials, apparatus, and equipment furnished and installed under the mechanical division of these specifications shall be new and free from all defects. Should any defects develop, within one year (unless a longer period is listed in other sections of the specifications) from the date of final acceptance by the owner or from the date of certificate of substantial completion, whichever is earlier, due to inferior or faulty materials and/or workmanship, the trouble shall be corrected by this Contractor without expense to the Owner. Any defective materials or inferior workmanship noticed at the time of installation or during the guarantee period shall be corrected immediately to the entire satisfaction of the Owner.

B. The work shall be installed of such materials and in such a manner that:

1. The operation of all parts of the system shall be noiseless to the extent that no objectionable sound of operation will be heard outside of the rooms enclosing the apparatus or equipment.
2. Apparatus or equipment shall operate in accordance with detailed specifications covering each item.
3. Contractor shall, at his own expense, make any adjustments or changes required to produce a condition of quietness satisfactory to the Engineer or his representative. Such adjustments or changes shall not reduce the performance or quantities called for on the drawings.
4. Contractor shall guarantee that his installation of all materials and equipment will meet the performance requirements of these specifications and that all equipment will deliver the specified or required capacities.
5. The Owner reserves the right to make temporary or emergency repairs as necessary to keep equipment in operating condition without voiding the guarantee contained herein nor relieving the Contractor of his responsibilities during the guarantee period.
6. Contractor shall be responsible for all damage to any part of the premises caused by leaks or break in pipe lines, fixtures or equipment furnished and installed under his contract for a period of one year after date of acceptance of the project by Owner. He shall replace in kind, at his own expense, any and all items so damaged to the complete satisfaction of the Owner.

END OF SECTION 23 00 10

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SECTION 23 00 50 – 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete base construction requirements.
3. Escutcheons.
4. Flexible connectors.
5. Mechanical sleeve seals.
6. Equipment nameplate data requirements.
7. Labeling and identifying mechanical systems and equipment is specified in Division 23 Section "Identification for HVAC Piping and Equipment."
8. Nonshrink grout for equipment installations.
9. Field-fabricated metal and wood equipment supports.
10. Installation requirements common to equipment specification sections.
11. Cutting and patching.
12. Touchup painting and finishing.

B. Pipe and pipe fitting materials are specified in Division 23 piping system 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, crawl spaces, 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 rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

B. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

C. Coordination Drawings: For access panel and door locations.

D. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:

1. Planned piping layout, including valve and specialty locations and valve-stem movement.
2. Clearances for installing and maintaining insulation.
3. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
4. Equipment and accessory service connections and support details.
5. Exterior wall and foundation penetrations.
6. Fire-rated wall and floor penetrations.
7. Sizes and location of required concrete pads and bases.
8. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
9. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
10. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

E. Samples: Of color, lettering style, and other graphic representation required for each identification material and device.

1.5 QUALITY ASSURANCE

A. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in

writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section.

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Refer to individual Division 23 piping Sections for pipe and fitting materials and joining methods.

2.2 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32.

1. Alloy E: Approximately 95 percent tin and 5 percent antimony, lead free.

C. Brazing Filler Metals: AWS A5.8.

1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.4 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

    a. Underdeck Clamp: Clamping ring with setscrews.

5. PE: Manufactured, reusable, tapered, cup shaped, smooth outer surface, with nailing flange for attaching to wooden forms.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: Split casting, with concealed hinge and set screw.

    a. Finish: Rough brass.
    b. Finish: Polished chrome-plate.

4. Stamped Steel: One piece, with spring clips and chrome-plated finish.
5. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome-plated finish.
6. Cast-Iron Floor Plate: One-piece casting.

2.5 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 23 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

N. Sleeves are not required for core drilled holes.

O. Permanent sleeves are not required for holes formed by PE removable sleeves.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
    b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
    c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Sections for flashing.

        1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Sections for materials.

5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

Q. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Sections for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
5. 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:

a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
c. Align threads at point of assembly.

d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
e. 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.

6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

W. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

C. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. 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.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 PAINTING AND FINISHING

A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
6. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

C. Paint visible sheet metal behind ceiling inlets and outlets flat black.

D. Do not paint piping specialties with factory-applied finish.

E. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage 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.

3.7 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.8 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

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SECTION 23 05 17 – SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water stop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

C. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Presealed Systems.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves Galvanized-steel wall sleeves Galvanized-steel-pipe sleeves Sleeve-seal fittings.
b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.

2. Interior Partitions:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 23 05 17

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SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following hangers and supports for mechanical system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
3. Division 23 Section "Metal Ducts” for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7 & 1617A.1.26 of CBC.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.
4. Pipe positioning systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze 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.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

D. Welding Certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel.".

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

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 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Grinnell Corp.
3. Tolco, Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Power-Strut Div.; Tyco International, Ltd.
3. Unistrut Corp.; Tyco International, Ltd.
4. Tolco, Inc.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. ERICO/Michigan Hanger Co.
2. Pipe Shields, Inc.
3. Rilco Manufacturing Company, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Hilti, Inc.
c. ITW Ramset/Red Head.

2.7 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. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
6. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
7. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches 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.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

6. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
7. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

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. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

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SECTION 23 05 48 – VIBRATION AND SEISMIC CONTROLS FOR HVAC

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. Elastomeric isolation mounts.
2. Housed-restrained-spring isolators.
3. Spring hangers.
4. Snubbers.
5. Restraint cables.
6. Seismic-restraint accessories.
7. Mechanical anchor bolts.
8. Adhesive anchor bolts.

B. Related Requirements:

1. Section 22 05 48 "Vibration and Seismic Controls for Plumbing" for devices for plumbing equipment and systems.

1.3 DEFINITIONS

A. CBC: California Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning & Development (for the State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic forces required to select vibration isolators and seismic and wind restraints and for designing vibration isolation bases.

a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.
4. Seismic Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer.

C. Welding certificates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the CBC unless requirements in this Section are more stringent.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPM number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the CBC: A.
2. Assigned Seismic Use Group or Building Category as Defined in the CBC: III.

    a. Component Importance Factor: 1.0.
    b. Component Response Modification Factor: 1.5.
    c. Component Amplification Factor: 1.0.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second).
4. Design Spectral Response Acceleration at 1.0-Second Period.

5. Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

    a. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

2.2 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Kinetics Noise Control, Inc.
    b. Mason Industries, Inc.
    c. Vibration Isolation.

2. Mounting Plates:

    a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
    b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.3 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Kinetics Noise Control, Inc.
    b. Mason Industries, Inc.
    c. Vibration Eliminator Co., Inc.

2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.4 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Mason Industries, Inc.
   b. Vibration Eliminator Co., Inc.
   c. Vibration Isolation.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.5 SNUBBERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Insert manufacturer's name; product name or designation or comparable product by one of the following:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. Vibration Mountings & Controls, Inc.

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

2.6 RESTRAINT CHANNEL BRACINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper B-Line, Inc.
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.7 RESTRAINT CABLES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Kinetics Noise Control, Inc.
2. Loos & Co., Inc.
3. Vibration Mountings & Controls, Inc.

B. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.8 SEISMIC-RESTRAINT ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper B-Line, Inc.
2. Mason Industries, Inc.
3. TOLCO.

B. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.9 MECHANICAL ANCHOR BOLTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper B-Line, Inc.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.10 ADHESIVE ANCHOR BOLTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Hilti, Inc.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.

B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete." or Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Comply with requirements in Section 07 72 00 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

D. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

E. Install cables so they do not bend across edges of adjacent equipment or building structure.

F. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 23 21 13 "Hydronic Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. Test and adjust restrained-air-spring isolator controls and safeties.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 23 05 48

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SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.
5. Warning tags.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 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 locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White
3. Background Color: Black
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 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.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black

C. Background Color: Yellow

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 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.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1

B. Pipe Label Colors: As specified in Article “Pipe Label Installation.”

C. Pretensioned Pipe Labels: Precoiled, semigrid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.4 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch 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-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption such as “DANGER,” “CAUTION,” or “DO NOT OPERATE.”
4. Color: Safety-yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels ma be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, 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 subparagraphs:

1. Valve-Tag Size and Shape:

a. Chilled Water: 2 inches, round.
b. Condenser Water: 2 inches, round.
c. Refrigerant: 2 inches, round.
d. Hot Water: 1-1/2 inches round.
e. Gas: 1-1/2 inches, round.

2. Valve-Tag Colors:

a. Toxic and Corrosive Fluids: Black letters on a safety-orange background.
b. Flammable Fluids: Black letters on a safety-yellow background.
c. Combustible Fluids: White letters on a safety-brown background.
d. Potable and Other Water: White letters on a safety-green background.
e. Compressed Air: White letters on a safety-blue background.
f. Defined by Use: White letters on a safety-purple background, black letters on a safety-white background, white letters on a safety-gray background, and white letters on a safety-black background.

3.5 WARNING-TAG INSULATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

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SECTION 23 05 93 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems:

    a. Constant-volume air systems.
    b. Variable-air-volume systems.

2. Testing, Adjusting, and Balancing Equipment:

    a. Motors.

3. Testing, adjusting, and balancing existing systems and equipment.
4. Sound tests.
5. Vibration tests.
6. Duct leakage tests.
7. Control system verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Needs for coordination and cooperation of trades and subcontractors.
d. Proposed procedures for documentation and communication flow.

1.5 ACTION SUBMITTALS

A. LEED Submittals:

1. Air-Balance Report for Prerequisite IEQ 1: Documentation indicating that work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
2. TAB Report for Prerequisite EA 2: Documentation indicating that work complies with ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.

3. Application.
4. Dates of use.
5. Dates of calibration.

1.7 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC or NEBB

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABCor NEBB
2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB or as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.8 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from commissioning authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:

    a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
    b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
    c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
    d. Adjust controls so that terminal is calling for minimum airflow.
    e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
    f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
    g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.

5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
    c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

6. Measure fan static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air-handling system.

d. Report any artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

   a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
   b. Verify that terminal units are meeting design airflow under system maximum flow.

8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
9. Verify final system conditions as follows:

   a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
   b. Re-measure and confirm that total airflow is within design.
   c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
   d. Mark final settings.
   e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
   f. Verify tracking between supply and return fans.

3.7 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

   1. Manufacturer's name, model number, and serial number.
   2. Motor horsepower rating.
   3. Motor rpm.
   4. Phase and hertz.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter size and thermal-protection-element rating.
   8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.9 SOUND TESTS

A. After the systems are balanced and construction is Substantially Complete, measure and record sound levels at 15 locations as designated by the Architect.

B. Instrumentation:

1. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.
2. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels, and measuring the equivalent continuous sound pressure level (LEQ).
3. The sound-testing meter must be capable of using 1/3 octave band filters to measure mid-frequencies from 31.5 Hz to 8000 Hz.
4. The accuracy of the sound-testing meter shall be plus or minus one decibel.

C. Test Procedures:

1. Perform test at quietest background noise period. Note cause of unpreventable sound that affects test outcome.
2. Equipment should be operating at design values.
3. Calibrate the sound-testing meter prior to taking measurements.
4. Use a microphone suitable for the type of noise levels measured that is compatible with meter. Provide a windshield for outside or in-duct measurements.
5. Record a set of background measurements in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment off.
6. Take sound readings in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment operating.
7. Take readings no closer than 36 inches (900 mm) from a wall or from the operating equipment and approximately 60 inches (1500 mm) from the floor, with the meter held or mounted on a tripod.
8. For outdoor measurements, move sound-testing meter slowly and scan area that has the most exposure to noise source being tested. Use A-weighted scale for this type of reading.

D. Reporting:

1. Report shall record the following:

    a. Location.
    b. System tested.
    c. dBA reading.
    d. Sound pressure level in each octave band with equipment on and off.

2. Plot sound pressure levels on NC worksheet with equipment on and off.

3.10 VIBRATION TESTS

A. After systems are balanced and construction is Substantially Complete, measure and record vibration levels on equipment having motor horsepower equal to or greater than 10.

B. Instrumentation:

1. Use portable, battery-operated, and microprocessor-controlled vibration meter with or without a built-in printer.
2. The meter shall automatically identify engineering units, filter bandwidth, amplitude, and frequency scale values.
3. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.
4. Verify calibration date is current for vibration meter before taking readings.

C. Test Procedures:

1. To ensure accurate readings, verify that accelerometer has a clean, flat surface and is mounted properly.
2. With the unit running, set up vibration meter in a safe, secure location. Connect transducer to meter with proper cables. Hold magnetic tip of transducer on top of the bearing, and measure unit in mils of deflection. Record measurement, then move transducer to the side of the bearing and record in mils of deflection. Record an axial reading in mils of deflection by holding nonmagnetic, pointed transducer tip on end of shaft.
3. Change vibration meter to velocity (inches per second) measurements. Repeat and record above measurements.
4. Record CPM or rpm.
5. Read each bearing on motor, fan, and pump as required. Track and record vibration levels from rotating component through casing to base.

D. Reporting:

1. Report shall record location and the system tested.
2. Include horizontal-vertical-axial measurements for tests.
3. Verify that vibration limits follow Specifications, or, if not specified, follow the General Machinery Vibration Severity Chart or Vibration Acceleration General Severity Chart from the AABC National Standards. Acceptable levels of vibration are normally "smooth" to "good."
4. Include in report General Machinery Vibration Severity Chart, with conditions plotted.

3.11 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.12 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.13 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent
2. Air Outlets and Inlets: Plus or minus 10 percent
3. Heating-Water Flow Rate: Plus or minus 10 percent
4. Cooling-Water Flow Rate: Plus or minus 10 percent

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.14 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.15 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.
6. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches (mm), and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches (mm), and bore.
    f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm (L/s).
    b. Total system static pressure in inches wg (Pa).
    c. Fan rpm.
    d. Discharge static pressure in inches wg (Pa).
    e. Filter static-pressure differential in inches wg (Pa).
    f. Preheat-coil static-pressure differential in inches wg (Pa).
    g. Cooling-coil static-pressure differential in inches wg (Pa).
    h. Heating-coil static-pressure differential in inches wg (Pa).
    i. Outdoor airflow in cfm (L/s).
    j. Return airflow in cfm (L/s).
    k. Outdoor-air damper position.
    l. Return-air damper position.
    m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Entering-water temperature in deg F (deg C).
i. Leaving-water temperature in deg F (deg C).
j. Refrigerant expansion valve and refrigerant types.
k. Refrigerant suction pressure in psig (kPa).
l. Refrigerant suction temperature in deg F (deg C).

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h (kW).
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches (mm), and bore.
n. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

2. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Entering-air temperature in deg F (deg C).
c. Leaving-air temperature in deg F (deg C).
d. Air temperature differential in deg F (deg C).
e. Entering-air static pressure in inches wg (Pa).
f. Leaving-air static pressure in inches wg (Pa).
g. Air static-pressure differential in inches wg (Pa).
h. Low-fire fuel input in Btu/h (kW).
i. High-fire fuel input in Btu/h (kW).
j. Manifold pressure in psig (kPa).

k. High-temperature-limit setting in deg F (deg C).
l. Operating set point in Btu/h (kW).
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h (kW).

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F (deg C).
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches (mm).
f. Duct area in sq. ft. (sq. m).

g. Indicated airflow rate in cfm (L/s).
h. Indicated velocity in fpm (m/s).
i. Actual airflow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

J. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft. (sq. m).

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm (L/s).
b. Air velocity in fpm (m/s).
c. Preliminary airflow rate as needed in cfm (L/s).
d. Preliminary velocity as needed in fpm (m/s).
e. Final airflow rate in cfm (L/s).
f. Final velocity in fpm (m/s).
g. Space temperature in deg F (deg C).

K. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.16 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of commissioning authority.

B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, Architect may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.17 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

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SECTION 23 07 13 – DUCT 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. This Section includes semirigid and flexible duct, and plenum, insulation; insulating cements; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 07 Sections for firestopping materials and requirements for penetrations through fire and smoke barriers.
2. Division 23 Section "HVAC Equipment Insulation" for insulation materials and application for pumps, tanks, hydronic specialties, and other equipment.
3. Division 23 Insulation Sections for insulation for piping systems.
4. Division 23 Section "Metal Ducts" for duct liner.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Removable insulation sections at access panels.
2. Application of field-applied jackets.
3. Applications at linkages for control devices.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

D. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mineral-Fiber Insulation:

a. CertainTeed Manson.
b. Knauf FiberGlass GmbH.
c. Owens-Corning Fiberglas Corp.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

2.3 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8-oz./sq. yd.

1. Tape Width: 4 inches.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
2. Galvanized Steel: 0.005 inch thick.
3. Nickel-Copper Alloy: 0.005 inch thick.

C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

D. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts and plenums; and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface.

2.4 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

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.

B. 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.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

F. Keep insulation materials dry during application and finishing.

G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Apply insulation with the least number of joints practical.

I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Seal insulation to roof flashing with vapor-retarder mastic.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
    c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.

4. Impale insulation over anchors and attach speed washers.

5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
7. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FINISHES

A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 09 Painting Sections.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.6 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:

1. Indoor concealed supply-, return-, and outside-air ductwork.
2. Indoor exposed supply-, return-, and outside-air ductwork.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
5. Flexible connectors.
6. Vibration-control devices.
7. Testing agency labels and stamps.

8. Nameplates and data plates.
9. Access panels and doors in air-distribution systems.

3.7 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Concealed, round and rectangular, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.

C. Concealed, round and rectangular, return-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.

D. Concealed, supply-air plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.

E. Concealed, return-air plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 3 inches (75 mm) thick 6-lb/cu. ft. (96-kg/cu. m) nominal density.

F. Exposed, round and flat-oval, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.
3. Mineral-Fiber Pipe and Tank: 3 inches (75 mm) thick.

G. Exposed, round and flat-oval, return-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.

H. Exposed, rectangular, supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.

I. Exposed, rectangular, return-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.

J. Exposed, supply-air plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.

K. Exposed, return-air plenum insulation shall be one of the following:

1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 3 inches (75 mm) thick and 6-lb/cu. ft. (96-kg/cu. m) nominal density.

END OF SECTION 23 07 13

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SECTION 23 07 19 – HVAC PIPING 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 insulating the following HVAC piping systems:

1. Condensate drain piping, indoors and outdoors.
2. Refrigerant suction and hot-gas piping, indoors and outdoors.

B. Related Sections:

1. Section 23 07 13 "Duct Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Calcium Silicate:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Industrial Insulation Group (IIG); Thermo-12 Gold.

2. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
3. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
4. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Pittsburgh Corning Corporation; Foamglas.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Board Insulation: ASTM C 552, Type IV.
5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.

6. Preformed Pipe Insulation with Factory-Applied ASJ ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

H. Flexible Elastomeric Insulation: 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 following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I, or II with factory-applied vinyl jacket, III with factory-applied FSK jacket or III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

J. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000-Degree Pipe Insulation.
c. Manson Insulation Inc.; Alley-K.
d. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket, with factory-applied ASJ or with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, 1200 deg F (649 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, without factory-applied jacket, with factory-applied ASJ or with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

K. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Knauf Insulation; Permawick Pipe Insulation.
    b. Owens Corning; VaporWick Pipe Insulation.

L. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ or FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; CrimpWrap.
    b. Johns Manville; MicroFlex.
    c. Knauf Insulation; Pipe and Tank Insulation.
    d. Manson Insulation Inc.; AK Flex.
    e. Owens Corning; Fiberglas Pipe and Tank Insulation.

M. Phenolic:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Kingspan Tarec Industrial Insulation NV; Koolphen K.
    b. Resolco International BV; Insul-phen.

2. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
3. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

    a. Preformed Pipe Insulation: ASJ.

N. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Chemical Company (The); Trymer 2000 XP.
    b. Duna USA Inc.; Corafoam.
    c. Dyplast Products; ISO-25.
    d. Elliott Company of Indianapolis; Elfoam.

2. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F (0.027 W/m x K) at 75 deg F (24 deg C) after 180 days of aging.

3. Flame-spread index shall be 25 or less, and smoke-developed index shall be 50 or less for thickness up to 1 inch (25 mm) as tested by ASTM E 84.
4. Fabricate shapes according to ASTM C 450 and ASTM C 585.
5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

    a. Pipe Applications: ASJ, ASJ-SSL, PVDC or PVDC-SSL.

O. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Armacell LLC; Tubolit.
    b. Nomaco Insulation; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.

P. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F (0.038 W/m x K) after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Dow Chemical Company (The); Styrofoam.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ramco Insulation, Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ramco Insulation, Inc.; Thermokote V.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-97.
   b. Eagle Bridges - Marathon Industries; 290.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-27.
   d. Mon-Eco Industries, Inc.; 22-30.
   e. Vimasco Corporation; 760.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Phenolic and Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-96.
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-33.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Aeroflex USA, Inc.; Aeroseal.
   b. Armacell LLC; Armaflex 520 Adhesive.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
   d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

G. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F (29 to plus 60 deg C).

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-96.
   b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60.

H. 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 following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

I. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 739, Dow Silicone.
b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    b. Eagle Bridges - Marathon Industries; 501.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
    d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    b. Eagle Bridges - Marathon Industries; 570.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
    b. Eagle Bridges - Marathon Industries; 550.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    d. Mon-Eco Industries, Inc.; 55-50.

e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
5. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.

2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-70.

b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.

3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
6. Color: White or gray.
7. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of 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 (Minus 40 to plus 121 deg C).
5. Color: White.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm (0.013 metric perm) when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

6. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm (0.007 metric perm) when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
b. Vimasco Corporation; Elastafab 894.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).

1. Products: Subject to compliance with requirements, provide one of the following:

a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.

c. Proto Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color-code jackets based on system. Color as selected by Architect.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. 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: 2.5-mil- (0.063-mm-) thick polysurlyn.
d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
b. Material, finish, and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 2.5-mil- (0.063-mm-) thick polysurlyn.
d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Underground Direct-Buried Jacket: 125-mil- (3.2-mm-) thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Pittsburgh Corning Corporation; Pittwrap.
b. Polyguard Products, Inc.; Insulrap No Torch 125.

F. Self-Adhesive Outdoor Jacket: 60-mil- (1.5-mm-) thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white or stucco-embossed aluminum-foil facing.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Polyguard Products, Inc.; Alumaguard 60.

G. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms (0.013 metric perms) when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Chemical Company (The); Saran 540 Vapor Retarder Film.

H. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms (0.007 metric perms) when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Chemical Company (The); Saran 560 Vapor Retarder Film.

I. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.

2. Width: 3 inches (75 mm).
3. Film Thickness: 4 mils (0.10 mm).
4. Adhesive Thickness: 1.5 mils (0.04 mm).
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.

F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Chemical Company (The); Saran 560 Vapor Retarder Tape.

2. Width: 3 inches (75 mm).
3. Film Thickness: 6 mils (0.15 mm).
4. Adhesive Thickness: 1.5 mils (0.04 mm).
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch (10.1 N/mm) in width.

2.12 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal 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. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy, 0.062-inch (1.6-mm) soft-annealed, stainless steel or 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. C & F Wire.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly

against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.

3. Finish valve and specialty insulation same as pipe insulation.

3.7 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

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.

3.9 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch (300-mm) intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm) wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.11 INSTALLATION OF POLYISOCYANURATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.
2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm) thickness.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as pipe insulation.

C. Insulation Installation on Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of polyisocyanurate insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

3.12 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.13 INSTALLATION OF POLYSTYRENE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.
2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.

3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, and make thickness same as adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm).
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed section of polystyrene insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.14 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches (50 mm) over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.15 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 90 00 “Painting and Coating.”

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.17 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.18 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
c. Phenolic: 1 inch (25 mm) thick.
d. Polyisocyanurate: 1 inch (25 mm) thick.
e. Polyolefin: 1 inch (25 mm) thick.

B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches (50 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
c. Phenolic: 2 inches (50 mm) thick.
d. Polyisocyanurate: 2 inches (50 mm) thick.
e. Polyolefin: 2 inches (50 mm) thick.

C. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 2 inches (50 mm) thick.
b. Polyolefin: 2 inches (50 mm) thick.

3.19 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 2 inches (50 mm) thick.
b. Flexible Elastomeric: 2 inches (50 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches (50 mm) thick.
d. Phenolic: 2 inches (50 mm) thick.
e. Polyisocyanurate: 2 inches (50 mm) thick.
f. Polyolefin: 2 inches (50 mm) thick.
g. Polystyrene: 2 inches (50 mm) thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 2 inches (50 mm) thick.
b. Polyolefin: 2 inches (50 mm) thick.

3.20 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. PVC, Color-Coded by System: 30 mils (0.8 mm) thick.
2. Aluminum, Smooth, Corrugated or Stucco Embossed: 0.040 inch (1.0 mm) thick.
3. Painted Aluminum, Smooth, Corrugated or Stucco Embossed: 0.032 inch (0.81 mm) thick.
4. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish, Corrugated or Stucco Embossed: 0.024 inch (0.61 mm) thick.

3.21 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. PVC PVC, Color-Coded by System: 30 mils (0.8 mm) thick.
3. Aluminum, Smooth, Corrugated or Stucco Embossed: 0.040 inch (1.0 mm) thick.
4. Painted Aluminum, Smooth, Corrugated or Stucco Embossed: 0.032 inch (0.81 mm) thick.
5. Stainless Steel, Type 304, 316, 304 or 316, Smooth 2B Finish, Corrugated or Stucco Embossed: 0.024 inch (0.61 mm) thick.

D. Piping, Exposed:

1. PVC: 40 mils (1.0 mm) thick.
2. Painted Aluminum, Smooth, Corrugated, Stucco Embossed or with Z-Shaped Locking Seam: 0.040 inch (1.0 mm) thick.
3. Stainless Steel, Type 304, 316, 304 or 316, Smooth 2B Finish, Corrugated, Stucco Embossed or with Z-Shaped Locking Seam: 0.024 inch (0.61 mm) thick.

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SECTION 23 09 00 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, equipment, and service necessary for a complete and operating temperature control system, utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only.

B. All labor, material, equipment and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

C. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).

1.2 SYSTEM DESCRIPTION

A. The entire temperature control system shall be comprised of a network of interoperable, stand-alone digital controllers communicating via BacNet communication protocols to a Network Area Controller (NAC). Temperature Control System products shall be manufactured by Honeywell. Equivalent BacNet products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal.

B. The Temperature Control System as provided in this Division shall be based on the Honeywell WEBs System incorporating the Niagara Framework™. Equivalent products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal. Systems not developed on the Niagara Framework platform are unacceptable.

1.3 SUBMITTAL

A. Two copies of shop drawings of the components and devices for the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions for all controllers, valves, dampers, sensors, routers, etc. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package.

B. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol.

C. Submittal shall also include a complete point list of all points to be connected to the temperature control system. Controls Contractor shall provide necessary point lists, protocol documentation, and factory support information for systems provided.

D. Submittal shall also include a copy of each of the graphics developed for the Graphic User Interface including a flowchart (site map) indicating how the graphics are to be linked to one another for system navigation. The graphics are intended to be 80% - 90% complete at this stage with the only remaining changes to be based on review comments from the A/E design team and/or Owner.

E. Include the following display graphics for each of the sites (where applicable):

1. Site plan view of entire campus identifying each building.
2. Individual buildings, including room layout with display of all space temperatures and occupied mode, outside air temperature & humidity.
3. Mechanical equipment display for each AC unit to include space temperature, heating and cooling setpoints, supply air temperature, fan status, occupied mode, outside temperature & humidity.
4. Boiler and hot water pumps showing all related points.
5. Page showing all room temperatures, room temperature setpoints, occupied mode, AC unit fan status and AC unit mode (heating or cooling).

F. Upon completion of the work, provide a complete set of ‘as-built’ drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Two copies of the ‘as-built’ drawings shall be provided in addition to the documents on compact disk. Controls Contractor shall provide as-builts for their portions of work.

1.4 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

NAC	Network Area Controller
IDC	Interoperable Digital Controller
IBC	Interoperable BACnet Controller
GUI	Graphical User Interface
WBI	Web Browser Interface
POT	Portable Operator’s Terminal
PMI	Power Measurement Interface
DDC	Direct Digital Controls
LAN	Local Area Network
WAN	Wide Area Network

OOT	Object Oriented Technology
PICS	Product Interoperability Compliance Statement

1.5 AGENCY AND CODE APPROVALS

A. All products of the temperature control system shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1. UL-916; Energy Management Systems
2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 “signal Equipment”
3. CE
4. FCC, Part 15, Subpart J, Class A Computing Devices

1.6 SOFTWARE LICENSE AGREEMENT

A. The Owner shall agree to the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

B. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner. The owner shall determine which organizations to be named in the SI organization ID (“orgid”) of all software licenses. Owner shall be free to direct the modification of the “orgid” in any software license, regardless of supplier.

1.7 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.8 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and

that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

PART 2 - MATERIALS

2.1 ACCEPTABLE CONTROL MANUFACTURER / CONTRACTOR

A. Honeywell "Authorized Controls Integrator"

1. R & R Controls Inc.
   4564 B Alvarado Canyon Road
   San Diego, CA 92120
   Phone: 619-516-1880
   Fax: 619 516-1881

2.2 GENERAL

A. The temperature control system shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein. All systems and software within temperature control system shall be supported by compliance documentation from the manufacturer.

B. The installed system shall provide secure password access to all features, functions and data contained in the overall temperature control system.

2.3 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, LonWorks technology, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.

C. All components and controllers supplied under this Division shall be true “peer-to-peer” communicating devices. Components or controllers requiring “polling” by a host to pass data shall not be acceptable.

D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer’s internal Intranet network. Systems employing a “flat” single tiered architecture shall not be acceptable.

1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.4 NETWORKS

A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3
2. Cable; 100 Base-T, UTP-8 wire, category 5
3. Minimum throughput; 100 Mbps.

2.5 NETWORK ACCESS

A. Remote Access.

1. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer’s Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

2.6 NETWORK AREA CONTROLLER (NAC)

A. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and also provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:

1. Calendar functions
2. Scheduling
3. Trending
4. Alarm monitoring and routing
5. Time synchronization
6. Integration of LonWorks controller data and BACnet controller data
7. Network Management functions for all LonWorks based devices

B. The Network Area Controller must provide the following hardware features as a minimum:

1. One Ethernet Port – 10/100 Mbps
2. One RS-232 port
3. One LonWorks Interface Port – 78KB FTT-10A
4. One RS-485 ports
5. Battery Backup
6. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
7. The NAC must be capable of operation over a temperature range of 32 to 122°F
8. The NAC must be capable of withstanding storage temperatures of between 0 and 158°F
9. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

C. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.

E. Event Alarm Notification and actions

1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:

    a. To alarm
    b. Return to normal

c. To fault
d. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.

4. Provide timed (schedule) routing of alarms by class, object, group, or node.
5. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

F. Control equipment and network failures shall be treated as alarms and annunciated.

G. Alarms shall be annunciated in any of the following manners as defined by the user:

1. Screen message text
2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:

a. Day of week
b. Time of day
c. Recipient

3. Pagers via paging services that initiate a page on receipt of email message
4. Graphic with flashing alarm object(s)
5. Printed message, routed directly to a dedicated alarm printer

H. The following shall be recorded by the NAC for each alarm (at a minimum):

1. Time and date
2. Location (building, floor, zone, office number, etc.)
3. Equipment (air handler #, access way, etc.)
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

I. Alarm actions may be initiated by user defined programmable objects created for that purpose.

J. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

K. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

L. Provide a “query” feature to allow review of specific alarms by user-defined parameters.

M. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

N. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.7 DATA COLLECTION AND STORAGE

A. The NAC shall have the ability to collect data for any property of any object and store this data for future use.

B. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:

1. Designating the log as interval or deviation.
2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

C. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web browser.

D. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

E. All log data shall be available to the user in the following data formats:

1. HTML
2. XML
3. Plain Text
4. Comma or tab separated values

F. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.

G. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:

1. Archive on time of day
2. Archive on user-defined number of data stores in the log (buffer size)
3. Archive when log has reached it’s user-defined capacity of data stores
4. Provide ability to clear logs once archived

2.8 AUDIT LOG

A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally

(to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:

1. Time and date
2. User ID
3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.9 DATABASE BACKUP AND STORAGE

A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.

B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.

C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.10 INTEROPERABLE DIGITAL CONTROLLER (IDC)

A. Controls shall be Honeywell Spyder microprocessor based Interoperable BacNet Controllers (IDC) or approved equal. Where possible, all Interoperable Digital Controllers shall bear the applicable BacNet ™ BLT logo on each product delivered.

B. HVAC control shall be accomplished using BacNet ™ based devices where the application has a BacNet profile defined. The Controls Contractor shall provide all programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation.

C. The Controls Contractor shall run the BacNet network trunk to the nearest Network Area Controller (NAC). Coordinate locations of the NAC to ensure that maximum network wiring distances, as specified by the BacNet wiring guidelines, are not exceeded. A maximum of 32 devices may occupy any one BacNet trunk and must be installed using the appropriate trunk termination device. All BacNet devices must be supplied using BacNet MSTP communications transceivers.

D. The Network Area Controller (NAC) will provide all scheduling, alarming, trending, and network management for the BacNet based devices.

E. The IDCs shall communicate with the NAC at a baud rate of not less than 38.4K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.

F. All IDCs shall be fully application programmable and shall at all times maintain their LONMARK certification, if so certified. Controllers offering application selection only (non-programmable), require a 1% spare point capacity to be provided for all applications. All

control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

G. The Controls Contractor supplying the IDC's shall provide documentation for each device, with the following information at a minimum:

1. Network Variable Inputs; name and type
2. Network Variable Outputs; name and type
3. Network configuration parameters; name and type

H. It is the responsibility of the Division 15 contractor to ensure that the proper Network Inputs and Outputs are provided in each IDC, as required by the point charts.

I. The supplier of any programmable IDC shall provide one copy of the manufacturer's programming tool, with documentation, to the owner.

2.11 GRAPHICAL USER INTERFACE SOFTWARE

A. Operating System: WEBSTATION-AX™

B. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

C. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:

1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.

    a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
    b. Holidays shall be set by using a graphical calendar without requiring any keyboard entry from the operator.

5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.

D. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:

1. Create, delete or modify control strategies.
2. Add/delete objects to the system.
3. Tune control loops through the adjustment of control loop parameters.
4. Enable or disable control strategies.
5. Generate hard copy records or control strategies on a printer.
6. Select points to be alarmable and define the alarm state.
7. Select points to be trended over a period of time and initiate the recording of values automatically.

E. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

F. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

G. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

H. Alarm Console

1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.12 WEB BROWSER CLIENTS

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the EMCS, shall not be acceptable.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
5. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

    a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
    b. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
    c. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
    d. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
    e. View logs and charts
    f. View and acknowledge alarms
    g. Setup and execute SQL queries on log and archive information

7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.13 SERVER FUNCTIONS AND HARDWARE

A. The central server is located at the Grossmont Union High School District's Maintenance Office. The server shall support all Network Area Controllers (NAC) connected to the customer's network whether local or remote.

B. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1 or dial-up connection.

C. It shall be possible to provide access to all Network Area Controllers via a single connection to the server. In this configuration, each Network Area Controller can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.

D. The server shall provide the following functions, at a minimum:

1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
3. The server shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).
4. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
5. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.
6. The server shall provide demand limiting that operates across all Network Area Controllers. The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
7. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.
8. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.
9. The server shall provide central alarm management for all Network Area Controllers supported by the server. Alarm management shall include:

    a. Routing of alarms to display, printer, email and pagers
    b. View and acknowledge alarms

c. Query alarm logs based on user-defined parameters

10. The server shall provide central management of log data for all Network Area Controllers supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:

    a. Viewing and printing log data
    b. Exporting log data to other software applications
    c. Query log data based on user-defined parameters

2.14 SYSTEM PROGRAMMING

A. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide “real-time” data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

C. Programming Methods

1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user’s application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
2. Configuration of each object will be done through the object’s property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.

5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.15 NETWORK MANAGEMENT

A. The Graphical User Interface software (GUI) shall provide a complete set of integrated BacNet network management tools for working with BacNet networks. These tools shall manage a database for all BacNet devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between BacNet devices, known as "binding".

B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

C. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

D. These tools shall provide the ability to "learn" an existing BacNet network, regardless of what network management tool(s) were used to install the existing network, so that existing BacNet devices and newly added devices are part of a single network management database.

E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

F. Standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

G. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.

H. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.

I. All control objects shall conform to the control objects specified in the BACnet specification.

J. The library shall include applications or objects for the following functions, at a minimum:

1. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.

2. Calendar Object. . The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical “point-and-click” selection. This object must be “linkable” to any or all scheduling objects for effective event control.
3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building’s “flywheel” effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day’s performance.
6. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

K. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.

1. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
2. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
3. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an “on” condition. The user must be able to specify either input condition as the “on” condition.
4. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection

as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.

5. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
6. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
7. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
8. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.
10. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an “On” state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.
11. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the “contained” application that are represented on the graphical shell of this container.

L. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:

1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.
2. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file and documentation for the device to facilitate device integration.
3. For BACnet devices, provide the following objects at a minimum:

    a. Analog In
    b. Analog Out
    c. Analog Value
    d. Binary
    e. Binary In
    f. Binary Out
    g. Binary Value
    h. Multi-State In
    i. Multi-State Out
    j. Multi-State Value
    k. Schedule Export
    l. Calendar Export
    m. Trend Export
    n. Device

4. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.
5. For BACnet devices, provide the following support at a minimum

    a. Segmentation
    b. Segmented Request
    c. Segmented Response
    d. Application Services
    e. Read Property
    f. Read Property Multiple
    g. Write Property
    h. Write Property Multiple
    i. Confirmed Event Notification
    j. Unconfirmed Event Notification
    k. Acknowledge Alarm
    l. Get Alarm Summary
    m. Who-has
    n. I-have
    o. Who-is
    p. I-am
    q. Subscribe COV
    r. Confirmed COV notification
    s. Unconfirmed COV notification
    t. Media Types

u. Ethernet
v. BACnet IP Annex J
w. MSTP
x. BACnet Broadcast Management Device (BBMD) function
y. Routing

2.16 MODBUS SYSTEM INTEGRATION

A. The Network Area Controller shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.

B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the EMS. Objects provided shall include at a minimum:

1. Read/Write Modbus AI Registers
2. Read/Write Modbus AO Registers
3. Read/Write Modbus BI Registers
4. Read/Write Modbus BO Registers

C. The Network Area Controller shall perform all scheduling, alarming, logging and global supervisory control functions, of the Modbus system devices.

D. The Controls Contractor shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning

2.17 OTHER CONTROL SYSTEM HARDWARE

A. Space Temperature Wall Module. Wall Module shall be Honeywell or equivalent.

1. Wall module shall have a 20K Ohm NTC thermistor temperature sensor with operating range of 45 to 99 F under a locking cover/enclosure with UL 916 listing designed for mounting on a standard electrical switch box.
2. Space temperature sensors shall be accurate to plus or minus one F degree.
3. Where specified, space temperature sensors shall have a setpoint knob calibrated for warmer-cooler adjustments
4. Where specified, wall module shall also have an after-hours override pushbutton and LED override indicator.
5. Insulating foam shall be installed on the back of all space temperature wall modules to prevent air infiltration from wall opening.

B. Duct Mount and Outside Air Temperature Sensors: Temperature sensors with an accuracy of + 0.3° F. Temperature sensors shall be Honeywell or equivalent.

1. Outside air sensors shall include an integral sun shield.

2. Duct sensors shall have sensor approximately in center of the duct, and shall have selectable lengths of 6, 12, and 18 inches.
3. Multipoint averaging element sensors shall be provided where specified and shall have a minimum of one foot of sensor length for each square foot of duct area (provide multiple sensors if necessary).
4. Pipe mount sensors shall have copper, or stainless steel separable wells.

C. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point shall be provided where specified. Current switches shall include an integral LED for indication of trip condition and a current level below trip set point.

D. Humidity Sensors. Humidity sensors shall be Honeywell or equivalent.

1. Duct and room sensors shall have a sensing range of 5% to 95%.
2. Duct sensors shall be provided with a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall have a compensated ambient temperature range of -40°F to 170° F.

E. Control Panels: Furnish control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. All external wiring shall be connected to terminal strips mounted within the panel. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All work described in this section shall be performed by a Honeywell "Authorized Controls Integrator" that has a successful history in the design and installation of integrated control systems using Niagara Framework™. The installing contractor shall have a local office located within 20 miles from Grossmont Union High School District and a minimum of fifteen years of integration experience installing Honeywell DDC control systems and shall provide documentation in the submittal package verifying the company's experience.

B. The Controls Contractor shall have employees at the local branch that are fully trained and certified for the Honeywell WEBs Systems incorporating Niagara Framework™. Copies of the employees Niagara Training Certificates shall be included in the submittals.

C. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

D. Drawings of the temperature control system network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Owner shall be furnished and installed without additional cost.

E. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by this contractor in accordance with these specifications.

F. Controls Contractors shall have a C-10 License in good standing in the state of California.

3.2 WIRING

A. All electrical control wiring and power wiring to the control panels, NAC, computers and network components shall be installed in conduit and be the responsibility of the Controls Contractor.

B. All wiring shall be in accordance with the California Electrical Code and any applicable local codes. All temperature control system wiring shall be installed in the conduit types allowed by the California Electrical Code or applicable local codes. Where plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

C. Direct Burial Cable shall be used for all underground communication bus wiring between buildings to prevent damage from moisture. The existing underground conduit systems are not watertight.

3.3 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this contractor at no expense to the Owner.

3.4 WARRANTY ACCESS

A. The Owner shall grant to this contractor, reasonable access to the temperature control system during the warranty period.

B. The owner shall allow the contractor to access the temperature control system from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.5 SOFTWARE LICENSE

A. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). The owner, or his appointed agent, shall determine which organizations to be named in the “orgid” of all Niagara Framework software licenses.

B. The owner, or his appointed agent, shall be free to direct the modification of the “orgid” in any Niagara Framework software license, regardless of supplier.

C. The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara Framework (Niagara) based controllers and/or servers and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required Ids and passwords for access to any component or software program shall be provided to the owner.

3.6 ACCEPTANCE TESTING

A. Upon completion of the installation, this contractor shall load all system software and start-up the system. This contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.

B. This contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: Satisfactory completion is when this contractor have performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner’s Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.7 OPERATOR INSTRUCTION, TRAINING

A. During system commissioning and at such time acceptable performance of the temperature control system hardware and software has been established this contractor shall provide both off-site and on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by factory-trained personal that are familiar with the system hardware, software and accessories.

B. This contractor shall provide 4 hours of instruction to the owner's designated personnel on the operation of the temperature control system and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation. Contractor to provide local training facility that will accommodate up to 12 school district employees.

PART 4 - SEQUENCES OF OPERATION

4.1 SEQUENCE OF OPERATION

A. See controls drawings for any required sequences of operation.

PART 5 - POINT LISTS

5.1 SUMMARY

A. The points shown on the controls drawings shall be accessible from the Graphical User Interface (GUI) and/or the Web browser interface (WBI). The supplier of the IDC and IBC devices shall ensure that the points listed in this table are accessible on their respective networks, by the Network Area Controller (NAC).

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SECTION 23 23 00 – REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).
2. Suction Lines for Heat-Pump Applications: 535 psig (3689 kPa).
3. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.
2. Solenoid valves.
3. Hot-gas bypass valves.
4. Filter dryers.
5. Strainers.
6. Pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Shop Drawing Scale: 1/4 inch equals 1 foot (1:50).
2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.8 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.9 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 72 00 "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B) or ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
4. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; Type, Grade, and wall thickness as selected in Part 3 piping applications articles.

B. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.

C. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevel-welded end connection, and raised face.

D. 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.

E. Flanged Unions:

1. Body: Forged-steel flanges for NPS 1 to NPS 1-1/2 (DN 25 to DN 40) and ductile iron for NPS 2 to NPS 3 (DN 50 to DN 80). Apply rust-resistant finish at factory.
2. Gasket: Fiber asbestos free.
3. Fasteners: Four plated-steel bolts, with silicon bronze nuts. Apply rust-resistant finish at factory.
4. End Connections: Brass tailpiece adapters for solder-end connections to copper tubing.
5. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
6. Pressure Rating: Factory test at minimum 400 psig (2760 kPa).
7. Maximum Operating Temperature: 330 deg F (165 deg C).

F. Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket
2. End Connections:

a. NPS 2 (DN 50) and Smaller: With threaded-end connections.
b. NPS 2-1/2 (DN 65) and Larger: With flanged-end connections.

3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
4. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.3 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 275 deg F (135 deg C).

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig (3450 kPa).
8. Maximum Operating Temperature: 275 deg F (135 deg C).

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig (3.4 kPa).
8. Working Pressure Rating: 500 psig (3450 kPa).
9. Maximum Operating Temperature: 275 deg F (135 deg C).

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig (3450 kPa).

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.

5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24, 115 or 208-V ac coil.
6. Working Pressure Rating: 400 psig (2760 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).
8. Manual operator.

F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat Disc: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig (2760 kPa).
6. Maximum Operating Temperature: 240 deg F (116 deg C).

G. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F (4.4 deg C).
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 450 psig (3100 kPa).

H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.

1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
5. Seat: Polytetrafluoroethylene.
6. Equalizer: Internal or External.
7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24, 115 or 208-V ac coil.
8. End Connections: Socket.
9. Throttling Range: Maximum 5 psig (34 kPa).
10. Working Pressure Rating: 500 psig (3450 kPa).
11. Maximum Operating Temperature: 240 deg F (116 deg C).

I. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig (3450 kPa).
5. Maximum Operating Temperature: 275 deg F (135 deg C).

J. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig (3450 kPa).
6. Maximum Operating Temperature: 275 deg F (135 deg C).

K. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).

L. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig (14 kPa).
8. Working Pressure Rating: 500 psig (3450 kPa).
9. Maximum Operating Temperature: 240 deg F (116 deg C).

M. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig (14 kPa).
8. Working Pressure Rating: 500 psig (3450 kPa).
9. Maximum Operating Temperature: 240 deg F (116 deg C).

N. Mufflers:

1. Body: Welded steel with corrosion-resistant coating.

2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig (3450 kPa).
4. Maximum Operating Temperature: 275 deg F (135 deg C).

O. Receivers: Comply with ARI 495.

1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 275 deg F (135 deg C).

P. Liquid Accumulators: Comply with ARI 495.

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig (3450 kPa).
4. Maximum Operating Temperature: 275 deg F (135 deg C).

2.4 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 1-1/2 (DN 40) and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines: Copper, Type ACR or L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Hot-Gas and Liquid Lines: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

D. Hot-Gas and Liquid Lines: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.

E. Hot-Gas and Liquid Lines: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

F. Hot-Gas and Liquid Lines:

1. NPS 5/8 (DN 18) and Smaller: Copper, Type ACR or L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 3/4 to NPS 1 (DN 20 to DN 25) and Smaller: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
3. NPS 1-1/4 (DN 32) and Smaller: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
4. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

G. Hot-Gas and Liquid Lines NPS 2 to NPS 4 (DN 50 to DN 100): Schedule 40, black-steel and wrought-steel fittings with welded joints.

H. Safety-Relief-Valve Discharge Piping: Copper, Type ACR or L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

I. Safety-Relief-Valve Discharge Piping: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

J. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.

K. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

L. Safety-Relief-Valve Discharge Piping:

1. NPS 5/8 (DN 18) and Smaller: Copper, Type ACR or L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 3/4 to NPS 1 (DN 20 to DN 25) and Smaller: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
3. NPS 1-1/4 (DN 32) and Smaller: Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
4. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): Copper, Type ACR, K (A) or L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

M. Safety-Relief-Valve Discharge Piping NPS 2 to NPS 4 (DN 50 to DN 100): Schedule 40, black-steel and wrought-steel fittings with welded joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless or packed-angle valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

L. Install receivers sized to accommodate pump-down charge.

M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Section 23 09 00 "Instrumentation and Control for HVAC" and Section 23 09 93 "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08 31 13 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.

4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.
2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

S. Identify refrigerant piping and valves according to Section 23 05 53 "Identification for HVAC Piping and Equipment."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.

2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints according to AWS D10.12/D10.12M.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).

4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
6. NPS 2 (DN 50): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
7. NPS 2-1/2 (DN 65): Maximum span, 108 inches (2700 mm); minimum rod size, 3/8 inch (9.5 mm).
8. NPS 3 (DN 80): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (9.5 mm).
9. NPS 4 (DN 100): Maximum span, 12 feet (3.7 m); minimum rod size, 1/2 inch (13 mm).

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (9.5 mm).
2. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (9.5 mm).
3. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (9.5 mm).
4. NPS 4 (DN 100): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).

E. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 23 00

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SECTION 23 31 13 – 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.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7 and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports; AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports; and AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-

support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lindab Inc.
    b. McGill AirFlow LLC.
    c. SEMCO Incorporated.
    d. Sheet Metal Connectors, Inc.
    e. Spiral Manufacturing Co., Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements,

materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Factory- or Shop-Applied Antimicrobial Coating:

1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
5. Shop-Applied Coating Color: Black .
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. CertainTeed Corporation; Insulation Group.
    b. Johns Manville.
    c. Knauf Insulation.
    d. Owens Corning.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

    a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Aeroflex USA Inc.
    b. Armacell LLC.
    c. Rubatex International, LLC

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

    a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel, aluminum or stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s).
7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch (2.4-mm) diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 6 inches (152 mm).
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.7 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kinetics Noise Control.
2. Mason Industries.

3. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service, the Office of Statewide Health Planning and Development for the State of California or an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized or ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet (3.7 m) in horizontal ducts, and at every floor for vertical ducts, or as

indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches (38 mm) from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "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 (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
2. Brace a change of direction longer than 12 feet (3.7 m).

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service, the Office of Statewide Health Planning and Development for the State of California or an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 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 Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Ducts with a Pressure Class Higher Than 3-Inch wg (750 Pa): Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
    b. Supply Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 100 percent of total installed duct area for each designated pressure class.
    c. Return Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 100 percent of total installed duct area for each designated pressure class.
    d. Exhaust Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 100 percent of total installed duct area for each designated pressure class.

e. Outdoor Air Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 100 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 33 00 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.11 START UP

A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.12 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel with thicker coating on duct exterior or stainless steel.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units :

    a. Pressure Class: Positive 2-inch wg (500 Pa).
    b. Minimum SMACNA Seal Class: C.
    c. SMACNA Leakage Class for Rectangular: 12
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Constant-Volume Air-Handling Units:

    a. Pressure Class: Positive 3-inch wg (750 Pa).
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

    a. Pressure Class: Positive 4-inch wg (1000 Pa).
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. SMACNA Leakage Class for Round and Flat Oval: 6.

4. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive 4-inch wg (1000 Pa).
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
    b. Minimum SMACNA Seal Class: C.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

    a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

   a. Pressure Class: Negative 3-inch wg (750 Pa).
   b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 12.
   d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

   a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
   b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 12.
   d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

   a. Exposed to View: Type 304, stainless-steel sheet, No. 4 or No. 3 finish.
   b. Concealed: Type 304, stainless-steel sheet, No. 2D finish or Carbon-steel sheet.
   c. Welded seams and joints.
   d. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
   e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   f. SMACNA Leakage Class: 3.

4. Ducts Connected to Dishwasher Hoods:

   a. Type 304, stainless-steel sheet.
   b. Exposed to View: No. 4 or No. 3 finish.
   c. Concealed: No. 2D finish.
   d. Welded seams and flanged joints with watertight EPDM gaskets.
   e. Pressure Class: Positive or negative 3-inch wg (750 Pa).
   f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   g. SMACNA Leakage Class: 3.

5. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:

   a. Type 316 or Type 304, stainless-steel sheet.

      1) Exposed to View: No. 4 or No. 3 finish.
      2) Concealed: No. 2B or No. 2D finish.

   b. PVC-coated, galvanized sheet steel with thicker coating on duct interior.
   c. Pressure Class: Positive or negative 6-inch wg (1500 Pa).
   d. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   e. SMACNA Leakage Class: 3.

6. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel, Carbon steel coated with zinc-chromate primer or Galvanized steel or carbon steel coated with zinc-chromate primer.
2. PVC-Coated Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Galvanized or Match duct material.

3. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Galvanized or Match duct material.

4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

G. Liner:

1. Supply Air Ducts: Flexible elastomeric, 2 inches (51 mm) thick.
2. Return Air Ducts: Flexible elastomeric, 2 inches (51 mm) thick.
3. Supply Fan Plenums: Flexible elastomeric, 2 inches (51 mm) thick.
4. Return- and Exhaust-Fan Plenums: Flexible elastomeric, 2 inches (51 mm) thick.

5. Transfer Ducts: Flexible elastomeric, 2 inches (51 mm) thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Velocity 1000 fpm (5 m/s) or Lower:

      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.

   b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):

      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

   c. Velocity 1500 fpm (7.6 m/s) or Higher:

      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

      1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Standing seam or Welded.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 23 31 13

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SECTION 23 33 00 – AIR 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.

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Manual-volume dampers.
3. Turning vanes.
4. Flexible ducts.
5. Flexible connectors.
6. Duct accessory hardware.
7. Combination fire and smoke dampers.
8. Remote damper operators.
9. Duct-mounted access doors.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Wiring Diagrams: For power, signal, and control wiring.

C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. 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 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

1.7 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

1.9 CALIFORNIA GREEN BUILDING COMPLIANCE

A. In mechanically ventilated buildings, provide occupied areas of building with air filtration media for outside and return air prior to occupancy that provides at least MERV of 8 (Ref. Section 5.504.5.3).

B. Provide testing and adjusting of HVAC systems and controls per 5.713.10.4.

C. If the HVAC system is used during construction, return air filters with a MERV 8 rating shall be used per 5.714.4.1.

D. Installed HVAC equipment shall not contain CFC’s or halons per 5.714.8.1.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Stainless Steel: ASTM A 480/ A 480M

C. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT DAMPERS

A. Description: Suitable for horizontal or vertical installations.

B. Frame: 0.052-inch- thick, galvanized, sheet steel, with welded corners and mounting flange.

C. Blades: 0.050-inch- thick aluminum sheet.

D. Blade Seals: Neoprene.

E. Blade Axles: Galvanized steel.

F. Tie Bars and Brackets: Galvanized steel.

G. Return Spring: Adjustable tension.

2.3 MANUAL-VOLUME DAMPERS

A. General: 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. Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

B. Low-Leakage Volume Dampers: Multiple- or single-blade, opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

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 Seals: Neoprene.
4. Blade Axles: Galvanized steel.
5. Tie Bars and Brackets: Galvanized steel.

C. Jackshaft: 1-inch- diameter, galvanized steel pipe rotating within a 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 of a multiple-damper assembly.

D. 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 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch- wide, double radius curved blades set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into side strips suitable for mounting in ducts.

C. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.5 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized, sheet.

C. Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 4-3/8-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.

D. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.

E. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

F. High-Corrosive-Environment System Flexible Connectors: Glass fabric coated with a chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd..
2. Tensile Strength: 450 lbf/inch in the warp, and 340 lbf/inch in the filling.

2.6 FLEXIBLE DUCTS

A. General: Comply with UL 181, Class 1.

B. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing, glass-fiber insulation around a continuous inner liner. Duct insulation shall have an R value of 8.

1. Reinforcement: Steel-wire helix encapsulated in inner liner.
2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
3. Inner Liner: Polyethylene film.

C. Pressure Rating: 6-inch wg positive, 1/2-inch wg negative.

2.7 ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.

B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.

D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.8 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Greenheck, Ruskin, United Enertech.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded interlocking, gusseted or mechanically attached corners and mounting flange.

F. Heat-Responsive Device: Resettable, 212 deg F (100 deg C) rated, fire-closure device.

G. Heat-Responsive Device: Electric resettable device and switch package, factory installed, rated.

H. Smoke Detector: Integral, factory wired for single-point connection.

I. Blades: Roll-formed, horizontal, overlapping, 0.063-inch-thick, galvanized sheet steel.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 0.039-inch- (1.0-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

L. Master control panel for use in dynamic smoke-management systems.

M. Damper Motors: Modulating or two-position action.

N. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 23 09 23 "Direct Digital Control (DDC) System for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
7. Electrical Connection: 115 V, single phase, 60 Hz.

O. Accessories:

1. Auxiliary switches for signaling.
2. Test and reset switches, remote mounted.

2.9 TURNING VANES

A. Manufacturers: Ductmate, Duro Dyne, Metalaire, Semco.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

2.10 REMOTE DAMPER OPERATORS

A. Manufacturers,: Ruskin, MAT, Young Regulator.

B. Description: Battery operated damper drive wired system designed for remote manual damper adjustment. The system shall consist of a battery powered damper drive pre-wired with plenum rated cable and female over-molded connector, wall or ceiling connector termination fixtures, and a hand held control module (only one required per jobsite). A 9V DC motor shall be factory mounted to the damper drive and compliance tested prior to shipment. The damper drive unit shall operate at static pressure up to 2.5 in wg. Over-molded cable shall fit into surface termination plates, mechanical closet box, or recessed diffuser mount clip without requiring any tools. Plastic surface termination plates shall be UL94-V0 flammability rated. The damper drive shall be operated by a hand held remote control module powered by a 9V battery. Hand held remote control module features shall include an LED open circuit indicator for field verification of proper installation, a 2-color LED array damper position indicator, and an automatic motor shut-off feature at full open and full closed positions. Dampers supplied by others shall meet the following requirements:

1. Standoff bracket (or side plate) with a minimum mounting surface of 3 1/2” x 4” for the damper drive unit
2. 90° open-close motion (to use damper position indicator)
3. Open/close blade stops (to utilize damper position indicator and damper shutoff feature)
4. Maximum torque to open/close of 10 in-lbs.
5. Standoff bracket mounting holes located to ensure that worm gear axis is concentric with damper shaft axis (to prevent eccentric loads on the damper shaft)

C. Wall-Box Mounting: Recessed.

2.11 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Ductmate, Greenheck, United Enertech.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch (25-by-25-mm)butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches (460 mm) Square: Continuous and two sash locks.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

C. 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.

D. Provide test holes at fan inlet and outlet and elsewhere as indicated.

E. Install fire and smoke dampers according to UL listing.

F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Downstream from backdraft dampers and equipment.

2. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
3. Control devices requiring inspection.
4. Elsewhere as indicated.

G. Install turning vanes in 90° rectangular elbows.

H. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

I. Label access doors according to Section 23 05 53 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

J. Install flexible connectors to connect ducts to equipment.

K. Install duct test holes where required for testing and balancing purposes.

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. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION 23 33 00

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SECTION 23 34 23 – HVAC 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.

1.2 SUMMARY

A. Section Includes:

1. Centrifugal Roof Ventilators
2. In-line Centrifugal Fans

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also 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 and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For unit hangars and supports 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

D. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

E. Field quality-control reports.

F. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 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. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Loren Cook Company.
2. Twin City Fan.
3. Greenheck Fan Cooperation

C. Housing: Removable, spun-aluminum, dome top and outlet baffle, one-piece, aluminum base with venturi inlet cone.

1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

F. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 8 inches (200 mm).
3. Pitch Mounting: Manufacture curb for roof slope.
4. Metal Liner: Galvanized steel.

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Loren Cook Company.
2. Twin City Fan.
3. Greenheck Fan Cooperation

C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.

E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

G. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to 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. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Vibration- and seismic-control devices are specified in Division 23 Section “Vibration and Seismic Controls for HVAC Piping and Equipment.”

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

C. Install roof-mounted units to curbs with cadmium-plated hardware.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

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 "Air 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 for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

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.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 23 34 23

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SECTION 23 37 13 – 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:

1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
2. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for balancing diffusers, registers, and grilles.

1.3 DEFINITIONS

A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

C. Register: A combination grille and damper assembly over an air opening.

1.4 SUBMITTALS

A. Product Data: For each model indicated, include the following:

1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

B. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Diffusers, registers, and grilles are scheduled at the end of this Section.

2.2 SOURCE QUALITY CONTROL

A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

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. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

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 the panel. Where architectural features or other items conflict with installation, notify Engineer for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connection 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.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

3.5 DIFFUSER, REGISTER AND GRILLE SCHEDULE

A. Lay in Ceiling Diffuser:

1. Products: Subject to compliance with requirements, modular removable core, 4 core, provide one of the following:

    a. Tuttle and Bailey.
    b. Anemostat Products; Dynamics Corp. of America.
    c. Titus.

2. Material: Steel.
3. Finish: Baked enamel, white.
4. Duct Connection: Round. or Square.
5. Duct Connection Size: As shown on drawings.
6. Face Size: 24” x 24.”
7. Maximum Noise-Criterion Rating: NC20.
8. Face Style: Square. Perforated.
9. Mounting: Lay in.
10. Pattern: Adjustable.
11. Dampers: Opposed blade.

B. Hard Ceiling or Duct Mount Diffusers: Is the same as lay in ceiling diffusers except:

1. Face Size: Frame size required for duct connection size.
2. Face Style: Square.
3. Mounting: Surface mount.
4. Accessories: Provide fames style to match mounting style.

C. Layin ceiling return or exhaust register is same as lay in ceiling diffuser except without adjustable pattern and removable core.

D. Sidewall Supply Register:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Air Systems Components; Krueger Div.
   b. Anemostat Products; Dynamics Corp. of America.
   c. Titus.
   d. Price.

2. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Adjustable vertical.
5. Delete subparagraph below if no rear blades.
6. Rear Blade Arrangement: Adjustable horizontal.
7. Frame: 1 inch wide.
8. Mounting: Concealed.
9. Damper Type: Adjustable opposed-blade assembly.
10. Accessories: Provide frame style to match mounting surface.

E. Sidewall/Hard Ceiling: Return or Exhaust register is the same as sidewall supply register except square or rectangular face style and fixed horizontal single face blade.

END OF SECTION 23 37 13

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SECTION 23 37 23 – HVAC GRAVITY 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.

1.2 SUMMARY

A. Section Includes:

1. Roof hoods.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ventilators, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.

B. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
2. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft., acting inward or outward.

C. Seismic Performance: Ventilators, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. For louvered-penthouse ventilators specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

C. Samples: For each exposed product and for each color and texture specified.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of louvered-penthouse ventilator indicated, in manufacturer's standard size.

F. Delegated-Design Submittal: For shop-fabricated ventilators 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. Detail fabrication and assembly of shop-fabricated ventilators.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which roof curbs and ventilators will be attached.
2. Sizes and locations of roof openings.

B. Seismic Qualification Certificates: For ventilators, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 finish.

E. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat or hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

F. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.3 ROOF HOODS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Carnes.
2. Greenheck Fan Corporation.
3. Loren Cook Company.

B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.

C. Materials: Galvanized-steel sheet, minimum 0.064-inch- thick base and 0.040-inch- thick hood or Aluminum sheet, minimum 0.063-inch- thick base and 0.050-inch- thick hood; suitably reinforced.

D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Self-flashing without a cant strip, with; Built-in cant and; or Built-in raised cant and mounting flange.
2. Overall Height: 12 inches.

E. Bird Screening: Galvanized-steel, 1/2-inch- square mesh, 0.041-inch wire, Aluminum, 1/2-inch- square mesh, 0.063-inch wire, Flattened, expanded aluminum, 3/4 by 0.050 inch thick or Stainless-steel, 1/2-inch- square mesh, 0.047-inch wire.

F. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch or Stainless-steel, 18-by-18 mesh, 0.009-inch wire.

G. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.

    a. Color and Gloss: As selected by Architect from manufacturer's full range.

H. Capacities and Characteristics:

1. Free Area: Not less than 7.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
2. Air Performance: Not more than 0.10-inch wg static pressure drop at 600-fpm free-area exhaust or intake velocity.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Install goosenecks on curb base where throat size exceeds 9 by 9 inches.

C. Install gravity ventilators with clearances for service and maintenance.

D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during installation.

F. Label gravity ventilators according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in Section 23 31 13 "Metal Ducts". Drawings indicate general arrangement of ducts and duct accessories.

3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION 23 37 23

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SECTION 26 00 00

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

1.03 DEFINITIONS

A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

B. CalGreen: California Green Building Standards, CCR Title 24 Part 11, Chapter 5.

C. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constituted authorities and public utility franchise holders having jurisdiction.

D. "Extend", "Submit", "Repair" and similar words mean that the Contractor shall accomplish the action described.

E. "Products", "materials" and "equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.

F. Provide" means furnish, install and connect unless otherwise described in specific instances.

1.04 RELATED WORK

A. Coordination: Refer to Architectural and Mechanical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order and execute the work of this Division so that progress will coordinate with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of electrical work in relation to the work of other Divisions. Examine other Divisions for work related to the work of this Division especially Division 23 – HVAC (Mechanical).

1.05 EXISTING CONDITIONS

A. Visit the site prior to bidding and investigate the existing conditions which affect or will be affected by the work of this Division. Become thoroughly familiar with the working conditions and take into account any special or unusual features peculiar to this job. By the act of submitting a Bid, the Contractor will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his Bid.

1.06 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and the specifications, request clarification.

B. The District’s representative shall interpret the drawings and the specifications, and his decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished thereunder shall be accepted as final and conclusive.

C. In case of conflicts not clarified prior to Bidding deadline, use the most costly alternative (better quality, greater quantity or larger size) in preparing the Bid. A clarification will be issued to the successful Bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.

1.07 PERMITS AND INSPECTIONS

A. Obtain, schedule and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.

B. Afford the District's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

1.08 CODES AND REGULATIONS

A. By submitting a Bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. The Contract Documents may require installations which exceed Code requirements, but are not intended to allow installations which are below minimum Code requirements. In case of conflict where the Contract Documents are below the minimum requirements of applicable Codes, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the District, any work he executes in violation of Code requirements.

1. Applicable Codes: (Current adopted editions except as noted):

    a. California Electrical Code
    b. California Building Code
    c. California Fire Code
    d. Fire Marshal Regulations
    e. Regulations of all other authorities having jurisdiction.

2. Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.09 TESTS

A. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.

B. Provide instruments and personnel for tests and demonstrations. Submit signed test results.

C. Notify the District’s representative seven (7) days in advance of tests to allow presence of District’s representative.

D. Test wiring and connections for continuity, short circuits and improper grounds. Test each lighting panel with mains disconnected from feeders, branches connected, wall switches closed, and fixtures permanently connected and complete with lamps. Test each individual power circuit at panel with the power equipment connected for proper operation.

1.10 RECORDS AND DOCUMENTATION

A. Accumulate the following and deliver to the District’s representative prior to final acceptance of the work.

B. Record (As-Built) Drawings: Maintain in good order in the field office a complete set of electrical prints. Update the drawings daily with neat and legible annotation in red ink showing the work as actually installed.

C. Permits and Certificates of Inspection: Furnish the originals.

1.11 SUBMITTALS

A. Within 15 days after award of Contract, submit for approval a complete list of materials proposed for use. Furnish names and addresses of manufacturers, catalog numbers (where applicable) types and trade names. For purposes of uniformity, only one manufacturer will be accepted for each class or type of material. This list is in addition to Shop Drawings.

B. Submit shop drawings with such promptness as to cause no delay in the work. Do not commence fabrication of the equipment until the approved drawings are received from the District's representative. Shop Drawings and/or brochures are required for the panelboards, safety switches, motor control, and lighting fixtures.

C. Product Data

1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.

2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

3. Weight, dimensions and shipping splits.

4. Equipment operating and service (maintenance) clearances required around the equipment.

D. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.

E. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.

F. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures

G. Samples: when requested by Architect

H. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:

1. Operational procedures for the overall systems including the "Sequence of Operation".

2. Test procedures and test results.

3. Instruction for the proper operation and maintenance of the system.

4. Factory issued technical, installation, and maintenance manuals.

5. Factory issued operations and programming (software) manuals.

6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.

7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Materials shall be new, in accordance with the specification of the Institute of Electrical and Electronic Engineers, National Electrical Manufacturer's Association, National Fire Protection Association, and the California Electrical Code, and shall have an Underwriter's Laboratories listing and bear their label where such service is available.

B. Materials for the same purpose shall be of the same make and shall be the manufacturer's latest standard design that complies with the specification requirements.

C. Whenever on the plans, or in these specifications, products are identified by the name of one manufacturer, it is intended that equivalent products of other manufacturers are acceptable, unless otherwise indicated, if accepted in writing by the District’s representative. However, where three or more manufacturers are mentioned, then the products furnished shall be the product of one of the manufacturers listed. In general, the following manufacturers are considered qualified bidders on the listed categories. Manufacturers listed shall meet quality and performance of a particular item specified by both name and number.

D. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

E. Substitutions: Should the Contractor desire to substitute for specified products, he shall submit with the Material List a complete list of the requested substitutions. The request shall contain complete descriptive information of the products. Samples for evaluation shall also be submitted upon the District's representative request. If, in the District's representative opinion, the materials as presented in this first submittal is in variance with the specified material, or if the information submitted is not sufficiently complete to allow proper evaluation, the substitution will be disallowed from consideration and the specified materials shall be furnished.

2.02 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

B. Comply with CEC.

PART 3 - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

A. Workmanship shall be in conformance with NECA 1 and the best standard practice of the trade except where indicated otherwise.

B. Execute the work so as to contribute to ease of operation and maintenance, maximum accessibility and best appearance. Execute it so that the installation will conform and adjust itself to the building structure, its equipment and its usage. The work shall be symmetrical, plumb, uniform, properly aligned and firmly secured in place.

C. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

3.02 LOCATIONS, SIZES, ROUTINGS AND CLEARANCES

A. For the purpose of clearness and legibility, the drawings are essentially diagrammatic. The size and location of equipment is shown to scale wherever possible, but the Contractor shall make use of all the data in the Contract Documents, and shall verify such information. Contractor is responsible for the equipment provided by him fitting in the spaces available while maintaining required working, ventilation, and equipment maintenance access space. Exercise particular care that such space is not infringed by the work of other Divisions.

B. Conduit and Cable Routing: The drawings show the points of termination, and may suggest a route, for the conduit and cables. However, it shall be the responsibility of the Contractor to install the conduits and cables with a minimum number of bends in such a manner as to conform to the structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and meet all Code requirements with such offsets and special fittings as may be required.

C. Any outlet, wall switch or wiring device may be relocated within a radius of six feet at no additional charge to the District if such request is made prior to installation of the item and its branch circuit.

3.03 CUTTING AND PATCHING

A. Perform drilling, cutting, and patching of the general construction work, which may be required for the installation. Patch with the same materials, workmanship and finish as the original work and accurately match all surrounding work. Such work shall be done by a craftsman accredited in the applicable trade and be acceptable to the Architect.

3.04 GROUNDING AND BONDING

A. Ground and bond the electrical system and equipment in accordance with the most stringent of applicable codes but with the requirements herein and on drawings to be the minimum standards.

B. System Grounding Electrode:

1. Provide a grounding electrode consisting of a ground rod as indicated on the drawings, and bond to the service ground point in the main switchboard.

2. Where available on the premises and in accordance with Code requirements, the water piping system shall be bonded to form a grounding electrode system as described in CEC Article 250.

C. Bonding:

1. Provide piping system bonding in accordance with Article 250.

D. Grounding System Testing:

1. All testing shall be performed using laboratory accuracy test instruments of suitable design for the tests to be performed. Such instruments shall show a valid calibration label.

2. Test the continuity of and the proper connection of each ground conductor and system to assure that the grounding system is complete and proper. The following shall be tested:

a. New grounding electrodes.

b. Grounding conductors of all existing wiring which is reused.

c. Grounding conductors of new wiring for feeders and branch circuits larger than 20 amperes.

E. All portions of the installations which fail to pass these tests shall be replaced, repaired or otherwise corrected to the satisfaction of the Architect at no cost to the District. It is recommended that Contractor perform grounding system quality assurance testing as the work progresses and prior to the work becoming inaccessible by drywall installation.

F. The results of these tests shall be submitted by the Contractor as part of the project close-out submittal and shall show the date of test, instrument used, Contractor's name and name of person performing the tests, name of persons witnessing the test, test data, actual measured minimum value per Code/IEEE and a statement whether the measured values are within acceptable limits.

3.05 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK

A. Protect materials against dirt, water, chemical and mechanical damage both while in storage and during construction.

B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.

C. Replace or refinish any damaged materials including fronts of panels and switchboard sections.

D. Keep raceways, boxes, cabinets, and other openings closed to prevent entry of foreign matter.

3.06 CLEANUP AND HOUSEKEEPING

A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.

B. Leave exposed parts of the electrical work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surface polished. Clean lighting fixtures and wipe lamps clean.

END OF SECTION

SECTION 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Building wires and cables rated 600V and less.
B. Connectors, splices and terminations rated 600V and less.

1.03 DEFINITIONS

A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member of NETA or an NRTL.

1.05 SUBMITTALS

A. Product Data

1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.

2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

B. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.

C. Test Results Report: Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.

D. Samples: when requested by Architect

E. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:

1. Operational procedures for the overall systems including the "Sequence of Operation".

2. Test procedures and test results.

3. Instruction for the proper operation and maintenance of the system.

4. Factory issued technical, installation, and maintenance manuals.

5. Factory issued operations and programming (software) manuals.

6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.

7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Building Wire

a. Anaconda
b. BICC
c. General Cable
d. Okonite
e. Paranite Circle
f. Phelps-Dodge
g. Pirelli
h. Rome
i. Simplex
j. Triangle
k. Or equal

2. Multi-conductor Cable:

   a. Alpha Wire
   b. Belden
   c. Encore
   d. General Cable
   e. Southwire
   f. Or Equal

3. Wire Pulling Compound:

   a. Minerallac
   b. Wyrease
   c. Ideal
   d. Or equal

2.02 GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

B. Comply with CEC.

C. Deliver wire and cable to the site in their original unbroken packages, plainly marked or tagged with UL label, size and insulation type, and manufacturers name.

2.03 CONDUCTORS

A. Soft drawn copper, solid for No. 12 AWG and smaller, stranded for No. 10 AWG and larger or for connections to vibrating equipment or control wiring. Minimum size No. 12 unless noted otherwise. Aluminum conductors shall not be permitted.

2.04 INSULATION

A. Moisture resistant thermoset type XHHW-2 90°C for all underground feeders. Thermoplastic type THHN/THWN-2 90°C for feeders in dry locations and for all branch circuits, except provide high temperature insulations in abnormally high ambient temperatures as applicable.

B. Equipment and electrode ground wires may be uninsulated in conformance with codes, and where indicated.

C. Certain circuit breakers such as 100% rated circuit breakers may require the use of 90 degree C insulated wire (sized at the 75 degree C ampacity). If it is required it will be marked as such by the manufacturer.

2.05 CONNECTIONS AND TERMINATIONS

A. Use Pressure indenter type or self-threading spring wire connectors for sizes up to the catalog capacity of the connector. 3M Scotchlok, Ideal Supernut or Buchanan B Cap. Push-In wire connectors may be used for the solid and stranded wire (including stranding patterns) for which they are UL listed. Ideal In-Sure.

B. Use clamp type pressure connectors complete with clip held insulating cover for large sizes or capacities. As manufactured by Burndy, O.Z. or T & B.

C. In above grade dry locations wrap joints with two layers of plastic tape, half lapped, Scotch No. 33. For splices involving conductors 4 AWG and larger, provide pre-insulated lug kits listed for the conductor size(s) and materials being joined. As manufactured by Ilsco, Penn Union, or equal.

D. Wiring in underground pullboxes shall be spliced using compression connectors and resin encapsulation kits, 3M Scotch-cast, or equal; or shrink tubing kits. Splices shall be completely waterproof.

E. Bolted connections to equipment or busbars shall be made with approved solderless compression type or set screw type lugs for wires No. 8 AWG and larger. Special connections shall be as shown on the plans. Binding screws may be used for size No. 12 solid.

2.06 PULLING COMPOUND

A. Minerallac #100, Wyrease, Ideal 77 Yellow or equal.

2.07 COLOR CODING

A. Comply with identification requirements of Division 26 Section 26 05 53 “Identification for Electrical Systems.”

PART 3 - EXECUTION

3.01 DEMOLITION

A. All existing wiring not being reused shall be removed back to the switchboard, panel or first active outlet box. Vacated conduit shall be removed unless removal would damage the structure. Place blank faceplates on all vacated boxes left in place.

3.02 INSTALLATION

A. Install wiring in conduit unless noted or specified otherwise. Raceways shall be clean and dry before cable installation.

B. Complete raceway and cable tray installation before installation of conductors.

C. Do not exceed manufacturer's recommended pulling tension or minimum bending radius.

D. Tighten connections in accordance with manufacturer's published torque.

E. Provide a dedicated neutral for all 20 amp, 277V or 120V branch circuits. Multi-wire circuits shall not be provided for 277V or 120V loads. Exception: Multi-wire circuits shall be provided for systems furniture feeds in accordance with CEC 210.4 when indicated by the furniture manufacturer's installation instructions.

F. Do not use mechanical devices for pulling No. 2 AWG and smaller wire. Torque limiting types may be used for No. 1 and larger sizes but tensions shall not exceed cable manufacturer's recommendations.

G. Form wire into pigtail splices with 8 inch leads for connections to wiring devices and fixtures.

H. Comply with identification requirements of Division 26 Section 26 05 53 "Identification for Electrical Systems."

I. Attach identification tags to wire and cable at every point where runs are broken or terminated. Exception: Branch circuits need only be tagged at their point of origin. Neutrals for all 120 volt, 2 wire branch circuits shall be tagged in the panelboard with the circuit number or shall be grouped as required by CEC 210.4(D).

J. Provide a pullbox or wireway transition from conduit to MC Cable.

K. Splices shall not be permitted in feeders unless noted otherwise.

3.03 FIELD QUALITY CONTROL

A. All new or existing wire damaged as a result of installation or removal of wire under this Section, shall be pulled out and replaced with new at no additional charge. All existing wire found to be damaged or inadequate shall be called to the attention of the District's representative.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes grounding and bonding systems and equipment

1.03 DEFINITIONS

A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

B. NRTL: Nationally Recognized Testing Laboratory

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

1.05 SUBMITTALS

A. Product Data

1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.

2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

3. Weight, dimensions and shipping splits.

4. Equipment operating and service (maintenance) clearances required around the equipment.

B. Shop Drawings

C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.

D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.

E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures

F. Samples: when requested by Architect

G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:

1. Operational procedures for the overall systems including the "Sequence of Operation".

2. Test procedures and test results.

3. Instruction for the proper operation and maintenance of the system.

4. Factory issued technical, installation, and maintenance manuals.

5. Factory issued operations and programming (software) manuals.

6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.

7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Burndy
2. ERICO
3. ILSCO
4. O-Z Gedney

B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

B. Comply with CEC.

2.03 GROUND RODS:

A. 3/4 inch diameter X 10 feet long copper clad steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. System Grounding Electrode:

1. Where available on the premises and in accordance with Code requirements, the water piping system and metal building frame shall be bonded together to form a grounding electrode system as described in CEC Article 250.

B. Ground and bond the electrical system and equipment in accordance with the most stringent of applicable codes but with the requirements herein and on drawings to be the minimum standards.

C. Provide copper THHN/THWN-2 insulated equipment grounding conductors in all raceways used for electrical power circuits, including conduit, wireway, etc.

D. The grounding conductors shall be provided whether scheduled or shown on the drawings or not, and if necessary the conduit size shall be increased to accommodate them. These grounding conductors shall be connected to the ground terminals on the device or enclosure at each end of the installation and shall be interconnected with the other ground terminals and conductors to form a continuous wired grounding system throughout the electrical wiring system.

E. Ground rods: Drive full length into earth with the top 3 inches minimum below grade or underside of slab. Where ground rods cannot be driven vertically to the desired depth below grade, they shall be driven at an angle away from or parallel to the exterior wall. When driven parallel to the wall, the angle shall not exceed 45 degrees. The rod shall penetrate to a depth of permanent ground moisture.

F. When ground rods cannot be driven because of bedrock at less than 4 feet below grade level, a counterpoise grounding electrode shall be used in place of rods. The counterpoise system shall consist of not less than 50 feet of No. 2 AWG bare tinned copper wire, buried to a depth of at least 18 inches below grade, for each ground rod shown. The conductors shall be run in a straight line.

G. Connections: Connection to ground rods shall be made using exothermic welding devices. Above ground and accessible connections shall be made using exothermic devices. Multiple bolt silicon bronze connectors, Burndy or O.Z. Electric; or exothermic welded, Burndy, Erico Cadweld products, or equal.

H. Grounding electrode conductors shall be provided for service equipment and transformers by the Contractor. Utility Company transformer grounding shall be installed per Utility Company requirements. Ground conductor connections to transformer shall be by Utility Company

I. Flush wall outlets shall have a bonding wire from device ground terminal, or approved mounting screw from strap to metal box.

3.02 FIELD QUALITY CONTROL

A. Test each grounding electrode for resistance at the connection point before connecting any wires. Resistance at the grounding electrode shall not exceed the following:

Service entrance equipment: **10** ohms

Interior electrical systems: **25** ohms

Exterior lighting standards: **25** ohms

Computer isolated systems: **10** ohms

If the above values are not achieved with the installed system notify the District’s representative.

B. Resistance to ground of the electrode shall be a maximum of 10 ohms. If the resistance is in excess of that specified above, provide one or more ground rods bonded to the electrode described herein until the required resistance is obtained. Space rods a minimum of 10 feet apart. Bonding conductor shall be the same size as the grounding electrode connector. Test the electrode using the "fall of potential" method (described in IEEE No. 142) using a Biddle Earth Megger or equal, calibrated within the previous 12 months. Perform test not less than 48 hours after rainfall. No conductive agents, chemicals, water, etc. shall be applied to lower ground resistance.

C. Each grounding electrode shall be tested using a ground resistance Megger, or other suitable instrument, in conformance with the manufacturer's directions. Submit a report listing as a minimum the date of testing, name of tester, instrument used, location and type of ground electrode, and resistance in ohms. Submit within 5 days after testing is completed.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 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. For underground raceways and structures refer to Section 26 05 43 “Underground Ducts and Raceways for Electrical Systems”.

1.02 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.

1.03 DEFINITIONS

A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

B. EMT: Electrical Metallic Tubing

C. IMC: Intermediate Metal Conduit

D. RAC: Rigid Aluminum Conduit

E. RGS: Rigid Galvanized Steel

F. RPC: Rigid Plastic Conduit

1.04 QUALITY ASSURANCE

A. All materials shall be UL listed.

1.05 SUBMITTALS

A. Product Data

1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.

2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

3. Weight, dimensions and shipping splits.

4. Equipment operating and service (maintenance) clearances required around the equipment.

B. Shop Drawings

C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.

D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.

E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures

F. Samples: when requested by Architect

G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:

1. Operational procedures for the overall systems including the "Sequence of Operation".

2. Test procedures and test results.

3. Instruction for the proper operation and maintenance of the system.

4. Factory issued technical, installation, and maintenance manuals.

5. Factory issued operations and programming (software) manuals.

6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.

7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Floor Boxes:

a. Hubbell
b. Lew
c. Steel City
d. Russel – Stoll
e. Thomas & Betts
f. Or equal

2. Wireways:

a. Hoffman
b. Nepco
c. Square D
d. Or equal

C. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

B. Comply with CEC.

2.03 CONDUITS

A. Acceptable Manufacturers

1. Metallic Conduit: Triangle, PWC, Wheeling Steel, Youngstown Sheet & Tube Co., Allied Tube & Conduit Co., Wheatland, or equal.

2. Non-Metallic Conduit: Carlon, CertainTeed, Pacific Western, or equal.

3. Liquidtight Flexible Conduit: American Brass Co., Columbia Cable and Electric Corp. International Metal Hose, Appleton, or equal.

4. Conduit Bodies and Fittings: Appleton Electric, Crouse Hinds, Gedney Electric Mfg. Co., Thomas & Betts, Steel City, or equal.

B. General:

1. Types and applications shall be in conformance with Codes and with this specification

2. Minimum sizes: 3/4” underground or in concrete except that 1/2” is permissible where such a run terminates in a box containing a single wiring device and when required elsewhere herein and on drawings.

C. Types:

1. RGS and IMC and fittings: Hot dip galvanized. Threaded type. Required for circuits operating at voltages above 600 volts and when required elsewhere herein and on drawings.

2. EMT and fittings: Same finish requirements as for RGS. Use permitted only in dry, concealed locations (above suspended ceilings and inside stud walls) and interior exposed locations (10’ minimum above floor) where not subject to mechanical damage. Exposed EMT may be used anywhere within electrical rooms regardless of height. Fittings: Liquid tight compression gland type, steel or malleable iron. Steel City #TC715 or T & B #5123 series. Exception: Cast fittings are permitted for 1-1/2” and larger conduits.

3. Flexible steel conduit and fittings: Flexible conduit shall be galvanized steel and shall be used where shown on the plans and to connect conduit systems to motors, direct wired and vibrating equipment, and as a final connection to lighting fixtures in accessible dropped grid type ceilings. Flex shall not be used as a wiring system instead of EMT. Flex shall be used instead of EMT only where EMT would be impossible to use in interior dry frame or stud construction in conformance with codes and ordinances [and where permission is granted upon request, by the District’s representative].

4. Flexible conduit shall have a code sized grounding conductor run with it and shall have approved grounding fittings. Where used in damp or wet locations flexible conduit shall be of the liquid tight type with outer neoprene jacket and suitable liquid-tight fittings. Fittings: "Jake" or malleable iron squeeze type.

5. Liquid-tight flexible steel conduit and fittings: Same finish requirements as for rigid steel except PVC jacketed. Use in lieu of standard flexible conduit in damp or wet locations and for connections to motors. Fittings: Appleton “ST” series or American Brass “Sealtite” type U.A

6. RAC and fittings: May be used in lieu of EMT for sizes over 1" in interior, dry, above ground locations only. [RAC shall be used for all 400 Hz power circuits except where flexible conduit or other wireway are specified.] Fittings shall be suitable for aluminum and shall be of the threaded type.

7. RPC and fittings: PVC schedule 40. Use permitted only for underground runs and concealed in masonry walls. Final bends associated with conduit stub-ups to transition to above ground conduits shall be PVC coated rigid galvanized steel shall conform to NEMA TC 2 and shall be PVC equal to Carlon Type EPC 40. Conduit, fittings and solvent cement shall be produced by the same manufacturer and shall be chemically and mechanically compatible.

2.04 WIREWAYS AND WIRING GUTTERS

A. Construct of galvanized sheet steel which has been primed and given a final coat of grey enamel. Covers shall be hinged and fastened with brass machine screws spaced not more than 12 inches apart. When covers are on the bottom, provide removable wire supports not more than 3 feet apart.

2.05 OUTLET, JUNCTION AND PULL BOXES

A. Outlet boxes, junction boxes and covers shall be galvanized one-piece pressed steel knockout type. Exception: Exposed conduit boxes shall be cast metal if connected to rigid or intermediate conduit.

B. The size of each box for light outlets shall be determined by the number of wires or conduits, or size of conduits, entering the box but shall be not less than 4” square and 2-1/8” deep, unless prohibited by structural conditions.

C. Wall outlet boxes shall be of size and type to suit each individual location. Minimum box size shall be 4-4/16” square by 2-1/8” deep with single gang plaster rings (depth as necessary). Provide blank device plates

D. All junction boxes on the drawings shall be minimum 4-11/16” square by 2-1/8” deep.

E. Provide wall mounted boxes such as switch, receptacle, telephone, junction, etc., with manufactured "far side box supports", which shall be in contact with the gypsum board surface behind the box.

F. Use approved factory-made knockout seals in all boxes where knockouts are not intact.

G. Use offset bar hangers fitted with fixture studs to support outlet boxes in stud partitions and in furred or plastered ceilings.

H. Outlets for wall mounted telephones shall be an outlet box which is securely fastened to structure.

I. Nonmetallic Floor Boxes: Rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in California Electrical Code (CEC), by a qualified testing agency, and marked for intended location and application.

2. Nonmetallic floor boxes shall be gangable and adjustable.
3. Metal threaded inserts shall be provided for attachment of devices and trim plates.

4. Multi-gang floor box shall be used where indicated on the drawings.

5. There shall be minimum of 1-1/4 inch external height adjustment and minimum 3/8 inch internal final adjustment. Top flange shall be rectangular and adjusted flush with the finished floor.

6. Provide brass tile flanges. Cover shall be brass duplex flap type, equal to Hubbell #S3825 or equal for power, and brass 2-1/8 inch single type, equal to Hubbell #S2825 or equal, for telephone, signal and data systems, and Soundolier 'MRB' or equal series for projector and microphone jacks. Single and ganged floor boxes in carpeted areas shall be provided with clear polycarbonate carpet flange.

PART 3 - EXECUTION

3.01 DEMOLITION

A. Where an outlet, device or item of electrical equipment is shown to be removed, the entire installation, including boxes and conduit, shall be removed unless otherwise indicated.

B. Where the structure, finish, fixture, outlet, circuit or equipment is damaged or left incomplete or unworkable due to demolition work, it shall be patched, repaired, replaced, rerouted or relocated as conditions require and as directed by the Architect.

3.02 INSTALLATION – GENERAL

A. Continuously check the work of the other Divisions to prevent any interference between the various installations. Should structural difficulties or work of other Divisions prevent the routing of conduit as indicated on the drawings, make necessary deviations there from as directed by the District's representative.

B. Provide the empty raceway rough-in and the power for the following systems as indicated on drawings and described herein.

1. Telephone/Voice/Data
2. Fire Detection and Alarm
3. Access Control
4. Intercom
5. Classroom audio/visual

C. Installation of conduit, termination of conduit in terminal closets, and other work necessary for the system rough-in, shall comply with the requirements of communication system suppliers.

3.03 CONDUIT INSTALLATION

A. Telephone/Voice/Data conduit bends shall be as follows:

1. 3/4” and 1” conduit: 12” minimum radius bends,

2. 1-1/4" conduit, 18-in. minimum radius bend.

3. Conduit sizes shown on the drawings are designed so that each separate run will not have more than two 90° bends. If more than two ninety degree bends are required, install long sweep bends. Cast conduit bodies or pull boxes, if required, will not be permitted until the type and location are submitted for approval.

B. Conduit installed in concrete work shall be carefully laid and rigidly supported in the forms in such a manner as to provide proper clearance so that all boxes and outlets will be in exact locations after concrete has set and forms have been removed.

C. Concrete slabs on grade: Conduit shall not be installed in slab on grade.

D. Route conduit so as to clear beams, plates, footings and structural members, whether or not indicated on the plans. Do not run conduit through any structural member of the building, except as specifically directed by the Owner's representative.

E. Where conduit penetrates a fire rated separation, any of the following packing methods may be used to restore the integrity of the separation if Code approved: cement, mineral fiber sprayed with a flame retardant coating, or Dow Corning 3 ¬6548 RTV silicon foam, 3M caulk #CP25, 3M putty #303, or equal. Seal shall be water tight and shall be accomplished prior to wire pulling.

F. Where a conduit enters building through the concrete foundation wall or floor below ground level, provide a watertight seal assembly around the conduit. These seals shall be 0.Z. Type "FSK" or "WSK", or as approved.

G. Do not run conduit closer than 6 inches to any uninsulated hot water or steam pipe, heater flue or vent. If pipe is insulated, the clearance may be reduced to 2 inches.

H. Provide cast conduit bodies (condulets) for exposed runs of conduit where junction, bends or offset are required, whether such condulets are indicated on the plans or not. No bends are permitted around corners, beams, wall or equipment. No running threads are permitted. Run a die over factory threads to ensure that they are clean and free from all coating material and that good metallic contact with the fittings is obtained. Paint the exposed portion of field cut threads with a suitable zinc rich paint.

I. Upon completion of each run of conduit, test the run and clear it of all obstructions. Plug each conduit end with conduit pennies and bushings or manufacturers seals until ready for pulling wire. Provide a 200 pound test nylon or polypropylene pull rope in each empty conduit. Tie off rope at each end and provide an identification tag on rope at each end indicating the room and outlet designation of its destination (as directed by District's representative.

J. Where panelboards and cabinets are installed flush in walls, extend empty conduits from panel to an accessible space above or as indicated on plans. Provide a minimum of one 3/4" conduit for each three single pole spare circuit breakers or spaces, or equivalent, but not less than three conduits.

3.04 CONDUIT INSTALLATION – ABOVE GRADE

A. All conduit above grade or inside of a structure shall be metallic, except in masonry and concrete walls RPC may be used.

B. Run conduit concealed, except as otherwise indicated.

C. Run exposed conduit parallel with or at right angles to walls or as directed by the District's representative.

D. Where conduits are placed in partitions necessitating cutting of any structural member, provide supports as directed by Owner's representative in accordance with applicable structural requirements.

E. Locate conduit so as not to obstruct access or service to equipment.

F. Conduit passing through the roof: Flash and counter-flash in accordance with architectural drawings and specifications. Method shall be compatible with roofing system and acceptable to the Owner's representative. Roof top conduits shall be rigid steel and shall be neatly grouped and installed parallel to the building lines. Support conduit on minimum 2" x 4" redwood or equal sleepers at maximum 5' spacing.

G. Conduit 1” and smaller over metal channel for lath and plaster or acoustical ceilings shall be tied to the supporting channels with 12 gauge galvanized tie wire spaced at a maximum of 10 feet intervals. Conduits shall not obstruct accessibility of ceiling or removal of panels. Do not use ceiling wires for support. Support exposed conduit 1” and smaller from building with T & B, or equal, pipe straps spaced at a maximum of 10 ¬feet intervals. Attach supports with machine screws, nuts and lock washers in metal; wood screws in wood; and expansion shields or inserts in masonry or concrete. Perforated strap iron and nail straps shall not be used. Conduits larger than 1” shall be suspended on pipe racks with Grinnell No. 107B, or equal, split ¬ring hangers and rods from concrete inserts. Conduits supported by unistrut trapezes shall be attached with straps.

H. RGS shall be installed in interior wet locations, exposed exterior locations, and wherever specifically shown. Where installed in exterior locations, RGS and fittings shall be PVC coated for corrosion protection. Conduit, from slab to bottom of surface mounted panelboards, distribution panels, and device outlet boxes, terminal cabinets, where exposed, shall be RGS. Conduit concealed in wall from slab to flush mounted panels, distribution panels, terminal cabinets, and all device outlet boxes for all systems shall be EMT except to devices mounted at 36" or less in which case flexible conduit may be used. Contractor shall be allowed a dimension of 3” above slab to make transition from PVC to EMT, flex or rigid steel as allowed above.

I. Conduits which cross building expansion joints or seismic joints shall be provided with expansion/deflection couplings, Crouse Hinds “XD” Series, or equal where building movement exceeds the rating of expansion/deflection couplings, provide suitable flexible metallic conduit installation across joint.

J. The ends of all underground conduits entering buildings shall be capped or sealed with acceptable compound, such as Crouse Hinds "Chico A", after installation of wire. Cap empty conduit stub-outs at both ends.

3.05 WIREWAYS AND WIRING GUTTERS

A. Sections shall be securely attached to each other and to cabinets, boxes, or duct to insure ground continuity. Provide copper equipment grounding conductors throughout the wireway system. Securely attached or support the wireway or gutter from the building structure at points no more than 4 feet apart. Size shall be as indicated on drawings unless larger is required to conform to CEC. When suspended from roof or ceiling, the support spacing shall be not more than 4 feet and 3/8 inch diameter rods shall be used. When attached to wall, use expansion anchors in masonry and concrete, sheet metal screws supplemented with toggle bolts in drywall with metal studs, and wood screws supplemented with toggle bolts in drywall with wood studs.

B. Power gutter assemblies: Mount gutter to a 3/4 inch plywood backboard. Gutter and backboard shall be sized to accommodate the equipment. Arrange equipment neatly and symmetrically on backboard.

3.06 OUTLET, JUNCTION AND PULL BOXES

A. Boxes shall be labeled with a felt tipped pen indicating the designations of the circuits they contain (panel, circuit #, etc.). Locate the labeling text for easy reading if exposed or above ceiling or below access flooring.

B. Provide pull boxes and junction boxes where indicated on plans or where required by Code. Size to properly accommodate conductors with Code requirements as minimum. When necessary pull and junction boxes are not indicated on drawings and are to be placed in a public space, coordinate the location with the Owner's representative. Boxes of outlet box size which are in public spaces shall be flush mounted and shall have single gang ring and blank device plate painted to match adjacent surface.

C. In all conference rooms, audio labs, office walls common to printer bars, copy rooms, mechanical rooms and similar spaces and also where sound isolation walls are indicated on architectural drawings, provide sound pads (acoustical noise transfer reduction material) applied to all boxes, Dottie 68 type or equal.

D. For local switch outlets, provide 4 inch pressed steel boxes with switch plaster rings for one or two gangs. Where 2 gang, 20 ampere or larger switches occur, provide 4-11/16 inch square boxes with switch plaster rings.

E. For convenience outlets, etc., provide 4 inch square pressed steel boxes, or larger if necessary, with single gang plaster rings.

F. In masonry or concrete construction waterproof boxes manufactured for that purpose shall be used.

END OF SECTION

SECTION 26 05 48

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Work in this section includes providing materials, and equipment for the installation of vibration isolation mounts, brackets, seismic restraints, flexible connectors, and conduit isolation hangers. The installation shall be complete in every respect, tested, and adjusted to be in first class working order.

B. Related sections include the following:

1. Section 26 05 33 "Raceways and Boxes for Electrical Systems."

1.03 DEFINITIONS

A. CBC: California Building Code (CCR Title 24, Part 2)

1.04 GENERAL REQUIREMENTS

A. Comply with CBC and details on the drawings.

B. Comply with ASCE/SEI 7 where referenced by CBC.

C. Seismic-Restraint Loading: ASCE/SEI 7 Seismic Design Category, Component Importance Factor and Occupancy Category as indicated on drawings.

D. Consult vibration isolation schedule for types and static deflections of isolators.

E. Specific items of equipment and accessories are listed in specifications and/or shown on drawings. Where specific manufacturer's model numbers are referenced, it shall be considered that the manufacturer's current and complete specifications are included herein in full.

F. Provide vibration isolators of appropriate sizes and distribution to meet specified deflection requirements. For typical equipment units, provide not fewer than four isolators.

G. Take equipment weight into account and assure that all isolators for any equipment unit deflect uniformly and without “short-circuiting” when the unit is operating. Uniformly means that the maximum and the minimum isolator deflection shall be within 5% of the specified average deflection.

H. The static deflections specified are based on the anticipated equipment characteristics. In the event the equipment proposed by the Contractor has characteristics other than those indicated, the static deflection shall be re-evaluated and the proper mountings and other devices shall be provided.

I. Provide seismic restraints on all vibration isolated equipment and components. Restraints shall resist a seismic acceleration in any direction of at least 0.5 G without damage to equipment, building or mounts. Restraints shall not short-circuit vibration isolators during normal operation. Generally, there shall be as many seismic restraints as there are vibration isolators on a piece of equipment and restraints and isolators shall be paired together.

J. The Contractor shall rigorously avoid short-circuiting to the building any vibration isolated piece of equipment, conduit or other component. Short-circuits with or via rigid braces, rigid sleeves, framing, etc. all shall be avoided. The Contractor shall coordinate among trades so as to prevent the short-circuiting of any vibration isolation system and shall bring any unresolved conflicts to the Owner's representative and attention.

K. Provide all incidental equipment or parts needed to meet the requirements stated, even if not specified or shown on drawings, without claim for additional payment.

1.05 SUBMITTALS

A. Refer to related sections elsewhere for submittal procedural instructions.

B. Submit and obtain approval of shop drawings before ordering components or materials.

C. Submit shop drawings including the following:

1. Location and type of vibration isolations.
2. A complete tabulation showing for each vibration isolator:
3. The design load.
4. The static deflection expected under the design load.
5. Specified minimum static deflection.
6. The additional deflection to solid under design load.
7. The ratio of spring height under design load to spring diameter.

D. Details of seismic restraints, steel brackets, steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, and vibration isolator and seismic restraint mounting attachment methods.

E. Special details at large scale and all other necessary information to convey complete understanding of the work to be provided.

F. Calculations by a professional structural engineer licensed in the state of California, showing that all seismic restraints, bolts, cables, and associated components will conform with the requirements of California Building Code, will comply with other applicable local codes.

G. Submission of samples may be requested for some or all vibration isolation devices. After approval, sample will be returned for installation at the job. All costs associated with submission and return (but not review) of sample shall be borne by the Contractor.

H. Submit, at the time of shipment, a certified statement by the galvanizer indicating conformity of the galvanizing with ASTM specifications for vibration isolators that are located out of doors.

I. At completion of installation, submit the following documents. Submission of these documents must be complete before final acceptance of vibration isolation systems is given.

J. A complete tabulation showing for each vibration isolator:

1. The actual static deflection measured at the project site and the specified minimum static deflection.

2. A report certifying that each piece of isolated equipment or equipment component (conduit, etc.) is not short-circuited by any means

K. The actual static deflection measured at the project site and the specified minimum static deflection.

L. A report certifying that each piece of isolated equipment or equipment component (conduit, etc.) is not short-circuited by any means.

1.06 SUBSTITUTIONS

A. Substitutions of equal equipment beyond the alternates listed will be permitted only with the written permission of the District's representative. Accompany each request for acceptance of substitute equipment with manufacturer's certified data providing the equivalence of the proposed substitute in quality and performance. The District's representative shall be the final judge of the validity of the data submitted.

PART 2 - PRODUCTS

2.01 MATERIALS, COMPONENTS AND PARTS

A. All materials, components, and parts shall be new.

B. Vibration isolators, and seismic restraints shall be the products of an experienced and approved manufacturer. Insofar as possible, they shall be the product of a single manufacturer.

C. All metal parts of vibration isolators installed out of doors shall be hot-dip galvanized after fabrication. Galvanizing shall comply with ASTM A 123, A 153, and A 386 as applicable.

D. All elastomeric mounts, pads, bushings, sleeves, washers, etc., shall have a Shore-A hardness of 30 to 50 durometer after minimum aging of 20 days or corresponding oven-aging.

2.02 ACCEPTABLE MANUFACTURERS

A. Amber/Booth Company, A/B, Houston, Texas

B. Mason Industries Inc., Mason, Los Angeles, California

C. Kinetics Noise Control Inc, Dublin, Ohio

2.03 VIBRATION ISOLATION MOUNTS

A. Mount P1 - Single or Multiple Extra Thick Neoprene Pad(s) and Bearing Plate(s).

B. Neoprene pad shall be waffled, ¾ inch thick, 30 to 40 or 50 durometer, as scheduled, with a minimum 1/16 inch thick steel bearing plate on top. Pad areas shall be selected so no more than 15% and no less than 10% deflection occurs due to the supported load.

C. Provide single or multiple pads and plates in series as specified with 1/16" thick steel shim between layers.

D. Mount P1 shall be the following or approval equal

1. Mason Super W + Plate(s) or SWM
2. Mount B1 - Neoprene-in-Shear Base Mount

E. Neoprene isolators shall be double-deflection neoprene-in-shear type with steel-reinforced base. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed. Bolt holes shall be supplied in the base and the top shall have a threaded fastener. Neoprene no harder than 50 durometer.

F. Mount B1 shall be of the following or approved equal:

1. A/B RVD
2. Mason ND
3. Kinetics RD

G. Mount B1EQ - Neoprene Mount with Seismic Restraint

H. A neoprene isolator with concentric steel elements separated by neoprene no harder than 50 durometer. Mount capable of acting in tension, compression or shear.

I. Mount B1EQ shall be the following or approved equal:

1. Mason RAA, RBA or RCA

2.04 EQUIPMENT BASES

A. Equipment shall have an integral casing or base frame that is adequately strong to be supported directly on vibration isolators without deforming the casing or frame or affecting equipment or isolator operation. Place vibration isolators directly under equipment or connect steel height-saving brackets to the sides of the equipment and place isolators under brackets. Equipment manufacturer shall approve such mounting.

2.05 SEISMIC RESTRAINTS

A. EQR1 - Floor-Mounted Equipment on Isolation Mounts without Seismic Restraint Housing.

B. Separate earthquake restraints shall be provided for all floor-mounted equipment on vibration isolation mounts that do not include seismic restraint housings. Provide a minimum of four all-directional earthquake restraints that are located as close to the vibration isolators as possible to facilitate attachment of both to the base and the structure. The restraints shall consist of interlocking steel members restrained by a shock-absorbent neoprene bushing. Bushing shall be a minimum of ¼" thick. Restraints shall be manufactured with an air gap between hard and resilient material of 3/16 to ¼". Snubbers shall be installed with factory-set clearances. Snubber end shall be removable to allow inspection of internal clearances. Snubber bushing shall be rotated during and after installation to insure no short circuits exist. Restraints shall comply with the CBC and shall resist a seismic acceleration in any direction of at least 0.5 G without damage to themselves, the building or the equipment.

C. Earthquake restraints shall be the following or an approved equal:

1. Mason Z-1011 or Z-1225

2.06 FLEXIBLE CONNECTIONS

A. Make flexible electrical connections to all vibrating equipment so as to prevent any vibration transfer to the building.

B. Alternate A

1. Employ flexible metallic conduit installed grossly slack. Support flexible metallic conduit on both sides of slack portion per CEC.

C. Alternate B

1. Employ flexible expansion/deflection conduit couplings sized for the application (1” to 6” diameters available). Coupling to have flexible and watertight outer jacket, inner grounding strap, flexible plastic inner sleeve to maintain smooth wireway, and end hubs with threads to fit standard threaded metal conduit.

2. Coupling shall be XD Xpansion/Deflection Coupling by Crouse-Hinds of Syracuse, New York, or Type DF Expansion and Deflection Fitting by Spring City Electrical Mfg. Co. of Spring City, Pennsylvania.

2.07 CUSTOM RESILIENT AND AIRTIGHT SLEEVE FOR CONDUITS AT CONSTRUCTION PENETRATIONS

A. Sleeve shall be custom-fabricated. It shall be formed from pipe or sheet metal that is 1” larger in each cross-sectional dimension than the penetrating element and is 2” longer than the thickness of the construction penetrated.

1. The annular space between the sleeve and the penetrating element shall be packed tightly with long-fiber glass fiber 2 - to 3-pcf density to within 2” of the ends of the sleeve.

2. The remaining 2” space at each end shall be filled completely with acoustical sealant to form an airtight seal.

B. Glass fiber packing by CertainTeed, Manville, or Owens-Corning.

C. Acoustical Sealant by DAP, Tremco or U.S. Gypsum, choice depending on application and as approved by Owner’s representative.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall provide the vibration isolation devices, seismic restraints, and related materials as specified herein.

B. The Contractor shall not install any conduit that makes rigid contact with the “building” unless it is approved in this specification or by the Owner’s representative. “Building” includes, but is not limited to, roofs, floors, beams, columns, walls, partitions, ceilings, studs, ceiling framing and suspension systems.

C. Prior to installation, the Contractor shall bring to the Owner's representative attention any conflicts between trades that will result in unavoidable rigid contact of conduit with the building due to inadequate space or other unforeseen conditions. Corrective work after installation, necessitated by unresolved conflicts before installation, shall be at the Contractor's expense.

D. Prior to installation, the Contractor shall bring to the Owner's representative attention any discrepancies between the specifications and field conditions or any charges required due to specific equipment selection. Corrective work after installation, necessitated by unreported discrepancies or changes, shall be at the Contractor's expense.

E. The Contractor shall obtain written and/or instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices; alternatively, the equipment may be installed by the vibration isolation manufacturer.

F. No equipment unit shall bear directly on or be suspended from vibration isolators or brackets unless its own frame or casing is suitable rigid to span between isolators without any significant or noticeable deformation and such support is approved by the manufacturer.

G. Unless otherwise indicated, a minimum clearance of 1" shall be provided between the top of a housekeeping pad or floor or roof and the underside of an equipment unit or steel base frame or concrete inertia block that is vibration-isolated. This space shall be cleaned thoroughly of all dirt and debris.

H. A written report shall be submitted to the Owner's representative covering all base-mounted equipment and stating that required floor-base clearances have been achieved and that the intervening spaces are clean and free of any material that could short-circuit vibration isolators.

I. After each equipment unit installation is complete and under full operational load, vibration isolators shall be adjusted so that loads are transferred to them and away from temporary blocking washers and shims. Blocks and shims then shall be removed and used as gauges to judge required clearances. Washers shall be moved away.

J. Inspect all vibration-isolated equipment, coordinate the work of all involved trades, and see the vibration isolators are not short-circuits. Also, ensure that for hanger isolators and their rods or wires do not touch any other hung building components especially ceiling systems.

K. Where "conduit systems" are required to be vibration-isolated in a certain room or for a certain distance from an equipment unit, "conduit systems" shall include all conduit, and connected hardware.

L. Space all vibration-isolated equipment and isolated components and all vibration isolators (including rods and wires) so as to be entirely free of any contact with any building element in any reasonable operating position.

M. Size, select, and install all seismic restraints so as to resist seismic forces from the building in any direction without damage to equipment, isolators, restraints, or building. Restraints shall not short-circuit vibration isolators during normal operation. Restraints shall comply with the California Building Code and any local codes and shall resist an acceleration of at least 0.5 G.

3.02 SPECIFIC EQUIPMENT

A. Utility Transformer:

1. These can be hard-mounted to a separate concrete pad provided.

B. Large Main Building Transformer:

1. Isolate main building transformer (over 200kVA) on Type B1 or B1EQ mounts providing a minimum static deflection of 0.35". Provide flexible bus connections or flexible conduit connections between these transformers and all switchboards. Rigid busses should be suspended via Type H2 hangers (0.35" m.s.d.).

C. Remote and Smaller Building Transformers:

1. UNDER 100kVA: Isolate on Type P-1 pads sized (with appropriate bearing areas) for 0.10" m.s.d. Provide Type EQR1 seismic restraint. Provide flexible conduit connections to all transformers.

2. OVER 100kVA: Isolate on Type B1 or B1EQ mounts providing 0.35" m.s.d. Provide Type EQR1 seismic restraints. Provide flexible conduit connections to all transformers.

D. Dimmer Banks:

1. Treat the same as over 100kVA @ transformer (described above).

2. Conduit Connections to All Isolated Equipment:

3. Conduit connections to fans, pumps, etc., which are vibration isolated should be made flexible.

3.03 FLOOR-MOUNTED EQUIPMENT

A. The equipment unit to be isolated shall be supported on vibration isolators as scheduled and as specified in Part 2 above.

B. All general execution requirements shall be observed in accordance with Paragraph 3.01 above.

3.04 SEISMIC RESTRAINTS

A. All rigidly or resiliently installed equipment, and conduits shall be capable of receiving a seismic input from the building in any direction on the equipment center of gravity without damaging the buildings, equipment or mounting system.

B. All installations shall be inspected and approved by the Owner's representative for adequate seismic restraint and to assure that such does not short-circuit vibration isolators during normal operation. Adjustments, as reasonably required, shall be made by the Contractor at no expense to the Owner.

C. All vibration isolators and seismic restraints shall be suitably secured to appropriate structure so that the fastenings and structure can handle the seismic load.

3.05 RESILIENT SUPPORT OF CONDUITS

A. Unless otherwise specified, provide resilient support for all conduits throughout the building. No such conduit is to come into rigid contact with the building.

B. Support all piping in mechanical equipment rooms on Type B3 or B4 or H3 springs sized for minimum 1 inch static deflection, unless otherwise noted.

3.06 CONNECTIONS TO EQUIPMENT

A. Make flexible electrical connections to all vibrating equipment.

1. Alternate A

    a. Install flexible conduit in a grossly slack, shallow "U" form. Flexible conduit shall be at least 3 feet or 20 diameters long, whichever is longer.

2. Alternate B

    a. The flexible coupling shall be free of any nearby building construction and shall be installed slack and free of strain in any direction.

3.07 RESILIENT AND AIRTIGHT SLEEVES

A. Custom sleeves

1. Cut a clean opening in the penetrated construction very nearly the size of the sleeve for each penetrating element. Provide lintels above, relief structure below, and vertical framing between and to the sides as required. Provide the above, escutcheon plates, and anything else necessary to make the penetrated structure as solid and massive near the penetrations as away from the penetrations.

2. Set the metal sleeve into the penetrated construction in an airtight manner around its outer periphery, using grout, dry packing, plaster, or drywall compound full depth and all around - but only to a maximum width of 1 inch - or the requirements of the above paragraph shall not have been satisfied.

3. Pack the 2 inch wide annular opening with glass fiber between metal sleeve and penetrating element full depth all around to a firm degree of compaction. Leave a 2 inch deep annular opening free at each end of the metal sleeve; fill this fully with acoustical sealant.

3.08 FIELD INSPECTIONS AND TESTS

A. Upon completion of the work, the District's representative will carry out an inspection of the project and of final project record documents and will inform the installing contractor of any further work that must be completed. Make all adjustments as directed by the District's representative that result from this inspection. This work shall be done before final acceptance of vibration isolation systems is given.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Identification of fire alarm raceways
2. Identification of power and control cables
3. Identification of conductors
4. Identification of wiring device faceplates
5. Underground line warning tape
6. Identification of switchboards, panelboards, transformers and disconnects

1.03 DEFINITIONS

A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.04 QUALITY ASSURANCE

A. Comply with ANSI A13.1 “Scheme for the Identification of Piping Systems. “

B. Comply with CEC.

C. Comply with 29 CFR 1910.144 “Safety color code for marking physical hazards” and 29 CFR 1910.145 “Specifications for accident prevention signs and tags.”

D. Comply with ANSI Z535.4 “Product Safety Signs and Labels”

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969 “Marking and Labeling Systems.”

1.05 SUBMITTALS

A. Product Data

1. Material List and Manufacturer's Literature

B. Samples: when requested by Architect.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 IDENTIFICATION SYSTEMS

A. Nameplates

1. Provide nameplates indicating the equipment designation for safety switches and individually mounted breakers, starters, remote control switches and similar items. For indoor locations provide tape nameplates (Kroy, Brother, Weber or equal). For outdoor locations provide laminated black-white-black Bakelite or phenolic plastic with 3/16” high lettering engraved through the outer covering. Affix with small self-tapping cadmium plated machine screws, or a durable, waterproof, heat and sun resistant adhesive appropriate to the purpose. The text shall be spaced away from each end so the screw heads do not overlap the text.

2. Provide nameplates as required by other Sections. Nameplates shall be laminated black-white-black bakelite or phenolic plastic with 3/16” high lettering engraved through the outer covering except where specifically described otherwise. Affix with small self-tapping cadmium plated machine screws appropriate to the purpose (no rivets or glue). The text shall be spaced away from each end so the screw heads do not overlap the text. The screws shall not project beyond the backside face of panelboard doors.

3. Engrave as indicated on drawings or herein. If not indicated, the engraving should describe the equipment served.

B. Underground Warning Tape: Tape shall be polyethylene plastic manufactured specifically for warning and identification of all buried utility lines. Tape shall be of the type provided in rolls, 6” minimum width, color coded for electric lines (red), and communications (orange) with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Tape shall consist of top and bottom layers of B 721 polyethylene or polyester with a center metallic foil core suitable for locating by a conventional detector at the specified depth. Tape shall be by Thor Enterprises, Brady, Seton, or equal. Submit data sheets as specified under "SUBMITTALS".

PART 3 - EXECUTION

3.01 INSTALLATION

A. Device Plates

1. Provide switch and device plates with engraved designations wherever called for by words, set off in quotation marks near a switch location, or by symbol. If inscription is not detailed on drawings request it from the Owner's representative. Engraving shall be in 1/8” high block type letters filled with black enamel.

2. Each switch, receptacle device, etc. which is installed in an outlet box with coverplate shall have the panel and circuit number engraved with 1/8" high black filled lettering at top of cover plate.

B. Conduit

1. All Fire Alarm system conduits shall have a 2 inch wide band of red paint every 10 feet along the length.

C. Wire Color Coding

1. Insulation for wires No. 6 and smaller shall be factory color coded and for larger sizes where available from the factory. When factory color is not available provide 1" band of colored pressure sensitive tape at each splice and termination point. Colors shall be consistent throughout the respective system and shall be identified as follows.

System	A - Phase	B - Phase	C - Phase	Neutral	Ground
120/240V 1∅ 3W	Black	Red	----	White	Green
120/240V 3∅ 4W	Black	Orange	Blue	White	Green
240V 3∅ 3W	Black	Red	Blue		Green
208Y/120V 3∅ 4W	Black	Red	Blue	White	Green
480Y/277V 3∅ 4W	Brown	Orange	Yellow	Grey	Green

2. Isolated ground for conductors system shall be green with a yellow stripe or green marked with yellow tape.

3. Control, low voltage, and other systems shall have distinctive coloring different from above.

4. Control Circuits:

Hot Lead (usually to stop pushbutton)	Red
Common return	Yellow
Main coil (usually to start pushbutton)	Brown
Reset coil	Blue
Trip coil	Orange

D. Conductor Color Coding

1. All branch circuit conductors shall have their circuit numbers identified with tape labels on each phase conductor. Identification shall be provided at each outlet box, junction box, panelboard, contactor cabinet, or similar location.

E. Nameplates

1. Engraved nameplates shall be provided on each power and communications system feeders in underground pull boxes. Nameplates shall be fastened to feeders with plastic tie wrap. Description shall indicate origin voltage and destination of feeder, i.e.: "From MSB to Panel HZA voltage, 480Y/277 volts". This same tagging method shall be applied to all pull ropes in empty spare conduits. Tags for pull ropes shall include origin and destination of each conduit.

2. All conductors or signal cables left unconnected shall be identified by labeling with their intended use, circuit number, or other suitable information. All power and communications conductors or cables shall tape identified denoting circuit or zone numbers with tape type labels on each conductor of circuit or cable.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Daylight-harvesting controls.
4. Indoor occupancy sensors.
5. Outdoor motion sensors.
6. Room Controllers.
7. Lighting contactors.
8. Emergency shunt relays.
9. Modular dimming controls.

B. Related Requirements:

1. Section 26 27 26 "Wiring Devices" for manual toggle switches and occupancy-controlled receptacles.

2. CalGreen.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in Operation and Maintenance manuals.

B. Acceptance Testing Certification: For each interior and exterior space as required by CCR Title 26 Part 6.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Intermatic, Inc.
2. NSi Industries LLC; TORK Products.

B. Electromechanical-Dial Astronomical Time Switches: Comply with UL 917.

1. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: DPST.
3. Contact Rating: 30A inductive or resistive, 120V, 208V, 240V or 277V AC as indicated.
4. Circuitry: Allows connection of a photoelectric relay as a substitute for the on-off function of a program.
5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
6. Skip-a-day mode.
7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.
4. Tyco Electronics; ALR Brand.

B. Description: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 DAYLIGHT-HARVESTING DIMMING CONTROLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc. “Greengate”
2. Acuity Brands “nLight”
3. WattStopper “DLM”
4. Douglas Lighting Controls
5. Or Approved Equal

B. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.

1. Lighting control set point is based on two lighting conditions:

a. When no daylight is present (target level).
b. When significant daylight is present.

2. System programming is done with two hand-held, remote-control tools.

a. Initial setup tool.
b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent.

C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.

1. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts and light engines. Sensor is powered by controller unit.
3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by CEC.
4. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc (120 to 640 lux).

2.4 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc. “Greengate”
2. Acuity Brands “nLight”
3. WattStopper “DLM”
4. Douglas Lighting Controls
5. Or Approved Equal

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 HP at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by CEC.
5. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using both PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by selecting controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.5 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc. “Greengate”
2. Acuity Brands “nLight”
3. WattStopper “DLM”
4. Douglas Lighting Controls
5. Or Approved Equal

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 degrees F (0 to 49 degrees C).
3. Switch Rating: Not less than 800-VA fluorescent at 120 V and 1200-VA fluorescent at 277 V.
4. Switch Rating: Not less than 800-VA LED at 120 V and 1200-VA LED at 277 V.

C. Wall-Switch Sensors:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft. (84 sq. m).
2. Sensing Technology: PIR.
3. Switch Type: SP, manual "on," automatic "off."
4. Voltage: 120/277 V; passive-infrared type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space to help eliminate false "off" switching.

2.6 HIGH-BAY OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements provide products by one of the following:

1. Cooper Industries, Inc. “Greengate”
2. Acuity Brands “nLight”
3. WattStopper “DLM”
4. Douglas Lighting Controls
5. Or Approved Equal

B. General Description: Solid-state unit. The unit is designed to operate with the lamp and ballasts indicated.

1. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
2. Operation: Turn lights on when coverage area is occupied, and to half-power when unoccupied; with a time delay for turning lights to half-power that is adjustable over a minimum range of 1 to 16 minutes.
3. Continuous Lamp Monitoring: When lamps are dimmed continuously for 24 hours, automatically turn lamps on to full power for 15 minutes for every 24 hours of continuous dimming.
4. Operating Ambient Conditions: 32 to 131 degrees F (0 to 55 degrees C).
5. Mounting: Threaded pipe.
6. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
7. Detector Technology: PIR.
8. Power and dimming control from the lighting fixture ballast that has been modified to include the dimming capacitor and MyzerPORT option.

C. Detector Coverage: User selectable by interchangeable PIR lenses, suitable for mounting heights from 12 to 50 feet (3.7 to 15.2 m).

D. Accessories: Obtain manufacturer's installation and maintenance kit with laser alignment tool for sensor positioning and power port connectors.

2.7 OUTDOOR MOTION SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc. “Greengate”
2. Acuity Brands “nLight”
3. WattStopper “DLM”
4. Douglas Lighting Controls
5. Or Approved Equal

B. General Requirements for Sensors: Solid-state outdoor motion sensors.

1. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
2. PIR type, weatherproof. Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm). Comply with UL 773A.
3. Switch Rating:

    a. Lighting-Fixture-Mounted Sensor: 500-VA fluorescent or to match controlled LED and driver.
    b. Separately Mounted Sensor: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 HP at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by CEC.

4. Switch Type: SP, dual circuit. With bypass switch to override the "on" function in case of sensor failure.
5. Voltage: 277-V type.
6. Detector Coverage:

    a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
    b. Long Range: 180-degree field of view and 110-foot (34-m) detection range.

7. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
8. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
10. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 degrees F (minus 40 to plus 54 degrees C), rated as "raintight" according to UL 773A.

2.8 ROOM CONTROLLER

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc. “Greengate”
2. Acuity Brands “nLight”
3. WattStopper “DLM”
4. Douglas Lighting Controls
5. Or Approved Equal

B. General Requirements for Room Controllers: Provides a control and communication interface between line voltage circuits and low voltage sensors.

1. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
2. Listed under UL 508 and UL 924.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 104 degrees F (0 to 40 degrees C).
4. Input Voltage Rating: 120/277 V-ac.
5. Line Voltage Output Rating: Not less than 20A combined load per Room Controller. Relay contacts rated for 20A ballast load at 120/277-V ac, for 15A tungsten at 120-V ac, and for 1 HP at 120-V ac.
6. Class 2 Dimming Output Rating: 0-10-V dc.
7. Manual or automatic ON, BI-LEVEL, TRI-LEVEL and DIMMING control.
8. Integral Demand Response unit.
9. Integral skylight connection for classroom applications.
10. UL 924 emergency relay in separate or barriered compartment.
11. Integral receptacle (plug-load) control relay when required.
12. Automatic functionality upon power-up.
13. Compatible with LED dimming drivers.

C. Control Wiring for Room Controllers: Class 2 using RJ45 or equivalent low-voltage bus between controller and low voltage sensors.

2.9 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP.
3. Eaton Corporation.
4. Square D.

B. Description: Electrically operated and mechanically held, combination-type lighting contactors, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current) and LED.
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.

1. Monitoring: On-off status.
2. Control: On-off operation.

2.10 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lighting Control and Design.
2. Watt Stopper.
3. Bodine (Model GTD20A).

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

1. Coil Rating: 120 through 277 VAC.
2. Switch Rating: 20 amps

2.11 MULTIPRESET MODULAR DIMMING CONTROLS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc. “Greengate”
2. Acuity Brands “nLight”
3. WattStopper “DLM”
4. Or Approved Equal

B. Description: Factory-fabricated equipment providing manual dimming consisting of. the following:

1. Master controller.
2. Dimmer panels, and indicated number of zone stations.
3. Controls and dimmers shall be integrated for mounting in a multi-gang wall box under a single wall plate.
4. Each zone shall be adjustable to indicated number of scenes, which shall reside in the memory of zone controller.

C. Each zone shall be configurable to control the following loads:

1. Fluorescent lamps with electronic ballasts.
2. Non-dim, on-off switching only.
3. LED light engines

D. Dimmers: Regulate voltages to maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent rms.

E. Memory: Retain preset scenes and fade settings through power failures by retaining physical settings of controls.

F. Device Plates: Style, material, and color shall be manufacturer's standard matte black finish. Master-control cover plate shall be one piece.

G. Master controller shall include the following:

1. Wall-box style, single coverplate supplied by manufacturer.
2. Cover-mounted switches, including master off, all bright, and selectors for each scene.
3. Cover-mounted LED indicator lights, one associated with each scene switch, and one for the master off switch.
4. Concealed switches and indicators for specified function.
5. A raise/lower switch for each zone for temporary adjustments of the zone, without altering scene values stored in memory.
6. Fade time indicated by digital display for current scene while fading.
7. Cover-mounted infrared receiver.
8. All necessary power supplies to support the connected 24 volt DC peripheral devices.

H. Remote-Control Stations:

1. Numbered back-lit push buttons to select scenes.
2. Off switch to turn master station off.
3. On switch turns all scenes of master station to full bright.
4. Control Wiring: CEC, Class 2.
5. Mounting: Single flush standard 1-gang wall box with manufacturer's standard faceplate with matte black finish

I. Infrared Remote-Control Station: Same functions as for standard remote-control station except that functions are input by a hand-held infrared transmitter. Operate up to 50 feet (15 m) within line of sight of the master controller.

J. Dimmer Panels: Modular, plug-in type, complying with UL 508.

1. Integrated Short-Circuit Rating: 14 kA for 277 V.
2. Dimmers:

a. Dimming Circuit: Two SCR dimmers, in inverse parallel configuration.
b. Dimming Curve: Modified "square law" as specified in IESNA's "IESNA Lighting Handbook"; control voltage is 0- to 10-V dc.
c. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
d. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in rms voltage.

K. Circuit Breakers: Complying with UL 489 and classified as switch duty (SWD).

L. Ethernet Interface: Solid state interface device to allow control and monitoring of the modular dimming system from the theatrical dimming system.
1. Interface shall allow integration with RS232 or TCP/IP Ethernet communication protocols.
2. Shall as a minimum control scene selection, scene lockout, zone lockout, sequencing, zone raise/lower.
3. Provide an unventilated metal enclosure suitable for wall mounting.

M. Emergency Lighting Interface: Solid state, UL924 Listed.
1. Shall automatically turn all lighting loads to full brightness upon sensing of loss of normal power to all phases of the controlled lighting system.
2. Sensor range shall be 100-347 volts, 50/60 Hz, 1-phase or 3-phase.
3. Provide status indicator and test switch.
4. Unit shall mount to a standard 4-inch square junction box.

2.12 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 24 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

2.13 CURRENT LIMITING PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. LC & D Lighting Control and Design ‘Silver Bullet T24M-489UL’
2. Approved Equal

B. Description: Sub-branch circuit current limiter panel complying with UL 508 and UL 489.

1. Enclosure: Surface mount, hinged locking door, NEMA 1

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-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, or equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 26 05 53 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Permanently Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.

    a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
    b. Remove and replace malfunctioning modular dimming control components and retest as specified above.

2. Perform and document all acceptance tests required by California Title 24 Energy Code. Coordinate acceptance testing with commissioning agent when commissioning is applicable. Testing shall include, but not necessarily limited, to the following:

    a. Automatic Daylighting Control Acceptance.
    b. Occupant Sensor Acceptance.
    c. Automatic Time Switch Control Acceptance.
    d. Demand Response Controls.
    e. Outdoor Motion Sensor Acceptance.
    f. Outdoor Lighting Shut Off Controls.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment at no additional cost to the District.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

E. Reports: Provide written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments. Reports shall be completed and signed by the certified technician and submitted to the District and to other entities as required by CCR Title 24 Part 6.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit District's operations.
2. For daylighting controls, adjust set points and dead band controls to suit District's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train District's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 26 09 23

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Snap switches
2. Keyed switches
3. Duplex receptacles
4. GFCI receptacles
5. Device plates

1.03 DEFINITIONS

A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

B. CBC: California Building Code (CCR Title 24, Part 2)

C. GFCI: Ground-fault Circuit Interrupter

D. NECA 1: Standard Practice of Good Workmanship in Electrical Contracting

E. SPD: Surge Protective Device, formerly TVSS: Transient Voltage Surge Suppressor

1.04 QUALITY ASSURANCE

A. Comply with CEC and NECA 1.

1.05 SUBMITTALS

A. Product Data

1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.

2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

B. Shop Drawings

C. Samples: when requested by Architect

D. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:

1. Instruction for proper operation.
2. Factory issued technical, installation, and maintenance manuals.
3. Factory issued operations and programming (software) manuals.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

2.02 ACCEPTABLE MANUFACTURERS

A. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.03 SWITCHES

A. AC general use snap switches shall be industrial grade toggle handle, quiet operating, UL 20 listed and verified to meet Federal Specification W S 896 and NEMA WD 1 heavy duty tests.

B. Switches shall be rated 120/277V, 20A.

C. Toggle handle color shall be white.

D. Switches shall be constructed with oversized silver cadmium alloy contacts, permanent lubrication, and binding head screws suitable for #10 AWG wire, back & side wire. Connection shall be made by wrapping the wire around the screw or tightening a screw clamp. Push in type connections are not acceptable. Switches may have built in pigtail connection in lieu of screw connection. Switches shall be self- grounding.

E. Acceptable Manufacturers:

1. Cooper (Arrow Hart) 1221
2. Hubbell HBL1221
3. Leviton 1221-2
4. Pass & Seymour #PS20AC1

F. Keyed and momentary contact switches, required but not listed, shall be of the same manufacturers and identical quality as those listed above.

G. Illuminated mushroom pushbuttons for cooktop, range and shop power shutdown shall be 2¼" diameter, red, equal to Square D 9001 series, mounted on stainless steel plate. Plate shall be fastened with four screws, one at each corner.

2.04 RECEPTACLES

A. General receptacle outlets shall be premium industrial grade 20A, 125 volt, 2 pole, 3 wire NEMA 5-20R. The attachment screw shall have an automatic grounding clip. A green grounding screw shall be mounted on the bridge which shall run around the back of a break and impact resistant plastic body. The bridge shall be securely locked to the body. Outlets shall be UL 498 listed and verified to meet Federal Specification WC 596 and NEMA WD 1 heavy duty performance tests. Contacts shall be extra heavy duty copper alloy or bronze double wipe type. Outlets shall have binding head screws suitable for #10 AWG wire. Connection shall be made by wrapping the wire around the screw or tightening a clamp. Push in type connections are not acceptable. Outlets may have built in pigtail connection in lieu of screw connection.

B. Receptacle outlet faces shall be white. Exception: receptacles that are controlled by occupancy sensors as switched plug loads shall be gray.

1. Acceptable Manufacturers:
    a. Cooper (Arrow Hart) AH5362
    b. Hubbell HBL5362
    c. Leviton 5362
    d. Pass & Seymour 5362

C. Receptacles installed outdoors or in other damp or wet locations shall be listed weather-resistant.

D. Ground fault circuit interrupter (GFCI) outlets shall be specification grade UL 498 NEMA 5-20R 125V 20A duplex grounding non-feed-through type self-testing receptacle, designed to prevent normal operation when miswired, suitable for mounting in a standard outlet box. A ground current of 5 milliamps or higher shall trip the circuit open in less than 1/30 second. There shall be a test button and a reset button on the front. Each GFCI outlet shall be tested after installation and results of the test submitted in writing.

1. Acceptable Manufacturers:

    a. Cooper (Arrow Hart)
    b. Hubbell GF20ST
    c. Leviton S7899
    d. Pass & Seymour 2094

E. Industrial type outlets shall be by Crouse Hinds, Appleton, or Russell and Stoll, and shall be rated for the amps, volts, poles, and wires indicated on the drawings.

F. Isolated ground receptacles shall be premium industrial grade NEMA 5-20R 20A, 125V, 2P, 3W grounding type. Provide each isolated ground duplex receptacle with an engraved faceplate to read: "ISOLATED GROUND", Pass & Seymour #S 8 IG **or equal**.

1. Acceptable Manufacturers:

a. Cooper (Arrow Hart) IG5362
b. Hubbell IG5362
c. Leviton 5362-IG
d. Pass & Seymour IG6300

G. SPD receptacles shall be hospital grade NEMA 5-20R 20A, 125V, 2P, 3W isolated grounding type, and shall absorb a minimum of 13kA per mode. Receptacles shall include an LED surge suppression status indicator.

1. Acceptable Manufacturers:

a. Cooper (Arrow Hart) IG8300HG
b. Hubbell IG8362_SA
c. Leviton 8380-IG
d. Pass & Seymour IG8300-_SP

H. Special power outlets, not listed above, shall be standard NEMA configuration as noted on drawings and shall be of at least equal grade and quality to those listed above. Special receptacles not available in color may be silver or black finish.

2.05 DEVICE PLATES

A. Acceptable Manufacturers:

1. Cooper (Arrow Hart)
2. Hubbell
3. Leviton
4. Pass & Seymour

B. Plates for flush wiring devices, including telephone outlets, shall be satin finish type 304 stainless steel. Wiring devices and device plates shall be the same manufacturer.

C. Provide switch and device plates with engraved designations wherever called for by words, set off in quotation marks near a switch location, or by symbol. If inscription is not detailed on drawings request it from the Owner's representative. Engraving shall be in 1/8” high block type letters filled with black enamel.

D. Finish plates for all surface mounted devices shall be pressed steel galvanized. Cover plates for flush mounted junction boxes in finished areas shall be selected by Owner's representative.

E. For surface interior outlet and junction boxes of the pressed steel knockout type, use 1/2” raised galvanized steel plates for devices and flat galvanized steel for blank plates.

F. Weatherproof faceplates shall consist of a hinged outlet cover/enclosure clearly marked "Suitable for Wet Locations While in Use" and "UL Listed". A gasket shall be provided between the enclosure and the mounting surface, and between the hinged cover and mounting plate/base. TayMac #10310 or equal.

G. Locking faceplates shall be "Suitable for Wet Locations While in Use" and "UL Listed" heavy cast aluminum with neoprene gasket. T.W. Cole TL310-WCS or equal. Grey tumbler key lockable, vertical mount, specification grade hinged type, Taymac #10370 or equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF OUTLETS AND EQUIPMENT

A. All outlets, wall switches and wiring devices may be relocated within a radius of 12 feet at no additional charge to the Owner if such request is made prior to installation of the rough-in for the item.

B. Accurately place outlet boxes independently and securely fasten to the structure and, in concealed work, provide with plaster rings and set flush with finished surface of walls or ceilings.

C. Coordinate the location and mounting heights of wall-mounted receptacles, fire alarm and signal devices switches with casework, shelving, furniture, and other equipment shown on Architectural and Interiors drawings and fabrication shop drawings and comply with the Americans with Disabilities Act (ADA), CBC, ANSI, and all other applicable codes governing the project. Conflicts shall immediately be brought to the attention of the District’s representative for resolution before the installation of the rough-in for the devices.

D. Outlet and junction boxes for interior use shall be galvanized, one piece pressed or welded steel, knockout type, except where other types of boxes are indicated or specified. In masonry or concrete construction waterproof boxes manufactured for that purpose shall be used. Plastic, fiber or composition boxes will not be permitted.

E. Protectively cover all devices, outlet boxes, cabinets, etc., before plastering and painting.

F. All receptacles for restrooms, toilet rooms, custodial closets, locker rooms, kitchens, electric water coolers, vending machines and on building exterior shall be GFCI type.

3.02 FACEPLATE INSTALLATION

A. Provide a plate for each outlet, receptacle, switch, device and box.

B. Each switch, receptacle device, etc. which is installed in an outlet box with coverplate shall have the panel and circuit number engraved with 1/8" high black filled lettering at top of coverplate.

C. Plates for roof outdoor exterior wall locations shall be weatherproof, key lockable.

D. Ganged devices shall have gang plates exactly matching the arrangement and quantity of devices. All plates shall fit the box perfectly with no field modification necessary. Plates on surface mounted boxes shall not overhang the box. All plates shall be manufactured specifically for the type of outlet, device and box to which they are applied.

3.03 FIELD QUALITY CONTROL

A. GFCI receptacles and GFCI branch circuit breakers shall be tested by applying a ground current of 5 mA, + 1 mA, which shall trip the unit off. Each test shall be recorded and the record shall include the type of test equipment used, results of test, location of device tested, date of test, and name of test technician. "Test" button operation shall be successfully demonstrated but will not be acceptable as a substitute for the trip test described.

B. Where required or directed, systems shall be tested in the presence of the District’s representative to demonstrate that equipment furnished, installed or connected functions in the manner intended.

C. Contractor shall furnish all necessary instruments and equipment and all power sources and connections required for making required tests, and shall immediately correct any defective work at no additional charge.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Cartridge fuses rated 600V AC and less.
2. Spare fuse cabinet

1.03 DEFINITIONS

A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.04 QUALITY ASSURANCE

A. Comply with NEMA FU 1.

B. Comply with CEC.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

1.05 SUBMITTALS

A. Product Data

1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.

2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bussmann
2. Littelfuse
3. Mersen/Ferraz

B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 FUSES

A. Fuses for feeders and motor branch circuits shall be time delay current limiting type with 200,000 AIC. The time delay shall be minimum 10 sec. at 500% load for 600A or smaller fuses and 4 sec. at 500% load for larger than 600A. 600A. and smaller fuses shall be class RK5. Fuses larger than 600A. shall be class 'L'.

B. Fuses for direct current (DC) circuits shall be specifically listed for such applications.

C. Upon District's acceptance of the electrical distribution system, provide the District's representative with spare fuses and cabinet to hold same as follows: Three fuses of each rating installed 601 amperes and larger, 10% of each type and rating installed 0 to 600 amperes, but not less than three of each.

D. Fuse sizes shown on drawings protecting HVAC equipment are for reference only based on specified mechanical/plumbing equipment. Final determination of fuse sizes shall be made by Contractor based on CEC and approved mechanical/plumbing equipment nameplate ratings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fuses shall be installed so that the rating can be clearly read from the front of the open switch without removing the fuse.

END OF SECTION

SECTION 26 29 13

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes the following enclosed controllers rated 600V and less:

1. Combination motor controllers
2. Manual motor controllers

1.03 DEFINITIONS

A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

B. CPT: Control Power Transformer

C. HOA: Hand-Off-Auto

D. MCP: Motor Circuit Protector

E. N.C.: Normally Closed

F. N.O.: Normally Open

1.04 QUALITY ASSURANCE

A. Comply with CEC.

1.05 SUBMITTALS

A. Product Data

1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.

2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

3. Weight, dimensions and shipping splits.

4. Equipment operating and service (maintenance) clearances required around the equipment.

B. Shop Drawings

C. Test Procedures: A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.

D. Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.

E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures

F. Samples: when requested by Architect

G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:

1. Operational procedures for the overall systems including the "Sequence of Operation".

2. Test procedures and test results.

3. Instruction for the proper operation and maintenance of the system.

4. Factory issued technical, installation, and maintenance manuals.

5. Factory issued operations and programming (software) manuals.

6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.

7. All portions of the material list and shop drawings which are not included in the foregoing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following

1. Cutler-Hammer
2. Siemens
3. Square D

B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

B. Comply with CEC.

2.03 COMBINATION MOTOR STARTERS - INDIVIDUALLY MOUNTED

A. Starters used in indoor dry conditions shall have NEMA 1 enclosures. Starters exposed to wet or outdoor conditions shall have non-metallic or stainless steel NEMA 4X enclosures.

B. Magnetic: Shall be combination starters, NEMA size 0 minimum. Provide with an MCP unless specifically indicated on drawings to be with a fused switch. Provide integral current limiter if necessitated by available fault current. Refer to Single Line Diagram on drawings for fault current values. The combination motor starters shall not be subjected to fault currents exceeding those listed by the manufacturer for the MSCP in combination with the contactor and overload relay.

C. Provide accessories (start/stop pushbuttons, H.O.A. switches, red neon pilot running lights, interlock contacts, CPT, etc.) as required by this Division and by Division 23 - Mechanical plans and specifications.

D. Confirm ratings (watts, volts, amps, etc.) with mechanical control system supplier prior to ordering of components. Each starter unit shall, as a minimum, have in its cover an overload reset, H.O.A. selector switch and a red pilot running light. Equip each starter unit with the number of auxiliary N.O. and N.C. contacts required but at least four N.O./N.C. convertible contacts. Equip each starter with an overload relay in each undergrounded wire.

E. Select overload ratings to match the characteristics of the motors actually installed. Control voltage shall be 120V except for external mechanical control circuits. Source shall be unit transformers in each starter compartment. Transformer shall be 100VA minimum rating.

2.04 MANUAL STARTERS

A. Toggle type with integral melting alloy overload protection. Where shown on the drawings, fractional horsepower motors shall have toggle type manual starters with thermal overload protection in each phase.

B. Provide a padlocking device on the handle.

C. Where the motor is out of sight of the switch provide a pilot light in the cover to indicate switch is closed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide a nameplate for each starter unit indicating the load served (such as "EXH. FAN EF-1") and the source panel and circuit number.

3.02 FIELD QUALITY CONTROL

A. Equipment installed under this section shall be inspected for defects, and tested for proper operation.

B. Enclosures and cabinets shall be checked for cleanliness inside and out and for defective or damaged finish.

C. Systems shall be tested for short circuits, open circuits and wrong connections and shall be free from mechanical and electrical defects.

D. Bolted connections shall be torque tightened to manufacturer's specifications.

E. Where required or directed, systems shall be tested in the presence of the District’s representative to demonstrate that equipment furnished, installed or connected functions in the manner intended.

F. Contractor shall furnish all necessary instruments and equipment and all power sources and connections required for making required tests, and shall immediately correct any defective work at no additional charge.

END OF SECTION

SECTION 26 51 10

LED INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: LED lighting for the building, and accessories.

B. Related Sections:

1. Section 26 09 23 LIGHTING CONTROL DEVICES

1.02 SUMMARY

A. Provide U.L. listed and labeled lighting fixtures complete with lamps at light outlets indicated on the drawings. Each fixture shall bear the U.L. Label, and shall comply with Code Requirements.

B. Fixtures are listed and described in the Lighting Fixture Schedule and in the following paragraphs. Fixture catalog numbers are to be used as a guide only and shall be understood to be followed by the words "except as modified by the total fixture description both text and pictorial". Provide accessories, features and adaptations necessary to meet the requirements of the description.

1.03 DEFINITIONS

A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

B. CalGreen: California Green Building Standards, CCR Title 24 Part 11, Chapter 5.

1.04 QUALITY ASSURANCE

A. Products shall be UL listed and labeled.

B. Comply with CEC.

1.05 SUBMITTALS

A. Product Data

1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.

2. Catalog cuts for each fixture including complete photometric data.

3. Weight and dimensions.

4. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

B. Samples: when requested by Architect.

C. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:

1. Operational procedures for the overall systems including the "Sequence of Operation".

2. Test procedures and test results.

3. Instruction for the proper operation and maintenance of the system.

4. Factory issued technical, installation, and maintenance manuals.

5. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.

6. All portions of the material list and shop drawings which are not included in the foregoing.

1.06 FIELD REPLACEMENT LIGHT ENGINE

A. Integrate LEDs, driver, power supply, thermal management, and optical mixing components.

PART 2 - PRODUCTS

1.01 ACCEPTABLE MANUFACTURERS

A. Refer to lighting Fixture schedule on drawing.

1.02 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

B. Comply with CEC.

1.03 CONSTRUCTION MATERIALS

A. 20 Gauge steel housing, field replaceable light engine, one-piece lower reflector, finishes are textured high reflectance white polyester powder coating.

PART 3 - EXECUTION

1.04 ACCEPTANCE TESTING

A. Complete the testing and documentation requirements of Title 24 Energy Code Acceptance Testing procedures. Complete and sign the Acceptance Testing Forms and submit to District and DSA Inspector (IOR).

1.05 UTILITY DESIGN INCENTIVE PROGRAM

A. Furnish the utility company representative with the itemized, paid proof of purchase/invoice for the purchase and installation of energy efficient equipment.

B. Assist the utility in the verification by utility representative of both the purchase and installation of the energy efficient equipment, including providing the representative access to the Construction Project, at reasonable times, for verification of installation of the equipment.

C. Provide the utility with a written request for payment of the Incentives calculated, when the Construction Project is completed and occupied.

1.06 CLEANING

A. After construction of total project is completed:

1. Remove all non-essential labels and other markings.

2. Wash dirty luminaires inside and out with nonabrasive mild soap or cleaner.

3. Clean luminaire plastic lenses with antistatic cleaners only.

4. Touch up all painted surfaces of luminaires and poles with matching paint supplied by manufacturer.

END OF SECTION

SECTION 26 51 13

LED DIMMING DRIVERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. LED dimming driver.

B. Related Sections:

1. Section 26 27 26 - Wiring Devices
2. Section 26 51 10 – LED Interior Lighting
3. Section 26 09 23 – Lighting Control Devices: Occupancy sensors used in conjunction with central dimming control system.
4. Section 26 56 00 Exterior Lighting

1.02 REFERENCES

A. International Electrotechnical Commission.

1. (IEC) 801-2 Electrostatic Discharge Testing Standard.
2. IEC/EN 60669-2-1 Switches for fixed electrical installations - electronic switches.

B. International Organization for Standardization (ISO)

1. 9001 (2000) – Quality Management Systems.

C. Underwriters Laboratories, Inc. (UL):

1. 8750 (2009) – LED drivers

D. Federal Communications Commission (FCC) rules – Part 15: Radio Frequency Devices.

1. Commercial rated

1.03 DESCRIPTION

A. LED dimming driver

1. 3-Wire (Line Voltage Controlled) Dimming Drivers
2. Digital (Low Voltage Controlled) Dimming Drivers
3. Forward Phase Control (neutral wire required) (Line Voltage Controlled) Dimming Drivers

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Specification Conformance Document: Indicate whether the submitted equipment:

1. Meets specification exactly as stated.
2. Meets specification via an alternate means and indicate the specific methodology used.

C. Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer: Minimum **10** years of experience in manufacture of electronic lighting controls.

B. Manufacturer’s Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.

C. Recognized by UL. Provide evidence of compliance upon request.

1.06 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 10 degrees to 40 degrees C (50 degrees to 140 degrees F).
2. Relative humidity: Maximum 90 percent, non-condensing.
3. Protected from dust and excess moisture during installation.

1.07 WARRANTY

A. Provide manufacturer's warranty covering 5 years with factory start-up on drivers from date of purchase.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Make replacements available for minimum of ten years from date of manufacture.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Lutron Electronics Co., Inc.

B. Basis of design product: Lutron or subject to compliance and prior approval with specified requirements of this section, one of the following:

1. Lutron

C. Substitutions: Under provisions of Division 012500.

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders.

2. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.

3. Any substitutions provided by the contractor shall be reviewed at the contractor's expense by the electrical engineer at a rate of $200.00 per hour.

4. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.

5. Provide complete engineered shop drawings (including power wiring) with deviations for the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

2.02 GENERAL

A. Ten-year operational life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

B. Designed and tested to withstand electrostatic discharges up to 15,000 V without impairment per IEC 801-2.

C. Electrolytic capacitors to operate at least 20 degrees C below the capacitor's maximum temperature rating when the driver is under fully-loaded conditions and under maximum case temperature.

D. Maximum inrush current of 2 amperes for 120V and 277V drivers.

E. Withstand up to a 4,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.

F. Manufactured in a facility that employ ESD reduction practices in compliance with ANSI/ESD S20.20.

G. Class A Sound Rating - Inaudible in a 27 dBA ambient.

H. No visible change in light output with a variation of plus/minus 10 percent line voltage input.

I. Total Harmonic Distortion less than 20 percent and meet ANSI C82.11 maximum allowable THD requirements

J. Drivers to track evenly across:

1. Multiple fixtures.
2. All light levels.

K. Constant current drivers must provide models to:

1. Support from 200mA to 2.1Amps (in 10mA steps) to ensure a compatible driver exists
2. Support LED arrays up to 40W or 50W (710mA to 1.05A in 10mA steps)

L. Constant voltage drivers must provide models to:

1. Support from 10Volts to 40Volts (in 0.5V steps) to ensure a compatible driver exists
2. Support LED arrays up to 40W

M. Configuration tool must be available to optimize the following for LED fixtures:

1. Light level
2. Efficacy
3. Thermal performance

N. Driver must be capable of operating from a supply voltage of 120 through 277VAC at 60Hz for EcoSystem and 3-wire models.

2.03 3-WIRE CONTROL

A. Continuous dimming from 100 percent to 1 percent relative light output.

B. Provide integral fault protection to prevent driver failure in the event of an input mis-wire.

2.04 ECOSYSTEM DIGITALLY ADDRESSABLE CONTROL

A. Continuous dimming from 100 percent to 1 percent relative light output

B. Ability to operate with installed or specified building control system

C. Lights automatically return to the setting prior to power interruption.

D. Each driver responds independently to:

1. Up to 32 occupant sensors.
2. Up to 16 daylight sensors.

E. Responds to digital load shed command.

1. Sets high end trim.

2. Automatically scales light output proportional to load shed command.

a. Example: If light output is at 30 percent and a load shed command of 10 percent is received, the driver automatically sets the maximum light output at 90 percent (of the 30 percent light level) and lowers current light output by 3 percent to 27 percent.

2.05 FORWARD PHASE CONTROL (NEUTRAL WIRE REQUIRED)

A. Continuous dimming from 100 percent to 1 percent relative light output

2.06 SOURCE QUALITY CONTROL

A. Perform full-function testing on 100 percent of all drivers at the factory.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's installation instructions.

B. Provide complete installation of system in accordance with Contract Documents.

C. Lead lengths to LED light engine/array may be as long as 30.5 m (100 feet) depending on wire gauge and power level of the driver.

3.02 SERVICE AND SUPPORT

A. Start-up:

1. Provide factory-certified field service engineer to a site visit to ensure proper installation and operation under following parameters:

a. Qualifications for factory-certified field service engineer:

1) Minimum experience of 2 years training in the electrical or electronic field.
2) Certified by the equipment manufacturer on the system installed.

b. Make a visit upon completion of installation to:

1) Verify connection of power feeds control circuits
2) Check performance.
3) Train building owner how to operate LED drivers.

B. Tech Support

1. Provide factory direct technical support hotline 24 hours per day, 7 days per week.
2. Provide factory direct technical support staff specially trained to address LED technology issues.

3.03 MAINTENANCE

A. Provide on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

B. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of commissioning.

END OF SECTION

SECTION 271100

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

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 Requirements

1. Section 260543 “Underground Ducts and Raceways for Electrical Systems”.
2. Section 271300 "Communications Backbone Cabling".
3. Section 271500 "Communications Horizontal Cabling".

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Grounding.

1.3 SCOPE OFWORK

A. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.

B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, backboards, wiring, cables, equipment, devices, etc. unless existing, shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Electrical Contractor for the particular wire and cable fills required for the systems installed. (Conduit sizes shall comply with the California Electrical Code.) The entire responsibility of the system, including the installation, operation, function, testing and maintenance for one (1) year (one year or two – see QUALITY ASSURANCE paragraph that requires a two-year warranty.) After final acceptance under this section shall be the responsibility of the installing electronic contractor.

C. The Installing Electronic Systems Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.

D. Contractor shall provide District with all packing slips, and receipts for all equipment over $500. This equipment requires a G-number for District tracking. Contractor is responsible for coordinating with CM, PM and site MSF for delivery of all equipment.

1.4 DEFINITIONS

A. Backbone: A facility (e.g., pathway, cable, or conductors) between telecommunications rooms or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.

B. BDF: Building Distribution Frame (same location as MDF)

C. BICSI: Building Industry Consulting Service International.

D. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

F. EMI: Electromagnetic interference.

G. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.

H. IDC: Insulation displacement connector.

I. IDF: Intermediate Distribution Frame

J. LAN: Local area network.

K. MDF: Main Distribution Frame

L. MTR: Main Telephone Room

M. RCDD: Registered Communications Distribution Designer.

N. RMC: Rigid metallic conduit.

O. UTP: Un-shielded twisted pair cable.

1.5 APPLICABLE STANDARDS

A. The equipment shall be U.L. listed labeled and approved for the application shown in the contract documents.

B. The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:

1. This Technical Specification and Associated Drawings.
2. ANSI/TIA 568-C.0 Generic Telecommunications Cabling for Customer Premises
3. ANSI/TIA 568-C.1 Commercial Building Telecommunications Cabling Standard
4. ANSI/TIA 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards
5. ANSI/TIA 568-C.3 Optical Fiber Cabling Components Standard
6. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair Cables-November, 1991 and all applicable revisions and addendums.
7. TIA/EIA-TSB-40 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded-Pair Connecting Hardware – January, 1994 and all applicable revisions and addendums.
8. TIA/EIA-TSB-75 Telecommunications System Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair consolidation points and cabling – January, 1997 and all applicable revisions and addendums.
9. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces – October 1990 and all applicable revisions and addendums.
10. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings – February 1993 and all applicable revisions and addendums.
11. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications – October 2002 and all applicable revisions and addendums.
12. Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM)-2000 and all applicable revisions and addendums.
13. TIA TSB62-23 Telecommunications Systems Bulletin, Measurement of the Non-liner coefficient of single-mode fibers – January 2003 and all applicable revisions and or addendums to these documents.

14. CEC (Current Edition, including all applicable revisions, addendums and errata's.)

1.6 QUALIFICATIONS

A. The installing Electronic Contractor must be a TE Connectivity (AMP) NETCONNECT Design & Installation (ND & I) certified contractor. Provide a copy of Contractor's ND & I certification with bid package. The Installing Electronic Contractor shall be an authorized TE Connectivity (AMP) ND & I business partner and shall provide 25 years extended product warranty and application assurance on this installation.

B. The supplier of the equipment shall be an authorized AMP ND & I distributor and service facility.

C. The Installing Electronic Systems Contractor shall hold a valid State of California C-7 license for all low voltage installations and a State of California C-10 License for any related high-voltage applications and shall have completed at least twenty projects including five projects with Grossmont Union High School District of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least ten years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.

D. The Installing Electronic Systems Contractor shall be a factory authorized distributor and warranty station for the brand of equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop.

E. Extend material and Performance Warranties.

1. The contractor shall facilitate and extend to the District all manufacturers' warranties for all products installed. Extended system (performance) and component warranties shall be provided which warrants functionality of all existing and new components (cable, connecting hardware and patch cords) used in the system for a minimum of (25) twenty-five years from the date of acceptance. Each component of the system shall be covered for defects in materials and workmanship. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA SP-2840A, Annex E. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA SP-2840A, Annex H. All fiber and copper cabling, termination components, and ancillary devices shall be of one manufacturer to insure no disputes can arise between different manufacturers if performance problems arise. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project.
2. Warranty scope includes, but is not limited to, network cables and terminations, network workstation plug-in outlets, and patch panel plug-in outlets, cable splices and connectors.
3. Repair or replace the defective material at the project premise, to comply with the performance standards outlined in the contract documents during the warranty period.
4. All newly installed fiber optic cabling and any existing fiber optic cabling which was disconnected/reconnect during the course of this project shall require complete link test in accordance with the testing requirements specified elsewhere in this document, and require a TE Connectivity (AMP) 25-Year EWP warranty.
5. In addition to the manufacturer warranties, the Contractor shall provide their own 2-year warranty covering all aspects of the project to include workmanship.
6. Upon successful completion of the installation and subsequent inspection, the District's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.
7. All conditions for obtaining the manufacturer's warranty shall be the sole responsibility of the contractor.

F. The structured cabling system shall be a TE Connectivity (AMP) NETCONNECT end-to-end solution. No equal. All equipment must be approved by District (Technology and Information Services).

1.7 ACTION SUBMITTALS

A. Provide three (3) full-size installation samples of the voice, data and IP speaker-clock system outlet. The sample shall include, as a minimum, the faceplate, two data and two voice system connectors (each terminated with a 12" length of distribution cabling) two blanking plates, and back boxes.

B. Shop Drawings:

1. Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.

2. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by District.

3. Cabling Administration Drawings.

C. Wiring diagrams to show typical wiring schematics including the following:

1. Workstation outlets, jacks, and jack assemblies.

2. Patch cords (Category 6 and Fiber Optic). Copper patch panels and blocks.

3. Fiber-optic enclosures.

4. Distribution blocks.

5. Equipment racks.

D. Submit manufacturers' product data sheets for each component of the voice, data and IP speaker-clock systems. Certify that the data sheets depict the components to be provided by the Contractor to make up the complete system as described in this specification. Submit details of the warranty (including manufacturer warranties) to be provided for the cabling systems, clearly indicating that all components are covered.

E. Submit samples of the labels to be used for labeling cables, patch panels, termination frames, cabinets and racks.

F. Submit a testing schedule indicating how each voice, data and IP speaker-clock cabling system component is to be tested. The scheduled shall, as a minimum, indicate the testing process from factory testing through to final acceptance testing. The schedule shall list (by part number) testing equipment that will be used and detail each step of each test to be performed. The schedule shall list the criteria that will be applied to each test of each component of the telephone and data cabling systems. The schedule shall include the test results form that will be filled in by the tester as each component is tested.

1. Submit example copy of copper and fiber test reports

G. Once samples have been submitted, reviewed by the School District Representative and approved they shall be retained. The samples shall be used as the standards by which the quality of work on the project by the Contractor shall be judged. Any installation, which does not meet this Once samples have been submitted, review by the School District Representative and approved, they standard, shall be replaced or reworked as approved by the School District Representative.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Submit references for a minimum of twenty similar projects successfully undertaken and completed within the last ten years. As a minimum, provide project name and address, client contact name and telephone number, and construction manager name and telephone number. Provide a brief description of each project indicating types of systems installed, quantities and configurations of outlets, and projected time scales.

B. Seismic Qualification Certificates: For equipment frames from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.9 AS BUILT DOCUMENTATION

A. Faceplate labeling, cable termination numbering, patch panel and fiber enclosure identification shall be coordinated with School District Representative.

B. The as-built documentation shall consist of prints with the station location numbers (faceplate identification numbers) inserted next to the symbol for the location.

C. The prints shall also contain the cabling routes taken between the cable tray, conduit and/or J-Hooks and the termination areas.

D. An additional requirement shall be a wire run list created in Microsoft Excel that contains the specific details of each location and all of the cables that are terminated there. Create separate tabs in the spreadsheet for MDF and each IDF.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications equipment with District's Representative.

B. Meet jointly with telecommunications and LAN equipment suppliers and District to exchange information and agree on details of equipment arrangements and installation interfaces.

1. Record agreements reached in meetings and distribute to other participants.

2. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

1.11 SYSTEM TESTING

A. Following voice, data, IP speaker-clock and fiber optic cable installation and termination at both ends, undertake and record tests to ensure that the cabling system will perform satisfactorily in service. In addition to the tests detailed in this specification, the Contractor shall carry out any additional tests that he deems necessary to ensure the satisfactory operation of the telephone, data, and fiber optic cable systems. The costs of these additional tests shall be borne by the Contractor.

B. Provide the District Representative with the opportunity to witness all testing. On request, the installer shall demonstrate that the test procedure competently identifies the fault conditions being tested for.

C. Complete the tests identified in all of the voice, data and IP speaker-clock system specifications.

D. Notify the District Representative fourteen working days before the date of commencement of the cable tests. Provide details, on that advance date, of proposed tests, the test schedule, equipment to be used, its certification and calibration, and the names and qualifications of test personnel.

E. Personnel shall be competent in and qualified by experience or training for detailed design, installation, and testing of voice, data, and fiber optic cable systems.

F. Include the cost of obtaining, calibrating, and maintaining test equipment, and the cost of carrying out and recording the tests, including labor costs, in the bid sum.

G. Ensure that all Test Equipment is in calibration before delivery to site and throughout the testing period. The installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment's calibration status are carried out.

H. To support the test procedure, create a printed table of every cable in the building with appropriate columns for each test result and comments.

I. Sign and date each successful series of test results as the tests proceed. As a minimum, each completed page of test results shall be signed and dated once all the tests on that page have been successfully completed and their results recorded.

J. The test documentation shall be available for inspection by the School District Representative during the installation period and the original documents (not copies or retyped versions) shall be passed to the School District Representative within five working days of completion of tests on cables in each area. The installer shall retain a copy to aid preparation of as-built information.

K. Failures detected during the testing shall be duly noted on the test results schedule and rectified. On the fault being rectified, this shall also be noted. These notes shall not be deleted or obliterated.

L. Rectification of all damaged cables shall include replacing damaged cables with new cables in complete runs or remaking poor terminations. In-line cable joints, splices, or distribution points are not acceptable. All damaged cables shall be removed from site.

1.12 QUALITY ASSURANCE

M. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.

3. Field Inspector: Currently registered by BICSI as RCDD, to perform the on-site inspection.

4. Products, services, and materials provided by the Contractor shall be new and of high quality and free of faults and defects.

5. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contactor follows procedures and requirements specified in Section 01330.

6. Work shall be done by a qualified TE Connectivity (AMP) ND&I Contractor holding licenses required by legally constituted authorities having jurisdiction over the work. Contractor shall have completed at least ten (10) projects of equal scope to systems described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years.

7. Contractor shall warranty all work executed and materials furnished shall be free from defects of material and workmanship for a period of two (2) years from acceptance date of Contract Completion. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at no expense to the District: Any defective material or work which may be discovered before final acceptance or work, or within warranty period; any material or work damaged thereby; and adjacent material or work which may be displaced in repair or replacement.

8. Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.

9. If Contractor fails to repair or replace material or work indicated above within 7 days of receiving written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess cost against Contractor, if Contractor does not respond accordingly.

10. Persons skilled in trade shall install system in accordance with best trade practice. Further, in accordance with all applicable building codes. Contractor and all contractors' employees terminating cable to wiring terminating devices shall be certified by the manufacturer of the wiring device. Copies of certificates shall be provided to the District Representative prior to the start of work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment frames shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Section 06 "Rough Carpentry."

2.3 SUBSTITUTIONS: Not accepted.

2.4 MAIN DISTRIBUTION FRAME (MDF) - If Required:

A. Provide wall mounted 66 punch down blocks for copper backbone cabling terminations.

1. Quantity to match cable pair count, + 25% spare.
2. Fuse protectors not required.

B. Equipment Frame

1. Manufacturer: Chatsworth Products, Inc.
   a. QuadraRack.
   b. 7’ High x 30” Deep per section. Quantity per plans.
   c. Description: Universal self-support four post 19” wide steel rack for equipment shown on drawings. Rack(s) shall be completely open at rear. Provide with slotted top panel for cable and equipment access. Equipment rack shall be securely fastened to floor at each corner of each section per details.
   d. Mounting Hole Pattern: 5/8” - 5/8” - 1/2” C to C, 12-24 thread, two sides.
   e. Finish: Black baked enamel.
2. Double-Sided Tray (UPS and/or CPU), provide (2) per MDF:
   a. Manufacturer: Chatsworth Products, Inc.
   b. Description: 18-3/4” deep x 5-3/4” high x 19” wide.
3. Single-Sided Tray (F.O.T.), provide (1) per MDF:
   a. Manufacturer: Chatsworth Products, Inc.
   b. Description: 15” deep x 5-3/16” high x 19” wide.
4. Wire Managers
   a. Manufacturer: Chatsworth Products, Inc. / TE Connectivity (AMP), or equal.
   b. Description: 3-1/2” high x 19” wide x 2” deep.
   c. Provide 1U horizontal wire management between each patch panel and piece of rack mounted equipment. Provide (2) spares

5. Provide vertical wire management at both ends of each rack front and back sides.
   a. CPI# 30161-703
6. Rack Mount Vertical Power Outlet Strip
   a. CPI Part #12848-706 with 20 amp power cord, or equal.
   b. Description: Rack mounting power strip with 6 receptacles on back, front panel with master switch, indicator light, and circuit breaker. Power strip shall be vertically mounted.
   c. 6’ power cord.

C. MDF Grounding, provide grounding kit in MDF rack for grounding:

7. Manufacturer: Chatsworth Products, Inc.
   a. CPI# 41016-001 (Invalid part #.)

2.5 MDF EQUIPMENT

A. Fiber Enclosure

1. Provide 4U fiber enclosure.
   a. TE Connectivity# 559552-2
2. Duplex SC fiber snap-in adapter panels in quantities required.
   a. TE Connectivity# 559596-5
3. Provide SC MM fiber connectors, MM fiber couplers, fan-out kits and fiber patch cords as necessary to terminate all fibers in the MDF.

B. Copper Patch Panels

1. Provide High Density ACO Category 6 24-port patch panels in quantities as required to terminate Category 6a cables from each outlet. Leave 25% spare capacity for future cable terminations. Provide cable support bars at rear of each panel. All cables shall be secured to bar using Velcro straps.
   a. TE Connectivity# 1479834-1
2. Provide ACO Category 6 inserts (patch panel shall be fully loaded.)
   a. TE Connectivity# 1644027-3
      1) EIA 568B Wired.
      2) Black in color.

C. Uninterruptable Power Supply, provide (1) per MDF:

1. Manufacturer: American Power Conversions (APC)
   a. APC# SURT5000RMXLT3U or latest model.
      1) 5000VA @ 208V
      2) Provide APC AP9626 APC Step-Down Transformer RM 2U 208V IN 120V OUT; w/5-20 Receptacles; no substitutions.

3) Provide (1) APC# AP9631 Network Management Card.
4) Programming shall be by the District.

D. Horizontal Power Strip, provide (2):

1. Power Strips: Comply with UL 1363.
2. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
3. Rack mounting.
4. Nine, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R and one always on receptacles. APC# NET9RMBLK.
5. LED indicator lights for power and protection status.
6. LED indicator lights for reverse polarity and open outlet ground.
7. Retain one of first two subparagraphs below.
8. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
9. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
10. Cord connected with 15-foot (4.5-m) line cord.
11. Rocker-type on-off switch, illuminated when in on position.
12. Retain two subparagraphs below if power strips contain surge protection. In first subparagraph, retain 33 kA for high exposure and cost, 26 kA for medium exposure and cost, and 13 kA for low exposure and cost.
13. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
14. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

E. Patch Cords

1. Fiber, provide quantities as required to connect to active hardware. Coordinate with District.
   a. Duplex SC to Duplex LC MM 50/125 micron XG
      1) TE Connectivity# 1907380-2 (2-meter in length)
2. Copper, provide quantities as required for total count of data drops. Color shall be gray. Patch cords to be installed by District.
   a. 7’ patch cords, 25% of total drop count.
      1) TE Connectivity# 219885-7.
   b. 4’ patch cords, 75% of total drop count.
      1) TE Connectivity# 219885-4.

F. Multi-pair copper terminations:

1. Provide wall-mounted 66-blocks for multi-pair copper cable termination.

2. Fuse protectors not required.

2.6 INTERMEDIATE DISTRIBUTION FRAME (IDF)

A. Provide wall mounted 66 punch down blocks for copper backbone cabling terminations.

1. Quantity to match cable pair count, + 25% spare.

2. Fuse protectors not required.

B. Equipment Frame

1. Manufacturer: Chatsworth Products, Inc.
   a. QuadraRack
   b. 7’ High x 30” Deep per section. Quantity per plans.
   c. Description: Universal self-support four post 19” wide steel rack for equipment shown on drawings. Cabinets shall be completely open at rear. Provide with slotted top panel for cable and equipment access. Equipment rack shall be securely fastened to floor at each corner of each section per details.
   d. Mounting Hole Pattern: 5/8” - 5/8” - 1/2” C to C, 12-24 thread, two sides.
   e. Finish: Black baked enamel.
   f. Maximum port density per cabinet:
      1) 160 data ports

2. Double-Sided Tray (UPS and/or CPU), provide (2) per IDF:
   a. Manufacturer: Chatsworth Products, Inc.
   b. Description: 18-3/4” deep x 5-3/4” high x 19” wide.

3. Wire Managers
   a. Manufacturer: Chatsworth Products, Inc. / TE Connectivity (AMP)
   b. Description: **3-1/2” high** x 19” wide x 2” deep.
   c. Provide **1U** horizontal wire management between each patch panel and piece of rack mounted equipment. Provide (2) spares.

4. Provide vertical wire management at both ends of each rack front and back sides.
   a. CPI# 30161-703

5. Rack Mount Vertical Power Outlet Strip
   a. CPI Part #12848-706 with 20 amp power cord, or equal.
   b. Description: Rack mounting power strip with 6 receptacles on back, front panel with master switch, indicator light, and circuit breaker. Power strip shall be vertically mounted.
   c. 6' power cord.

C. IDF Grounding, provide grounding kit in IDF rack/cabinet for grounding:
   1. Manufacturer: Chatsworth Products, Inc.
      a. CPI# 41016-001 (Invalid part #.)

2.7 IDF EQUIPMENT

A. Fiber Enclosure
   1. Provide 1U fiber enclosure.
      a. TE Connectivity# 1-1657014-7
   2. Duplex SC fiber snap-in adapter panels in quantities required.
      a. TE Connectivity# 559596-5
   3. Provide SC MM fiber connectors, MM fiber couplers, fan-out kits and fiber patch cords as necessary to terminate all fibers in the MDF.

B. Copper Patch Panels
   1. Provide High Density ACO Category 6 24-port patch panels in quantities as required to terminate Category 6a cables from each outlet. Leave 25% spare capacity for future cable terminations. Provide cable support bars at rear of each panel. All cables shall be secured to bar using Velcro straps.
      a. TE Connectivity# 1479834-1
   2. Provide ACO Category 6 inserts (patch panel shall be fully loaded.)
      a. TE Connectivity# 1644027-3
         1) EIA 568B Wired.
         2) Black in color.
   3. Provide 24-ports voice patch panels with 25 pair tails for incoming Voice feed termination block in IDF rack to terminate voice cables, Ortronics #OR-808004388.

C. Uninterruptable Power Supply, provide (1) per IDF:

1. Manufacturer: American Power Conversions (APC)
   a. APC# SRT2200RMXLA (Part # SURTA2200RMXL2U discontinued; this is the recommended replacement.)
      1) Provide PowerChute software.
      2) Provide (1) APC# AP9630 Network Management Card 2.

D. Horizontal Power Strip, provide (2):

1. Power Strips: Comply with UL 1363.
2. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
3. Rack mounting.
4. Nine, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R and one always on receptacles. APC# NET9RMBLK.
5. LED indicator lights for power and protection status.
6. LED indicator lights for reverse polarity and open outlet ground.
7. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
8. Cord connected with 15-foot (4.5-m) line cord.
9. Rocker-type on-off switch, illuminated when in on position.
10. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
11. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

E. Patch Cords

1. Fiber, provide quantities as required to connect to active hardware. Coordinate with District.
   a. Duplex SC to Duplex LC MM 50/125 micron XG
      1) TE Connectivity# 1907380-2 (2-meter in length)
2. Copper, provide quantities as required for total count of data drops. Color shall be gray. Patch cords to be installed by District.
   a. 7’ patch cords, 25% of total drop count.
      1) TE Connectivity# 219885-7.
   b. 4’ patch cords, 75% of total drop count.
      1) TE Connectivity# 219885-4.

F. Multi-pair copper terminations:

1. Provide wall-mounted 66-blocks for multi-pair copper cable termination.
2. Fuse protectors not required.

G. Wall Mounted Equipment Cabinet (District approval required for use.)

1. Manufacturer: Middle Atlantic
   a. SR-40-32
2. Description: Wall mounted three compartment equipment cabinet with 5” deep rear panel, 19” deep main panel and lockable front door with tinted window.
3. Maximum port density per cabinet:
   a. 64 data ports
4. Provide separate communications cabinet at IDF locations requiring wall mounted equipment cabinets for CATV, security and any additional telephone feeds.
   a. Minimum size: 36”Wx24”Hx6”D
5. Horizontal Power Strip, provide (1) in wall mounted equipment cabinet:
   a. Power Strips: Comply with UL 1363.
   b. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
   c. Rack mounting.
   d. Nine, 15-A, 120-V ac, NEMA WD 6, Configuration 5-15R and one always on receptacles. APC# NET9RMBLK.
   e. LED indicator lights for power and protection status.
   f. LED indicator lights for reverse polarity and open outlet ground.
   g. Circuit Breaker and Thermal Fusing: When protection is lost, circuit opens and cannot be reset.
   h. Cord connected with 15-foot (4.5-m) line cord.
   i. Rocker-type on-off switch, illuminated when in on position.
   j. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
   k. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes shall be not more than 330 V.

H. Patch Cords

1. Fiber: Provide quantities as required to connect to active hardware. Coordinate with District.
   a. Duplex SC to Duplex LC MM 50/125 micron XG
      1) TE Connectivity# 1907380-2 (2-meter in length)
2. Copper: Provide quantities as required for total count of data drops. Color shall be gray. Patch cords to be installed by District.
   a. 7’ patch cords, 25% of total drop count.
      1) TE Connectivity# 219885-7.
   b. 4’ patch cords, 75% of total drop count.
      1) TE Connectivity# 219885-4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. NO Splicing of Fiber or Copper Cables. All Fiber will be a Home-run from the MDF to the IDF and all Copper will be a Home-run from the IDF to the Data Port.

B. Comply with NECA 1.

C. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

G. Cables connecting to equipment racks shall be installed with not less than six feet of slack cable between the equipment rack/terminal block and terminal backboard. The slack cable shall be coiled and supported on the backboard and/or cable tray.

H. Cables shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12 inches on center mounted onto the plywood along the entire length of all cables.

I. No single cable run shall exceed 290 feet.

J. Provide 36 inches of cable slack at workstation outlets.

K. Provide cables installed from individual computer/data workstation outlets to respective terminal closet/room equipment rack patch panel. Cables shall be continuous without cutting or splices.

L. Minimum bending radius of fiber optic cables shall not be less than 12-inches. Maximum pulling tension shall not exceed 25 pounds. In no case shall the manufacturer's recommendations be violated.

M. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate manufacturer's recommendations.

N. Cable lengths over 50 feet shall be machine pulled and not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.

O. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200 feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull. A written report will be provided to the District.

P. The portions of cables installed without raceways or cable tray supports shall be installed with “j-hook” cable supports.

1. The “J-hooks” shall provide multi-tiered “treed” “J” shared hooks, with wide flat cable support base (0.5”W minimum) and smooth rounded corners, specifically designed for Category-6 and fiber optic cable support. As manufactured by Erico Inc or substitution of equal or better and approved by the District.
2. The individual “j-hook” attachment to the building structure shall be “beam clamp”, “hanger rod”, clevis hanger styles.
3. Install “J-hooks” not more than 36 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between adjacent hooks. Secure cables to “J-hooks” with cable tie wraps. “J-hooks” supported cables, bundle cables together with tie wraps.
4. “Bridle rings” shall not be used to support cables.
5. Cables shall not rest directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.

Q. In each conduit to be used for fiber cable provide four (4) 1-inch Innerduct with “Jack-moon” plugs.

R. All copper horizontal cables shall be installed in the following manner:

1. Cable raceways shall not be filled greater than the CEC maximum fill for the particular raceway type
2. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document
3. Cable splices are not allowed.
4. The cable’s minimum bend radius of 4 times the cable diameter and maximum pulling tension of 25 lbs. shall not be exceeded
5. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of three-foot intervals – at no point shall cable(s) rest on acoustic ceiling grids or panels
6. Horizontal distribution cables shall be bundled in groups of not greater than 40 cables (cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle)
7. Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware
8. The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices

9. Cables shall not be attached to ceiling grid or lighting support wires
10. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the District
11. Cables shall be identified by a self-adhesive label in accordance with the District standards.
12. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate
13. Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run
14. Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle
15. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturer's recommendations, and/or best industry practices
16. Pair untwist at the termination shall not exceed 0.25 inch for connecting hardware
17. Cables shall be neatly bundled and dressed to their respective panels or blocks
18. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame
19. The cable jacket shall be maintained as close as possible to the termination point
20. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties

S. Provide nylon pull strings with all cable runs, conduit stub ups, conduit sleeves, cable trays, open wiring routes, Innerduct, and spare. Pull strings shall be free from cable bundles in open wiring routes.

T. Provide Velcro cable management straps on all copper cable bundles, the last 20 feet or upon entry into equipment closet, a maximum of 12" apart, on the rear of the equipment racks and on the patch cords within the vertical cable managers. Straps shall be a maximum of 12" apart.

U. Provide protective bushings at the ends of all exposed conduits used for the data system cabling. This is to include all conduits installed for any future data cabling requirements.

3.2 HANDLING OF CABLE REELS

A. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation. Where ends seals are removed, reseal cable ends by stripping cable finishes back 2" down to insulation. Then apply four layers of an insulating tape crisscross over the cable end and carry back at least 4" onto cable outer finish. Add a containing cover of two layers of vinyl electrical tape completely over the end seal.

B. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Store reels of cable on a firm surface, paved, or on planking to prevent settling into soft ground.

3.3 CABLE TERMINATIONS

A. General

1. Computer/data workstation outlets connecting to ports in patch panels shall be grouped together in the patch panel by outlet, room location and building area location. Each group shall be identified with engraved (etched) nameplates indicating grouping identification and individual port numbers.

2. Polarity and color coding of cable connections at splices, terminations and outlets shall be consistently maintained throughout the entire electronic network system.

3. Terminate all cables onto respective outlets and terminals. Terminations shall comply with manufacturer's recommendations.

B. Fiber Optic Terminations

1. Individual fiber optic fibers shall each be terminated with a fiber optic fiber connector. The connector for each fiber shall be "plugged" into separate fiber optic fiber interconnection couplers on the rear of each respective outlet.

2. Each fiber optic termination ferrule shall be inspected, after completion of the termination, visually with a fiber optic inspection microscope and an interferometer, to insure fiber “undercut”, “protruding” fiber, over polish and under polish of fiber termination ends does not exist in the finished termination ferrule.

3. Fiber optic cables terminated between two fiber optic patch panels located in separate equipment racks. The fibers shall be paired together for purposes of identification. Each pair of fibers shall be "plugged" into separate, physically adjacent fiber optic fiber interconnection couplers at each patch panel. The horizontal/vertical arrangement of paired patch panel fiber couplers shall match at both ends of the fiber cable.

C. Copper Wire Terminations

1. Unless specifically directed otherwise by the District's Representative, Pin assignment for wiring terminations shall comply with ANSI/EIA/TIA 568B.

3.4 EQUIPMENT RACKS

A. Install, assemble, mount and connect devices and equipment in the respective equipment racks, bolted securely to the rack frame with stainless steel hardware. "Star" style lock washers shall be provided to insure an electrically continuous ground path between the equipment/devices and rack frames.

B. Provide blank metal filler panels to close unused equipment "front" mounting space in equipment racks, manufacturer's standard finish color.

C. Provide a copper wire outlet connector in the respective equipment rack for each remote copper wire computer workstation outlet and copper wire cable shown connected to the respective equipment rack. The copper wire outlet connectors in the equipment racks shall be provided in equipment rack mounted copper wire patch panels.

D. Terminal racks, equipment locations, patch panels, and cross connects shall be arranged to allow for natural cabling progression, minimize crossing of cables and allow easy access to each system component.

E. Equipment Rack Anchorage:

F. Securely anchor floor standing racks to the floor at each corner and the adjacent wall at the top of the rack.

G. Securely anchor wall-mounted racks to the wall at four corners.

H. Mounting method shall support the total rack weight including installed equipment, but in no case less than 500 pounds with a 2.0 times safety factor.

3.5 CIRCUIT TERMINAL ROOMS AND CLOSETS

A. Provide conductor/cable training and racking support distribution rings installed on backboards. Support rings shall be spaced a minimum of 10 inches on center along all cable/conductor routing paths on backboards and within 4 inches of each change in cable/conductor direction. As manufactured by Newton 3042 series, Saunders or equal with District approval.

3.6 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of interior and exterior floor and wall assemblies.

3.7 FIRESTOPPING

A. Comply with TIA-569-B, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

C. A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.

D. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

E. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the District’s Technical Representative prior to installing the firestop system.

F. All firestop systems shall be installed in accordance with the manufacturer’s recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.8 **GROUNDING**

A. Grounding and bonding shall comply with CEC, NFPA-70, J-STD-607-B, UL467 and the BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Provide #6 AWG green insulated copper ground wire with fiber optic cable from main telecom grounding bus bar located at MDF room to IDF location and terminate to ground bar in IDF.

C. All racks, cabinets, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the Telecommunication Room or Equipment Room shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. Where metallic panels attached to the rack do not have sufficient metal to metal contact to provide an adequate path to ground, they shall be bonded to the rack using a minimum #12 AWG copper conductor. The copper conductor size shall be upgraded based on the largest power conductor feeding any rack-mount equipment. The conductor shall be continuous; attaching all isolated components in a daisy chain fashion from top to bottom and bonded to the rack using an appropriate compression connector.

D. All wires used for telecommunications grounding purposes shall be identified with green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

E. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) 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.

F. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.9 LABELING AND IDENTIFICATION

A. Fiber optic and copper wire cables shall be identified in each pull box, equipment rack and computer workstation outlet. Identification tags shall include the following information:

1. Installation month and date (i.e. 3/2004, 4/2005, etc.)

2. Conductor size conductor type (i.e. loose tube fiber; (#24 AWG UTP Category 3, 200 pair, telephone/voice etc.).

3. Tag type to match existing site condition.

4. Label the faceplate at the fiber optic tray to correspond to each cable terminated.

B. Additional Labeling:

1. Camera – CAM

2. Projector – AV

3. Clock Speaker – CLK
4. Speaker only - SPKR

C. Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each data outlet and punch down point. A printed label shall be placed at each of the following locations:

1. On cable at the rear of the patch panel or termination block, provide self-laminating wrap around label, Brady Label self-laminating 1.2" by 1.5" wrap around label #29689 or equal to match site condition.
2. On each cable in the j-box behind the faceplate location. Provide self-laminating wrap around label, Brady Label self-laminating 1.2" by 1.5" wrap around label #29689 or equal to match site condition.
3. On the face plate of the patch panel, provide a ¾" by ¾" label with a letter or number identifying the patch panel designation.
4. On the face of the faceplate in the label holder window.

D. Labels shall be preprinted or computer-printed type.

E. The labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

1. Label the faceplate at the fiber optic tray to correspond to each cable terminated.
2. On the face plate of the patch panel, provide a ¾" by ¾" label with a letter or number identifying the patch panel designation.

F. All label printing will be machine generated using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, approximately sized to the outside diameter of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's label provided with the outlet assembly.

G. Handwritten labels are not permitted. Where cable ID includes room number identification the contractor shall obtain written verification of actual room numbers from school site prior to beginning labeling (numbers on plans do not always match actual room numbers). Cable pulling cross reference lists will not be accepted with final documentation.

H. Each patch panel port shall be identified with a unique sequential labeling scheme "IDF# / Room# / outlet #". Port identification labeling pattern shall be consistent throughout the project.

I. All faceplates shall be identified with permanent printed labels. Labels must not be subject to removal by incidental contact. Contractor shall be responsible for replacing defective labeling for a period of one year from date of final sign-off of project.

J. All fiber optic and UTP feed cables shall be identified with a permanent, water resistant, printed labels at the fiber shelf. Labeling information shall include closet identifications, quantity of conductors (UTP) or strands of (fiber) and house pair designations (UTP).

K. Labeling shall follow recommended EIA/TIA standards and as requested by the School District to match site condition. Contractor shall confirm labeling pattern prior to final identification and testing. Labeling for new sites shall identify “IDF# / Room# / outlet #”. All test results shall be identified by the final labeling scheme.

L. All fiber optic cables and/or Innerduct shall be tagged with orange fiber optic warning tags in every manhole and/or pull box. Fiber warning tags shall also be placed at each end of the cable in the termination closets in clear view. A minimum of (3) tags are required at each end. Fiber warning tags shall be placed on fiber optic cable and/or Innerduct routed through open ceiling environments at increments no less than 10 feet apart.

3.10 RECORD DRAWINGS

A. The installation contractor will be provided with two sets of drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor’s Foreman on a daily basis and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the District. Contractor shall also redraw, with AutoCAD version 2007 or newer, the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling scheme for all items. These CAD drawings shall be on 8-1/2” x 11” sheets of paper and disk and be turned over to the District with the O&M manuals.

B. The Contractor shall provide the central drawing set to the District at the conclusion of the project. The marked-up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

3.11 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminal are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing:

1. Provide all instruments for testing and demonstrating in the presence of the District's inspector that the system is operating as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification.

2. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at contractor's expense. Verify by the system test that the total system meets the specifications and complies with applicable standards.

3. The District reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject and or all of the equipment on the basis of the results thereby obtained.

3.12 CLEANING AND PROTECTION

A. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

3.13 WARRANTY

A. The entire system shall be warranted free of mechanical or electrical defects for a period of two (2) years after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District.

B. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the District after the end of the guarantee period.

C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

D. Manufacturer Warranty

1. The contractor shall facilitate a 25-year system performance warranty between the manufacturer and the District. An extended component warranty shall be provided which warrants functionality of all cabling and connectivity components used in the system for 25 years from the date of acceptance. The performance warranty shall warrant the installed horizontal copper and both the horizontal and the backbone optical fiber portions of the cabling system. Copper and fiber optic links shall be warranted to the link or channel performance as defined in ANSI/EIA-568-C.

2. Upon completion of the project, the customer's technical representative will perform a final inspection of the installed cabling system with the contractor's project foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the customer.

3. Upon receipt of the test documentation, the customer reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Customer testing will use the same method employed by the contractor, and minor variations shall be allowed to account for differences in test equipment and test variability. If significant discrepancies are found, the contractor will be notified for resolution.

4. During the three-week period between final inspection and delivery of the test and as-built documentation, the customer will activate the cabling system. The customer will validate operation of the cabling system during this period.

5. Completion of the installation, in-progress and final inspections, receipt of the test, receipt of the as-built documentation, and successful performance of the system for a two-week period will constitute acceptance of the system.

E. Special Warranty

6. The contractor shall warrant the cabling system against defects in workmanship for a period of two years from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. All warranty repairs shall be done within fourteen days from being notified in writing by the District. This warranty shall be provided at no additional cost to the District.

END OF SECTION

SECTION 271300

COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.01 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. All applicable portions of Division 26 and Division 27 shall apply to this section as though written herein completely.

C. Related Requirements:

1. Section 271100 "Equipment Room Fittings".
2. Section 271500 "Communications Horizontal Cabling".

1.02 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP Cable.
3. Multimode Fiber Cable.
4. Coaxial Cable.
5. Cable connecting hardware.
6. Cable identification products.

1.03 SCOPE OF WORK

A. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.

B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, backboards, wiring, cables, equipment, devices, etc. unless existing, shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Electrical Contractor for the particular wire and cable fills required for the systems installed. (Conduit sizes shall comply with the California Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for two years after final acceptance under this section shall be the responsibility of the installing electronic contractor.

C. The Installing Electronic Systems Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.

D. Contractor shall provide District with all packing slips and receipts for all equipment over $500. This equipment requires a G-number for District tracking. Contractor is responsible for coordinating with CM, PM and site MSF for delivery of all equipment.

1.04 DEFINITIONS

A. Backbone: A facility (e.g., pathway, cable, or conductors) between telecommunications rooms or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.

B. BDF: Building Distribution Frame (same location as MDF)

C. BICSI: Building Industry Consulting Service International.

D. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

F. EMI: Electromagnetic interference.

G. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.

H. IDC: Insulation displacement connector.

I. IDF: Intermediate Distribution Frame

J. LAN: Local area network.

K. MDF: Main Distribution Frame

L. MTR: Main Telephone Room

M. RCDD: Registered Communications Distribution Designer.

N. RMC: Rigid metallic conduit.

O. UTP: Un-shielded twisted pair cable.

1.05 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.06 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.07 APPLICABLE STANDARDS

A. The equipment shall be U.L. listed labeled, and approved for the application shown in the contract documents.

B. The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:

1. This Technical Specification and Associated Drawings.
2. ANSI/TIA 568-C.0 Generic Telecommunications Cabling for Customer Premises
3. ANSI/TIA 568-C.1 Commercial Building Telecommunications Cabling Standard
4. ANSI/TIA 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards
5. ANSI/TIA 568-C.3 Optical Fiber Cabling Components Standard
6. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair Cables-November, 1991 and all applicable revisions and addendums.
7. TIA/EIA-TSB-40 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded-Pair Connecting Hardware – January, 1994 and all applicable revisions and addendums.
8. TIA/EIA-TSB-75 Telecommunications System Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair consolidation points and cabling – January, 1997 and all applicable revisions and addendums.
9. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces – October 1990 and all applicable revisions and addendums.
10. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings – February 1993 and all applicable revisions and addendums.
11. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications – October 2002 and all applicable revisions and addendums.
12. Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM)-2000 and all applicable revisions and addendums.
13. TIA TSB62-23 Telecommunications Systems Bulletin, Measurement of the Non-liner coefficient of single-mode fibers – January 2003 and all applicable revisions and or addendums to these documents.
14. CEC (Current Edition, including all applicable revisions, addendums and errata’s.)

1.08 QUALIFICATIONS

A. The installing Electronic Contractor must be a CommScope certified contractor. Provide a copy of Contractor's ND & I certification with bid package. The Installing Electronic Contractor shall be an authorized CommScope business partner and shall provide 25 years extended product warranty and application assurance on this installation.

B. The supplier of the equipment shall be an authorized CommScope distributor and service facility.

C. The Installing Electronic Systems Contractor shall hold a valid State of California C-7 license for all low voltage installations and a State of California C-10 License for any related high-voltage applications and shall have completed at least twenty projects including five projects with Grossmont Union High School District of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least ten years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.

D. The Installing Electronic Systems Contractor shall be a factory authorized distributor and warrantee station for the brand of equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop.

E. Extend material and Performance Warranties.

1. The contractor shall facilitate and extend to the District all manufacturers'' warranties for all products installed. Extended system (performance) and component warranties shall be provided which warrants functionality of all existing and new components (cable, connecting hardware and patch cords) used in the system for a minimum of (25) twenty-five years from the date of acceptance. Each component of the system shall be covered for defects in materials and workmanship. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA SP-2840A, Annex E. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA SP-2840A, Annex H. All fiber and copper cabling, termination components, and ancillary devices shall be of one manufacturer to insure no disputes can arise between different manufacturers' if performance problems arise. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project.
2. Warranty scope includes, but is not limited to, network cables and terminations, network workstation plug-in outlets, and patch panel plug-in outlets, cable splices and connectors.
3. Repair or replace the defective material at the project premise, to comply with the performance standards outlined in the contract documents during the warranty period.
4. All newly installed fiber optic cabling and any existing fiber optic cabling which was disconnected/reconnect during the course of this project shall require complete link test in accordance with the testing requirements specified elsewhere in this document, and require an AMP 25-Year EWP warranty.
5. In addition to the manufacturer warranties, the Contractor shall provide their own 2-year warranty covering all aspects of the project to include workmanship.
6. Upon successful completion of the installation and subsequent inspection, the District's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.
7. All conditions for obtaining the manufacturers' warranty shall be the sole responsibility of the contractor.

F. The structured cabling system shall be an CommScope end-to-end solution. No equal. All equipment must be approved by District (Technology and Information Services).

1.09 ACTION SUBMITTALS

A. Provide three (3) full-size installation samples of the voice, data and IP speaker-clock system outlet. The sample shall include, as a minimum, the faceplate, two data and two voice system connectors (each terminated with a 12" length of distribution cabling) two blanking plates, and back boxes.

B. Shop Drawings:

1. Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.

2. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by District.

3. Cabling Administration Drawings.

C. Wiring diagrams to show typical wiring schematics including the following:

1. Workstation outlets, jacks, and jack assemblies.

2. Patch cords (Category 6A and Fiber Optic). Copper patch panels and blocks.

3. Fiber-optic enclosures.

4. Distribution blocks.

5. Equipment racks.

D. Submit manufacturers'' product data sheets for each component of the voice, data and IP speaker-clock systems. Certify that the data sheets depict the components to be provided by the Contractor to make up the complete system as described in this specification. Submit details of the warranty (including manufacturer warranties) to be provided for the cabling systems, clearly indicating that all components are covered.

E. Submit samples of the labels to be used for labeling cables, patch panels, termination frames, and faceplates for the telephone and data systems.

F. Submit a testing schedule indicating how each voice, data and IP speaker-clock cabling system component is to be tested. The scheduled shall, as a minimum, indicate the testing process from factory testing through to final acceptance testing. The schedule shall list (by part number) testing equipment that will be used and detail each step of each test to be performed. The schedule shall list the criteria that will be applied to each test of each component of the telephone and data cabling systems. The schedule shall include the test results form that will be filled in by the tester as each component is tested.

1. Submit example copy of copper and fiber test reports

G. Once samples have been submitted, reviewed by the School District Representative and approved they shall be retained. The samples shall be used as the standards by which the quality of work on the project by the Contractor shall be judged. Any installation, which does not meet this Once samples have been submitted, review by the School District Representative and approved, they standard, shall be replaced or reworked as approved by the School District Representative.

1.10 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Submit references for a minimum of twenty similar projects successfully undertaken and completed within the last ten years. As a minimum, provide project name and address, client contact name and telephone number, and construction manager name and telephone number. Provide a brief description of each project indicating types of systems installed, quantities and configurations of outlets, and projected time scales.

1.11 AS BUILT DOCUMENTATION

A. Faceplate labeling, cable termination numbering, patch panel and fiber enclosure identification shall be coordinated with School District Representative.

B. The as-built documentation shall consist of prints with the station location numbers (faceplate identification numbers) inserted next to the symbol for the location.

C. The prints shall also contain the cabling routes taken between the cable tray, conduit and/or J-Hooks and the workstation areas.

D. An additional requirement shall be a wire run list created in Microsoft Excel that contains the specific details of each location and all of the cables that are terminated there. Create separate tabs in the spreadsheet for MDF and each IDF.

1.12 COORDINATION

A. Coordinate layout and installation of voice, data and IP speaker-clock cabling with District's Representative.

B. Meet jointly with telecommunications and LAN equipment suppliers and District to exchange information and agree on details of equipment arrangements and installation interfaces.

1. Record agreements reached in meetings and distribute to other participants.

2. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

C. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contactor follows procedures and requirements specified in Division 1.

1.13 SYSTEM TESTING

A. Following voice, data, IP speaker-clock and fiber optic cable installation and termination at both ends, undertake and record tests to ensure that the cabling system will perform satisfactorily in service. In addition to the tests detailed in this specification, the Contractor shall carry out any additional tests that he deems necessary to ensure the satisfactory operation of the telephone, data, and fiber optic cable systems. The costs of these additional tests shall be borne by the Contractor.

B. Provide the School District Representative with the opportunity to witness all testing. On request, the installer shall demonstrate that the test procedure competently identifies the fault conditions being tested for.

C. Complete the tests identified in all of the voice, data and IP speaker-clock system specifications.

D. Notify the District Representative fourteen working days before the date of commencement of the cable tests. Provide details, on that advance date, of proposed tests, the test schedule, equipment to be used, its certification and calibration, and the names and qualifications of test personnel.

E. Personnel shall be competent in and qualified by experience or training for detailed design, installation, and testing of voice, data, and fiber optic cable systems.

F. Include the cost of obtaining, calibrating, and maintaining test equipment, and the cost of carrying out and recording the tests, including labor costs, in the bid sum.

G. Ensure that all Test Equipment is in calibration before delivery to site and throughout the testing period. The installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment's calibration status are carried out.

H. To support the test procedure, create a printed table of every cable in the building with appropriate columns for each test result and comments.

I. Sign and date each successful series of test results as the tests proceed. As a minimum, each completed page of test results shall be signed and dated once all the tests on that page have been successfully completed and their results recorded.

J. The test documentation shall be available for inspection by the School District Representative during the installation period and the original documents (not copies or retyped versions) shall be passed to the School District Representative within five working days of completion of tests on cables in each area. The installer shall retain a copy to aid preparation of as-built information.

K. Failures detected during the testing shall be duly noted on the test results schedule and rectified. On the fault being rectified, this shall also be noted. These notes shall not be deleted or obliterated.

L. Rectification of all damaged cables shall include replacing damaged cables with new cables in complete runs or remaking poor terminations. In-line cable joints, splices, or distribution points are not acceptable. All damaged cables shall be removed from site.

1.14 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.
4. Products, services, and materials provided by the Contractor shall be new and of high quality and free of faults and defects.
5. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contactor follows procedures and requirements specified in Division 01.
6. Work shall be done by a qualified CommScope Contractor holding licenses required by legally constituted authorities having jurisdiction over the work. Contractor shall have completed at least ten (10) projects of equal scope to systems described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years.

7. Contractor shall warranty all work executed and materials furnished shall be free from defects of material and workmanship for a period of two (2) years from acceptance date of Contract Completion. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at no expense to the District: Any defective material or work which may be discovered before final acceptance or work, or within warranty period; any material or work damaged thereby; and adjacent material or work which may be displaced in repair or replacement.
8. Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.
9. If Contractor fails to repair or replace material or work indicated above within 7 days of receiving written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess cost against Contractor, if Contractor does not respond accordingly.
10. Persons skilled in trade shall install system in accordance with best trade practice. Further, in accordance with all applicable building codes. Contractor and all contractors' employees terminating cable to wiring terminating devices shall be certified by the manufacturer of the wiring device. Copies of certificates shall be provided to the District Representative prior to the start of work.

PART 2 - PRODUCTS

2.1 FIBER OPTIC BACKBONE CABLE

A. Provide Outside Plant (OSP) Dielectric 24 strands 50/125mu Multimode Fiber Optic cable from MDF to IDF cabinet, Amp #8-1664191-5. Provide 20' service loop at both ends. Provide 6' long fiber optic patch cables at each MDF and IDF. Changes need to be approved by District ETS. Single mode fiber optic cable is not acceptable.

B. Fiber Optic Cable shall be one continuous length without any splicing. All fibers in a multi-fiber cable shall be fully operational within the performance characteristics prior to and after installation. The use of spare fibers in the cable to compensate for defective fibers is not permitted. Defective cable shall be removed and replaced with fully functional cable at no additional cost to the contract.

C. Fiber Optic Cable shall be UL listed, complying with CEC and ETL verified to meet or exceed specified requirement.

D. Provide “SC” type termination connector at each end of all fiber optic cables. SC connectors shall be ceramic aluminum oxide 2.5mm ferrule, multi-cure ultra violet or heat cured epoxy bonded to match cable fiber. Insertion loss of each mated connector shall be less than 0.3 dB. Provide dust cover cap for each connector. Connectors shall be Amp #5503692-1 and #5503593-1.

E. All fiber cable shall be rated for the space that it is installed. Cables installed in underground conduit shall be loose tube gel filled with rated jacket.

F. Label all fiber optic cable with permanent orange tags. Labeling shall follow the guidelines of ANSI/TIA/EIA – 606-A.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

A. Cables connecting to equipment racks shall be installed with not less than six feet of slack cable between the equipment rack/terminal block and terminal backboard. The slack cable shall be coiled and supported on the backboard and/or cable tray.

B. Cables shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12 inches on center mounted onto the plywood along the entire length of all cables.

C. No single cable run shall exceed 290 feet from patch panel to device without written direction from the District IS personnel.

D. Provide 36 inches of cable slack at workstation outlets.

E. Provide cables installed from individual computer/data workstation outlets to respective terminal closet/room equipment rack patch panel. Cables shall be continuous without cutting or splices.

F. Minimum bending radius of fiber optic cables shall not be less than 12-inches. Maximum pulling tension shall not exceed 25 pounds. In no case shall the manufacturer's recommendations be violated.

G. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate manufacturer's recommendations.

H. Cable lengths over 50 feet shall be machine pulled and not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.

I. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200 feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull. A written report will be provided to the District.

J. The portions of cables installed without raceways or cable tray supports shall be installed with “j-hood” cable supports.

1. The “J-hooks” shall provide multi-tiered “treed” “J” shared hooks, with wide flat cable support base (0.5”W minimum) and smooth rounded corners, specifically designed for Category-6 and fiber optic cable support. As manufactured by Erico Inc or substitution of equal or better and approved by the District.

2. The individual “J-hook” attachment to the building structure shall be “beam clamp”, “hanger rod”, clevis hanger styles.

3. Install “J-hooks” not more than 36 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between adjacent hooks. Secure cables to “J-hooks” with cable tie wraps. “J-hooks” supported cables, bundle cables together with tie wraps.

4. “Bridle rings” shall not be used to support cables.

5. Cables shall not rest directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.

K. In each 4” conduit to be used for fiber cable provide four (4) 1-inch Innerduct with “Jack-moon” plugs.

L. All copper horizontal cables shall be installed in the following manner:

1. Cable raceways shall not be filled greater than the CEC maximum fill for the particular raceway type

2. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document

3. Cable splices are not allowed.

4. The cable's minimum bend radius of 4 times the cable diameter and maximum pulling tension of 25 lbs. shall not be exceeded

5. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals – at no point shall cable(s) rest on acoustic ceiling grids or panels

6. Horizontal distribution cables shall be bundled in groups of not greater than 40 cables (cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle)

7. Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware

8. The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices

9. Cables shall not be attached to ceiling grid or lighting support wires

10. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the District

11. Cables shall be identified by a self-adhesive label in accordance with the District standards.

12. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate

13. Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run

14. Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle

15. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturer's recommendations, and/or best industry practices

16. Pair untwist at the termination shall not exceed 0.25 inch for connecting hardware

17. Cables shall be neatly bundled and dressed to their respective panels or blocks

18. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame

19. The cable jacket shall be maintained as close as possible to the termination point

20. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties

M. Provide nylon pull strings with all cable runs, conduit stub ups, conduit sleeves, cable trays, open wiring routes, Innerduct, and spare. Pull strings shall be free from cable bundles in open wiring routes.

N. Provide Velcro cable management straps on all copper cable bundles, the last 20 feet or upon entry into equipment closet, a maximum of 12" apart, on the rear of the equipment racks and on the patch cords within the vertical cable managers. Straps shall be a maximum of 12" apart.

O. Provide protective bushings at the ends of all exposed conduits used for the data system cabling. This is to include all conduits installed for any future data cabling requirements.

3.02 HANDLING OF CABLE REELS

A. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation. Where ends seals are removed, reseal cable ends by stripping cable finishes back 2" down to insulation. Then apply four layers of an insulating tape criss-cross over the cable end and carry back at least 4" onto cable outer finish. Add a containing cover of two layers of vinyl electrical tape completely over the end seal.

B. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Store reels of cable on a firm surface, paved, or on planking to prevent settling into soft ground.

3.03 CABLE TERMINATIONS

A. General

1. Computer/data workstation outlets connecting to ports in patch panels shall be grouped together in the patch panel by outlet, room location and building area location. Each group shall be identified with engraved (etched) nameplates indicating grouping identification and individual port numbers.
2. Polarity and color coding of cable connections at splices, terminations and outlets shall be consistently maintained throughout the entire electronic network system.
3. Terminate all cables onto respective outlets and terminals. Terminations shall comply with manufacturer's recommendations.

B. Fiber Optic Terminations

1. Individual fiber optic fibers shall each be terminated with a fiber optic fiber connector. The connector for each fiber shall be "plugged" into separate fiber optic fiber interconnection couplers on the rear of each respective outlet.
2. Each fiber optic termination ferrule shall be inspected, after completion of the termination, visually with a fiber optic inspection microscope and an interferometer, to insure fiber “undercut”, “protruding” fiber, over polish and under polish of fiber termination ends does not exist in the finished termination ferrule.
3. Fiber optic cables terminated between two fiber optic patch panels located in separate equipment racks. The fibers shall be paired together for purposes of identification. Each pair of fibers shall be "plugged" into separate, physically adjacent fiber optic fiber interconnection couplers at each patch panel. The horizontal/vertical arrangement of paired patch panel fiber couplers shall match at both ends of the fiber cable.

C. Copper Wire Terminations

1. Unless specifically directed otherwise by the District's Representative, Pin assignment for wiring terminations shall comply with ANSI/EIA/TIA 568B.

3.04 CIRCUIT TERMINAL ROOMS AND CLOSETS

A. Provide conductor/cable training and racking support distribution rings installed on backboards. Support rings shall be spaced a minimum of 10 inches on center along all cable/conductor routing paths on backboards and within 4 inches of each change in cable/conductor direction. As manufactured by Newton 3042 series, Saunders or equal with District approval.

3.05 LABELING AND IDENTIFICATION

A. Fiber optic and copper wire cables shall be identified in each pull box, equipment rack and computer workstation outlet. Identification tags shall include the following information:

1. Installation month and date (i.e. 3/2011, 4/2012, etc.)
2. Conductor size conductor type (i.e. loose tube fiber; (#24 AWG UTP Category 3, 200 pair, telephone/voice etc.).
3. Tag type to match existing site condition.
4. Label the faceplate at the fiber optic tray to correspond to each cable terminated.

B. Additional Labeling:

1. Camera – CAM
2. Projector – AV
3. Clock Speaker – CLK
4. Speaker only - SPKR

C. Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each data outlet and punch down point. A printed label shall be placed at each of the following locations:

1. On cable at the rear of the patch panel or termination block, provide self-laminating wrap around label, Brady Label self-laminating 1.2” by 1.5” wrap around label #29689 or equal to match site condition.
2. On each cable in the j-box behind the faceplate location. Provide self-laminating wrap around label, Brady Label self-laminating 1.2” by 1.5” wrap around label #29689 or equal to match site condition.
3. On the face plate of the patch panel, provide a ¾” by ¾” label with a letter or number identifying the patch panel designation.
4. On the face of the faceplate in the label holder window.

D. The labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

E. All label printing will be machine generated using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, approximately sized to the outside diameter of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's label provided with the outlet assembly.

F. Hand written labels are not permitted. Where cable ID includes room number identification the contractor shall obtain written verification of actual room numbers from school site prior to beginning labeling (numbers on plans do not always match actual room numbers). Cable pulling cross reference lists will not be accepted with final documentation.

G. Each patch panel port shall be identified with a unique sequential labeling scheme – "IDF# / Room# / outlet #". Port identification labeling pattern shall be consistent throughout the project.

H. All faceplates shall be identified with permanent printed labels. Labels must not be subject to removal by incidental contact. Contractor shall be responsible for replacing defective labeling for a period of one year from date of final sign-off of project.

I. All fiber optic and UTP feed cables shall be identified with a permanent, water resistant, printed labels at the fiber shelf. Labeling information shall include closet identifications, quantity of conductors (UTP) or strands of (fiber) and house pair designations (UTP).

J. Labeling shall follow recommended EIA/TIA standards and as requested by the School District to match site condition. Contractor shall confirm labeling pattern prior to final identification and testing. Labeling for new sites shall identify "IDF# / Room# / outlet #". All test results shall be identified by the final labeling scheme.

K. All fiber optic cables and/or innerduct shall be tagged with orange fiber optic warning tags in every manhole and/or pull box. Fiber warning tags shall also be placed at each end of the cable in the termination closets in clear view. A minimum of (3) tags are required at each end. Fiber warning tags shall be placed on fiber optic cable and/or innerduct routed through open ceiling environments at increments no less than 10 feet apart.

3.06 CABLE SYSTEM TESTING

A. All cables and termination hardware shall be 100% tested for defects in installation to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

B. Each copper cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. All category 6 cables shall be tested to ensure the category 6 standard performance to 500Mhtz is complied with. All tests shall be printed out in hard copy in the quantity called out in the general specifications for O&M and turn over documents as well as one disc copy for the Districts use. All test reports shall be delivered to the District prior to project close out. Data cables shall be tested using a (Fluke – DSP 4000 series or equivalent) cable analyzer.

C. Continuity

1. Each pair of each installed cable shall be tested using a “green light” test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicted by the test set in accordance with the manufacturers’ recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

D. Length

1. Each installed cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in identification number and circuit or pair number. For multi-pair cables, the longest pair length shall be recorded as the length for the cable.
2. Near End Cross-Talk (NEXT)
3. Attenuation
4. Ambient Noise
5. Attenuation to Cross-Talk Ratio (ACR)
6. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.

E. Fiber

1. All fiber terminations shall be visually inspected with a minimum 200X microscope to ensure that no surface imperfections exist after final polishing. In addition, each fiber strand shall be tested for attenuation with an optical power meter and light source as well as an OTDR. Cable length and splice attenuation shall be verified using and OTDR.

F. Attenuation

1. Horizontal distribution multimode optical fiber attenuation shall be measured at either 850 manometers (nm) or 1300 nm using and LED light source and power meter. Backbone multimode fiber shall be tested at both 850 nm and 1300 nm in one direction. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B. One 2-meter patch cord shall be used for the test reference and two 2-meter patch cords shall be used for the actual test. This test method uses a one jumper reference, two jumper test to estimate the actual link loss of the installed cables plus the loss of two connectors. This measurement is consistent with the loss which network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in the ANSI/TIA 568-C.3, Optical Fiber Link Performance Testing.
2. Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the District and the Contractor prior to the start of the test.
3. Test evaluation for the panel to panel (backbone) shall be based on the values set forth in the ANSI/TIA 568-C.3, Optical Fiber Link Performance Testing.

G. Length and Splice Loss

1. Each cable shall be tested with an Optical Time Domain Reflectometer (OTDR) to verify installed cable length and splice losses. The OTDR measurements for length shall be performed in accordance with EIA/TIA-455-60. The measurements to determine splice loss shall be performed in accordance with manufacturer's recommendations and best industry practices. These tests shall be employed on all cables after installation and in addition where one or more of the following conditions exist.
2. OTDR and power meter testing is specifically requested by the District.
3. Each strand shall be tested on all outside plant and tight-buffered cables.
4. A representative strand of each fiber cable shall be tested to verify length if the estimated cable length is within 10% of the maximum length specified, respective to cable function, in the ANSI/TIA 568-C Standard.

H. Test Documentation

1. Test documentation shall be provided in a three-ring binder(s) within three weeks after the completion of the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words “Test Results”, the project name, and the date of completion (month and year). The binder shall be divided by major heading tabs, Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Category 3, 4, or 5), fiber optic attenuation test results, OTDR traces, and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test.

2. Scanner tests shall be printed on 8-1/2” x 11”. Hand written test results (attenuation results and green light results) shall be documented on an Excel spreadsheet. OTDR test results shall be printed or attached and copied on 8-1/2” x 11” paper for inclusion in the test documentation binder. Provide spreadsheet on a CD

3. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be collated in the binder.

3.07 RECORD DRAWINGS

A. The installation contractor will be provided with two sets of drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor’s Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the District. Contractor shall also redraw, with AutoCAD version 2004 or newer, the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling scheme for all items. These CAD drawings shall be on 8-1/2” x 11” sheets of paper and disk, and be turned over to the District with the O&M manuals.

B. The Contractor shall provide the central drawing set to the District at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

3.08 FIRESTOP SYSTEMS

A. A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.

B. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE, licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the District's Technical Representative prior to installing the firestop system.

D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.09 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminal are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing:

1. Provide all instruments for testing and demonstrating in the presence of the District's inspector that the system is operating as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification.

2. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at contractor's expense. Verify by the system test that the total system meets the specifications and complies with applicable standards.

3. The District reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject and or all of the equipment on the basis of the results thereby obtained.

3.10 CLEANING AND PROTECTION

A. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

3.11 WARRANTY

A. The entire system shall be warranted free of mechanical or electrical defects for a period of one (1) year (one year or two – see QUALITY ASSURANCE paragraph that requires a two year warranty.) after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District.

B. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the District after the end of the guarantee period.

C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

D. Manufacturer Warranty

1. The contractor shall facilitate a 25-year system performance warranty between the manufacturer and the District. An extended component warranty shall be provided which warrants functionality of all cabling and connectivity components used in the system for 25 years from the date of acceptance. The performance warranty shall warrant the installed horizontal copper and both the horizontal and the backbone optical fiber portions of the cabling system. Copper and fiber optic links shall be warranted to the link or channel performance as defined in ANSI/EIA-568-C.
2. Upon completion of the project, the customer's technical representative will perform a final inspection of the installed cabling system with the contractor's project foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the customer.
3. Upon receipt of the test documentation, the customer reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Customer testing will use the same method employed by the contractor, and minor variations shall be allowed to account for differences in test equipment and test variability. If significant discrepancies are found, the contractor will be notified for resolution.
4. During the three week period between final inspection and delivery of the test and as-built documentation, the customer will activate the cabling system. The customer will validate operation of the cabling system during this period.
5. Completion of the installation, in-progress and final inspections, receipt of the test, receipt of the as-built documentation, and successful performance of the system for a two week period will constitute acceptance of the system.

E. Special Warranty

1. The contractor shall warrant the cabling system against defects in workmanship for a period of one year (one year or two – see QUALITY ASSURANCE paragraph that requires a two year warranty.) from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. All warranty repairs shall be done within fourteen days from being notified in writing by the District. This warranty shall be provided at no additional cost to the District.

END OF SECTION

SECTION 27 15 00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.01 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. All applicable portions of Division 26 and Division 27 shall apply to this section as though written herein completely.

C. Related Requirements:
   1. Section 271100 “Equipment Room Fittings”.
   2. Section 271300 "Communications Backbone Cabling".

1.02 SUMMARY

A. Section Includes:
   1. UTP Cable.
   2. Patch Cables.
   3. Voice Data Outlets
   4. Wireless Systems.

1.03 SCOPE OF WORK

A. The work under this section shall consist of all cabling, outlets, cabinets, patch panels, and associated material for a complete voice, data system as shown on the plans and as specified herein.

B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, backboards, wiring, cables, equipment, devices, etc. unless existing, shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Electrical Contractor for the particular wire and cable fills required for the systems installed. (Conduit sizes shall comply with the California Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for two years after final acceptance under this section shall be the responsibility of the installing electronic contractor.

C. The Installing Electronic Systems Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.

D. Contractor shall provide District with all packing slips, and receipts for all equipment over $500. This equipment requires a G-number for District tracking. Contractor is responsible for coordinating with CM, PM and site MSF for delivery of all equipment.

1.04 DEFINITIONS

A. Backbone: A facility (e.g., pathway, cable, or conductors) between telecommunications rooms or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.

B. BDF: Building Distribution Frame (same location as MDF)

C. BICSI: Building Industry Consulting Service International.

D. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

F. EMI: Electromagnetic interference.

G. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.

H. IDC: Insulation displacement connector.

I. IDF: Intermediate Distribution Frame

J. LAN: Local area network.

K. MDF: Main Distribution Frame

L. MTR: Main Telephone Room

M. RCDD: Registered Communications Distribution Designer.

N. RMC: Rigid metallic conduit.

O. UTP: Un-shielded twisted pair cable.

1.05 APPLICABLE STANDARDS

A. The equipment shall be U.L. listed and labeled, and approved for the application shown in the contract documents.

B. The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:

1. This Technical Specification and Associated Drawings.
2. ANSI/TIA 568-C.0 Generic Telecommunications Cabling for Customer Premises
3. ANSI/TIA 568-C.1 Commercial Building Telecommunications Cabling Standard
4. ANSI/TIA 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards
5. ANSI/TIA 568-C.3 Optical Fiber Cabling Components Standard
6. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair Cables-November, 1991 and all applicable revisions and addendums.
7. TIA/EIA-TSB-40 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded-Pair Connecting Hardware – January, 1994 and all applicable revisions and addendums.
8. TIA/EIA-TSB-75 Telecommunications System Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair consolidation points and cabling – January, 1997 and all applicable revisions and addendums.
9. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces – October 1990 and all applicable revisions and addendums.
10. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings – February 1993 and all applicable revisions and addendums.
11. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications – October 2002 and all applicable revisions and addendums.
12. Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM)-2000 and all applicable revisions and addendums.
13. TIA TSB62-23 Telecommunications Systems Bulletin, Measurement of the Non-liner coefficient of single-mode fibers – January 2003 and all applicable revisions and or addendums to these documents.
14. CEC (Current Edition, including all applicable revisions, addendums and errata’s.)

1.06 QUALIFICATIONS

A. The installing Electronic Contractor must be an CommScope certified contractor. Provide a copy of Contractor's CommScope certification with bid package. The Installing Electronic Contractor shall be an authorized CommScope business partner and shall provide 25 years extended product warranty and application assurance on this installation.

B. The supplier of the equipment shall be an authorized CommScope distributor and service facility.

C. The Installing Electronic Systems Contractor shall hold a valid State of California C-7 license for all low voltage installations and a State of California C-10 License for any related high-voltage applications and shall have completed at least twenty projects including five projects with Grossmont Union High School District of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least ten years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.

D. The Installing Electronic Systems Contractor shall be a factory authorized distributor and warrantee station for the brand of equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop.

E. Extend material and Performance Warranties.

1. The contractor shall facilitate and extend to the District all manufacturers'' warranties for all products installed. Extended system (performance) and component warranties shall be provided which warrants functionality of all existing and new components (cable, connecting hardware and patch cords) used in the system for a minimum of (25) twenty-five years from the date of acceptance. Each component of the system shall be covered for defects in materials and workmanship. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA SP-2840A, Annex E. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA SP-2840A, Annex H. All fiber and copper cabling, termination components, and ancillary devices shall be of one manufacturer to insure no disputes can arise between different manufacturers' if performance problems arise. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project.
2. Warranty scope includes, but is not limited to, network cables and terminations, network workstation plug-in outlets, and patch panel plug-in outlets, cable splices and connectors.

3. Repair or replace the defective material at the project premise, to comply with the performance standards outlined in the contract documents during the warranty period.
4. All newly installed fiber optic cabling and any existing fiber optic cabling which was disconnected/reconnect during the course of this project shall require complete link test in accordance with the testing requirements specified elsewhere in this document, and require an AMP 25-Year EWP warranty.
5. In addition to the manufacturer warranties, the Contractor shall provide their own 2-year warranty covering all aspects of the project to include workmanship.
6. Upon successful completion of the installation and subsequent inspection, the District's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.
7. All conditions for obtaining the manufacturers' warranty shall be the sole responsibility of the contractor.

F. The structured cabling system shall be an AMP NETCONNECT end-to-end solution. No equal. All equipment must be approved by District (Technology and Information Services).

1.07 ACTION SUBMITTALS

A. Provide three (3) full-size installation samples of the voice, data and IP speaker-clock system outlet. The sample shall include, as a minimum, the faceplate, two data and two voice system connectors (each terminated with a 12" length of distribution cabling) two blanking plates, and back boxes.

B. Shop Drawings:
1. Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.
2. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by District.
3. Cabling Administration Drawings.

C. Wiring diagrams to show typical wiring schematics including the following:
1. Workstation outlets, jacks, and jack assemblies.
2. Patch cords (Category 6 and Fiber Optic). Copper patch panels and blocks.
3. Fiber-optic enclosures.
4. Distribution blocks.
5. Equipment racks.

D. Submit manufacturers' product data sheets for each component of the voice, data and IP speaker-clock systems. Certify that the data sheets depict the components to be provided by the Contractor to make up the complete system as described in this specification. Submit details of the warranty (including manufacturer warranties) to be provided for the cabling systems, clearly indicating that all components are covered.

E. Submit samples of the labels to be used for labeling cables, patch panels, termination frames, and faceplates for the telephone and data systems.

F. Submit a testing schedule indicating how each voice, data and IP speaker-clock cabling system component is to be tested. The scheduled shall, as a minimum, indicate the testing process from factory testing through to final acceptance testing. The schedule shall list (by part number) testing equipment that will be used and detail each step of each test to be performed. The schedule shall list the criteria that will be applied to each test of each component of the telephone and data cabling systems. The schedule shall include the test results form that will be filled in by the tester as each component is tested.

1. Example copy of copper and fiber test reports.

G. Once samples have been submitted, reviewed by the School District Representative and approved they shall be retained. The samples shall be used as the standards by which the quality of work on the project by the Contractor shall be judged. Any installation, which does not meet this Once samples have been submitted, review by the School District Representative and approved, they standard, shall be replaced or reworked as approved by the School District Representative.

1.08 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Submit references for a minimum of twenty similar projects successfully undertaken and completed within the last ten years. As a minimum, provide project name and address, client contact name and telephone number, and construction manager name and telephone number. Provide a brief description of each project indicating types of systems installed, quantities and configurations of outlets, and projected time scales.

1.09 AS-BUILT DOCUMENTATION

A. Faceplate labeling, cable termination numbering, patch panel and fiber enclosure identification shall be coordinated with School District Representative.

B. The as-built documentation shall consist of prints with the station location numbers (faceplate identification numbers) inserted next to the symbol for the location.

C. The prints shall also contain the cabling routes taken between the cable tray, conduit and/or J-Hooks and the workstation areas.

D. An additional requirement shall be a wire run list created in Microsoft Excel that contains the specific details of each location and all of the cables that are terminated there. Create separate tabs in the spreadsheet for MDF and each IDF.

1.10 COORDINATION

A. Coordinate layout and installation of voice, data and IP speaker-clock cabling with District's Representative.

B. Meet jointly with telecommunications and LAN equipment suppliers and District to exchange information and agree on details of equipment arrangements and installation interfaces.

1. Record agreements reached in meetings and distribute to other participants.
2. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

C. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contactor follows procedures and requirements specified in Division 1.

1.11 SYSTEM TESTING

A. Following voice, data, IP speaker-clock and fiber optic cable installation and termination at both ends, undertake and record tests to ensure that the cabling system will perform satisfactorily in service. In addition to the tests detailed in this specification, the Contractor shall carry out any additional tests that he deems necessary to ensure the satisfactory operation of the telephone, data, and fiber optic cable systems. The costs of these additional tests shall be borne by the Contractor.

B. Provide the School District Representative with the opportunity to witness all testing. On request, the installer shall demonstrate that the test procedure competently identifies the fault conditions being tested for.

C. Complete the tests identified in all of the voice, data and IP speaker-clock system specifications.

D. Notify the District Representative fourteen working days before the date of commencement of the cable tests. Provide details, on that advance date, of proposed tests, the test schedule, equipment to be used, its certification and calibration, and the names and qualifications of test personnel.

E. Personnel shall be competent in and qualified by experience or training for detailed design, installation, and testing of voice, data, and fiber optic cable systems.

F. Include the cost of obtaining, calibrating, and maintaining test equipment, and the cost of carrying out and recording the tests, including labor costs, in the bid sum.

G. Ensure that all Test Equipment is in calibration before delivery to site and throughout the testing period. The installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment's calibration status are carried out.

H. To support the test procedure, create a printed table of every cable in the building with appropriate columns for each test result and comments.

I. Sign and date each successful series of test results as the tests proceed. As a minimum, each completed page of test results shall be signed and dated once all the tests on that page have been successfully completed and their results recorded.

J. The test documentation shall be available for inspection by the School District Representative during the installation period and the original documents (not copies or retyped versions) shall be passed to the School District Representative within five working days of completion of tests on cables in each area. The installer shall retain a copy to aid preparation of as-built information.

K. Failures detected during the testing shall be duly noted on the test results schedule and rectified. On the fault being rectified, this shall also be noted. These notes shall not be deleted or obliterated.

L. Rectification of all damaged cables shall include replacing damaged cables with new cables in complete runs or remaking poor terminations. In-line cable joints, splices, or distribution points are not acceptable. All damaged cables shall be removed from site.

1.12 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD Commercial Installer, Level 2 to perform the on-site inspection.
4. Products, services, and materials provided by the Contractor shall be new and of high quality and free of faults and defects.

5. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contactor follows procedures and requirements specified in Division 01.
6. Work shall be done by a qualified TE Connectivity (AMP) ND&I Contractor holding licenses required by legally constituted authorities having jurisdiction over the work. Contractor shall have completed at least ten (10) projects of equal scope to systems described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years.
7. Contractor shall warranty all work executed and materials furnished shall be free from defects of material and workmanship for a period of two (2) years from acceptance date of Contract Completion. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at no expense to the District: Any defective material or work which may be discovered before final acceptance or work, or within warranty period; any material or work damaged thereby; and adjacent material or work which may be displaced in repair or replacement.
8. Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.
9. If Contractor fails to repair or replace material or work indicated above within 7 days of receiving written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess cost against Contractor, if Contractor does not respond accordingly.
10. Persons skilled in trade shall install system in accordance with best trade practice. Further, in accordance with all applicable building codes. Contractor and all contractors' employees terminating cable to wiring terminating devices shall be certified by the manufacturer of the wiring device. Copies of certificates shall be provided to the District Representative prior to the start of work.

PART 2 - PRODUCTS

2.01 COPPER WIRE CABLE (TWISTED PAIRS)

A. Provide enhanced category 6A (4 pair) UTP blue color cable from each system jack indicated on the drawings to each building IDF or MDF patch panel.

B. Enhanced Category 6A UTP blue color cable shall be copper wire, individually insulated and color coded, with an overall non-conductive jacket, Amp #1499038-6 (CMR) and 1499033-6 CommScope or Netconnect 640 Series CAT6A (CMP).

C. All cable installed underground shall be rated for that use.

D. Provide ten foot service loop at the MDF/IDF location and three foot service loop at outlet location for each cable.

E. Provide enhanced category 6A cable for Data, Voice, LCD projector, IP camera, wireless data access point, IP speaker and combination IP clock/speaker system.

2.02 PORTABLE CATEGORY 6A COPPER WIRE PATCH CABLE ASSEMBLY (Patch cable type to match cable & outlets.)

A. Provide Category 6A patch cable assembly with pre-molded boot for all system jacks (for data, VOIP, LCD projector, IP camera, Wireless data access point, IP clock, IP speaker and combination IP clock/speaker), interconnecting electronic network equipment to electronic network outlets, interconnecting patch panel outlet patch locations with each other, interconnecting patch outlet to electronic equipment, and outlets location as indicated on drawings.

B. Provide following type portable Category 6 copper wire patch cable assembly.

1. Gray 4’ Category 6A patch cable assembly for data and VOIP, (Patch panel end). Provide 20% spare cables assembly.
2. Gray 7’ Category 6A patch cable assembly for data and VOIP, (Patch panel end). Provide 20% spare cables assembly.
3. Gray 8’ Category 6A patch cable assembly for data and VOIP, (work station location). Provide 85% of total work station patch cables assembly.
4. Gray 15’ Category 6A patch cord assembly for data and VOIP, (work station location). Provide 15% of total work station patch cables assembly.
5. Gray 4’ Category 6A patch cable assembly for IP clocks, IP speakers and combination IP clock/speakers (at IDF location). Provide 20% spare cables assembly.
6. Blue 7’ Category 6A patch cable assembly for IP clocks, IP speakers, and combination IP clock/speakers (at device location). Provide 20% spare cables assembly.

7. White 6' Category 6A patch cable assembly for LCD projector and IP camera, Amp #219889-6. Provide 50% spare cables assembly.
    a. All patch cables assembly shall be in compliance with manufacturer's "Link" Warranty requirements.

    b. Patch cables assembly shall be factory assembled with factory terminated plugs at each end. Field terminated patch cables assembly shall not be permitted. Terminated plug shall incorporate integral bending radius limiting molded "boots" and strain relief. Patch cables assembly shall be rated for "heavy duty" service.

    c. Patch cables assembly shall comply with the same cable communication performance requirement as the cables and outlets.

2.03 VOICE DATA OUTLETS (Outlets to match cable type.)

A. Twisted Pair Horizontal Cables: 4 pair, UTP, UL Level 6, type CMR or CMP, depending upon the environment in which the cables are placed, with performance characteristics that meet or exceed ANSI/EIA-568-C Category 6 requirements.

B. Faceplate/Jacks: Coordinate color of faceplates and outlets with Division 16 electrical Sections and with existing outlets.
    1. Manufacturer: CommScope. (This is a necessary item, that is only available from the listed source, or it is required to match existing Campus standards, and no other product shall be furnished.)
    2. Outlets: Subject to compliance with requirements, provide the following (X denotes color to be determined):
        a. Single gang, ACO Dual-port faceplate: AMP #558510-X.
        b. Double gang, two ACO's Dual-port faceplate: AMP #558512-X.
        c. Single ACO Single-port modular furniture plate: AMP #556679-X.
        d. CAT6 ACO Single-port Installation Kit: AMP #1479317-1
        e. CAT6 ACO Insert T568B: AMP #1644027-X
        f. ACO CAT6 Edge Connector Assembly: AMP #1479305-1
        g. "F" Connector ACO module: AMP #555645-X.
        h. Blank ACO Insert: AMP #555644-X.

2.04 WIRELESS SYSTEMS

A. Contractor shall provide mounting and data for wireless access as follows: All wireless equipment will be provided by the District, unless noted here or on the plans.

1. For In-wall mount: Provide a deep 2-gang box with single mud ring mounted between 8-feet and 10-feet high or as shown on the plans. Deep 2-gang box must be clear of obstructions in all directions a minimum of 12".
    a. Provide 2 Category 6A drop from IDF.
    b. Provide 2 Category 6A 4-Pair Modular Receptacles
    c. Provide face plate

2. For T-bar Ceiling mount below 10-feet: Provide flush deep 2-gang supported box with single mud ring mounted face down in the ceiling tile. Support in accordance with CBC requirements for equipment under 40 lbs.
    a. Provide 2 Category 6A drops from IDF.
    b. Provide 2 Category 6A 4-Pair Modular Receptacle
    c. Provide face plate

B. Contractor shall provide 2 wireless access point mounting locations per classroom located in opposite corners.

C. Contractor shall provide 1 mounting location per non-classroom within 400 sq. ft. of another wireless access point mounting location.

D. Wireless Equipment not listed here to be provided by GUHSD ETS.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

A. Cables connecting to equipment racks shall be installed with not less than six feet of slack cable between the equipment rack/terminal block and terminal backboard. The slack cable shall be coiled and supported on the backboard and/or cable tray.

B. Cables shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12 inches on center mounted onto the plywood along the entire length of all cables.

C. No single cable run shall exceed 290 feet from patch panel to device without written direction from the District IS personnel.

D. Provide 36 inches of cable slack at workstation outlets.

E. Provide cables installed from individual computer/data workstation outlets to respective terminal closet/room equipment rack patch panel. Cables shall be continuous without cutting or splices.

F. Minimum bending radius of fiber optic cables shall not be less than 12-inches. Maximum pulling tension shall not exceed 25 pounds. In no case shall the manufacturer's recommendations be violated.

G. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate manufacturer's recommendations.

H. Cable lengths over 50 feet shall be machine pulled and not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.

I. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200 feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull. A written report will be provided to the District.

J. The portions of cables installed without raceways or cable tray supports shall be installed with “j-hood” cable supports.

1. The “J-hooks” shall provide multi-tiered “treed” “J” shared hooks, with wide flat cable support base (0.5”W minimum) and smooth rounded corners, specifically designed for Category-6 and fiber optic cable support. As manufactured by Erico Inc. or substitution of equal or better and approved by the District.
2. The individual “J-hook” attachment to the building structure shall be “beam clamp”, “hanger rod”, clevis hanger styles.
3.
4. Install “J-hooks” not more than 36 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between adjacent hooks. Secure cables to “J-hooks” with cable tie wraps. “J-hooks” supported cables, bundle cables together with tie wraps.
5. “Bridle rings” shall not be used to support cables.
6. Cables shall not rest directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.

K. In each conduit to be used for fiber cable provide four (4) 1-inch innerduct with “Jack-moon” plugs.

L. All copper horizontal cables shall be installed in the following manner:

1. Cable raceways shall not be filled greater than the CEC maximum fill for the particular raceway type.
2. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document.
3. Cable splices are not allowed.
4. The cable's minimum bend radius of 4 times the cable diameter and maximum pulling tension of 25 lbs. shall not be exceeded.
5. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals – at no point shall cable(s) rest on acoustic ceiling grids or panels.
6. Horizontal distribution cables shall be bundled in groups of not greater than 40 cables (cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle).
7. Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware.
8. The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
9. Cables shall not be attached to ceiling grid or lighting support wires.
10. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the District.
11. Cables shall be identified by a self-adhesive label in accordance with the District standards.
12. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
13. Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run.
14. Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle.
15. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturer's recommendations, and/or best industry practices.
16. Pair untwist at the termination shall not exceed 0.25 inch for connecting hardware.
17. Cables shall be neatly bundled and dressed to their respective panels or blocks.
18. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

19. The cable jacket shall be maintained as close as possible to the termination point.
20. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties.

M. Provide nylon pull strings with all cable runs, conduit stub ups, conduit sleeves, cable trays, open wiring routes, Innerduct, and spare. Pull strings shall be free from cable bundles in open wiring routes.

N. Provide Velcro cable management straps on all copper cable bundles, the last 20 feet or upon entry into equipment closet, a maximum of 12” apart, on the rear of the equipment racks and on the patch cords within the vertical cable managers. Straps shall be a maximum of 12” apart.

O. Provide protective bushings at the ends of all exposed conduits used for the data system cabling. This is to include all conduits installed for any future data cabling requirements.

3.02 HANDLING OF CABLE REELS

A. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation. Where ends seals are removed, reseal cable ends by stripping cable finishes back 2" down to insulation. Then apply four layers of an insulating tape crisscross over the cable end and carry back at least 4" onto cable outer finish. Add a containing cover of two layers of vinyl electrical tape completely over the end seal.

B. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Store reels of cable on a firm surface, paved, or on planking to prevent settling into soft ground.

3.03 CABLE TERMINATIONS

A. General

1. Computer/data workstation outlets connecting to ports in patch panels shall be grouped together in the patch panel by outlet, room location and building area location. Each group shall be identified with engraved (etched) nameplates indicating grouping identification and individual port numbers.
2. Polarity and color coding of cable connections at splices, terminations and outlets shall be consistently maintained throughout the entire electronic network system.
3. Terminate all cables onto respective outlets and terminals. Terminations shall comply with manufacturer's recommendations.

B. Fiber Optic Terminations

1. Individual fiber optic fibers shall each be terminated with a fiber optic fiber connector. The connector for each fiber shall be "plugged" into separate fiber optic fiber interconnection couplers on the rear of each respective outlet.
2. Each fiber optic termination ferrule shall be inspected, after completion of the termination, visually with a fiber optic inspection microscope and an interferometer, to insure fiber “undercut”, “protruding” fiber, over polish and under polish of fiber termination ends does not exist in the finished termination ferrule.
3. Fiber optic cables terminated between two fiber optic patch panels located in separate equipment racks. The fibers shall be paired together for purposes of identification. Each pair of fibers shall be "plugged" into separate, physically adjacent fiber optic fiber interconnection couplers at each patch panel. The horizontal/vertical arrangement of paired patch panel fiber couplers shall match at both ends of the fiber cable.

C. Copper Wire Terminations

1. Unless specifically directed otherwise by the District's Representative, Pin assignment for wiring terminations shall comply with ANSI/EIA/TIA 568B.

3.04 CIRCUIT TERMINAL ROOMS AND CLOSETS

A. Provide conductor/cable training and racking support distribution rings installed on backboards. Support rings shall be spaced a minimum of 10 inches on center along all cable/conductor routing paths on backboards and within 4 inches of each change in cable/conductor direction. As manufactured by Newton 3042 series, Saunders or equal with District approval.

3.05 LABELING AND IDENTIFICATION

A. Fiber optic and copper wire cables shall be identified in each pull box, equipment rack and computer workstation outlet. Identification tags shall include the following information:

1. Installation month and date (i.e. 3/2011, 4/2012, etc.)
2. Conductor size conductor type (i.e. loose tube fiber; (#24 AWG UTP Category 3, 200 pair, telephone/voice etc.).
3. Tag type to match existing site condition.
4. Label the faceplate at the fiber optic tray to correspond to each cable terminated.

B. Additional Labeling:
   1. Camera – CAM
   2. Projector – AV
   3. Clock Speaker – CLK
   4. Speaker only - SPKR

C. Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each data outlet and punch down point. A printed label shall be placed at each of the following locations:
   1. On cable at the rear of the patch panel or termination block, provide self-laminating wrap around label, Brady Label self-laminating 1.2” by 1.5” wrap around label #29689 or equal to match site condition.
   2. On each cable in the j-box behind the faceplate location. Provide self-laminating wrap around label, Brady Label self-laminating 1.2” by 1.5” wrap around label #29689 or equal to match site condition.
   3. On the faceplate of the patch panel, provide a ¾” by ¾” label with a letter or number identifying the patch panel designation.
   4. On the face of the faceplate in the label holder window.

D. The labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

E. All label printing will be machine generated using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, approximately sized to the outside diameter of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer’s label provided with the outlet assembly.

F. Hand written labels are not permitted. Where cable ID includes room number identification the contractor shall obtain written verification of actual room numbers from school site prior to beginning labeling (numbers on plans do not always match actual room numbers). Cable pulling cross reference lists will not be accepted with final documentation.

G. Each patch panel port shall be identified with a unique sequential labeling scheme. Port identification labeling pattern shall be consistent throughout the project.

H. All faceplates shall be identified with permanent printed labels. Labels must not be subject to removal by incidental contact. Contractor shall be responsible for replacing defective labeling for a period of one year from date of final sign-off of project.

I. All fiber optic and UTP feed cables shall be identified with permanent, water resistant, printed labels at the fiber shelf. Labeling information shall include closet identifications, quantity of conductors (UTP) or strands of (fiber) and house pair designations (UTP).

J. Labeling shall follow recommended EIA/TIA standards and as requested by the School District to match site condition. Contractor shall confirm labeling pattern prior to final identification and testing. Labeling for new sites shall identify “IDF# / Room# / outlet #”. All test results shall be identified by the final labeling scheme.

K. All fiber optic cables and/or innerduct shall be tagged with orange fiber optic warning tags in every manhole and/or pull box. Fiber warning tags shall also be placed at each end of the cable in the termination closets in clear view. A minimum of (3) tags are required at each end. Fiber warning tags shall be placed on fiber optic cable and/or innerduct routed through open ceiling environments at increments no less than 10 feet apart.

3.06 CABLE SYSTEM TESTING

A. All cables and termination hardware shall be 100% tested for defects in installation to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

B. Each copper cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. All category 6 cables shall be tested to ensure the category 6 standard performance to 500Mhtz is complied with. All tests shall be printed out in hard copy in the quantity called out in the general specifications for O&M and turn over documents as well as one disc copy for the Districts use. All test reports shall be delivered to the District prior to project close out. Data cables shall be tested using a (Fluke – DSP 4000 series or equivalent) cable analyzer.

C. Continuity

1. Each pair of each installed cable shall be tested using a “green light” test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicted by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

D. Length

1. Each installed cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in identification number and circuit or pair number. For multi-pair cables, the longest pair length shall be recorded as the length for the cable.
2. Near End Cross-Talk (NEXT)
3. Attenuation
4. Ambient Noise
5. Attenuation to Cross-Talk Ratio (ACR)
6. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.

E. Fiber

1. All fiber terminations shall be visually inspected with a minimum 200 X microscope to ensure that no surface imperfections exist after final polishing. In addition, each fiber strand shall be tested for attenuation with an optical power meter and light source as well as an OTDR. Cable length and splice attenuation shall be verified using and OTDR.

F. Attenuation

1. Horizontal distribution multimode optical fiber attenuation shall be measured at either 850 manometers (nm) or 1300 nm using and LED light source and power meter. Backbone multimode fiber shall be tested at both 850 nm and 1300 nm in one direction. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B. One 2-meter patch cord shall be used for the test reference and two 2-meter patch cords shall be used for the actual test. This test method uses a one jumper reference, two jumper test to estimate the actual link loss of the installed cables plus the loss of two connectors. This measurement is consistent with the loss which network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in the ANSI/TIA 568-C.3, Optical Fiber Link Performance Testing.
2. Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the District and the Contractor prior to the start of the test.
3. Test evaluation for the panel to panel (backbone) shall be based on the values set forth in the ANSI/TIA 568-C.3, Optical Fiber Link Performance Testing.

G. Length and Splice Loss

1. Each cable shall be tested with an Optical Time Domain Reflectometer (OTDR) to verify installed cable length and splice losses. The OTDR measurements for length shall be performed in accordance with EIA/TIA-455-60. The measurements to determine splice loss shall be performed in accordance with manufacturer's recommendations and best industry practices. These tests shall be employed on all cables after installation and in addition where one or more of the following conditions exist.
2. OTDR and power meter testing is specifically requested by the District.
3. Each strand shall be tested on all outside plant and tight-buffered cables.
4. A representative strand of each fiber cable shall be tested to verify length if the estimated cable length is within 10% of the maximum length specified, respective to cable function, in the ANSI/TIA 568-C Standard.

H. Test Documentation

1. Test documentation shall be provided in a three-ring binder(s) within three weeks after the completion of the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words “Test Results”, the project name, and the date of completion (month and year). The binder shall be divided by major heading tabs, Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Category 3, 4, or 5), fiber optic attenuation test results, OTDR traces, and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test.
2. Scanner tests shall be printed on 8-1/2” x 11”. Hand written test results (attenuation results and green light results) shall be documented on an Excel spreadsheet. OTDR test results shall be printed or attached and copied on 8-1/2” x 11” paper for inclusion in the test documentation binder. Provide spreadsheet on a CD
3. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall collocated in the binder.

3.07 RECORD DRAWINGS

A. The installation contractor will be provided with two sets of drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor’s Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the District. Contractor shall also redraw, with AutoCAD version 2004 or newer, the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling scheme for all items. These CAD drawings shall be on 8-1/2” x 11” sheets of paper and disk, and be turned over to the District with the O&M manuals.

B. The Contractor shall provide the central drawing set to the District at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

3.08 FIRESTOP SYSTEMS

A. A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.

B. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (P.E., licensed in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the District's Technical Representative prior to installing the firestop system.

D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.09 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminal are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing:

1. Provide all instruments for testing and demonstrating in the presence of the District's inspector that the system is operating as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification.
2. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at contractor's expense. Verify by the system test that the total system meets the specifications and complies with applicable standards.
3. The District reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject and or all of the equipment on the basis of the results thereby obtained.

3.10 CLEANING AND PROTECTION

A. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

3.11 WARRANTY

A. The entire system shall be warranted free of mechanical or electrical defects for a period of one (1) year (one or two years – see QUALITY ASSURANCE paragraph) after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District.

B. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the District after the end of the guarantee period.

C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

D. Manufacturer Warranty

1. The contractor shall facilitate a 25-year system performance warranty between the manufacturer and the District. An extended component warranty shall be provided which warrants functionality of all cabling and connectivity components used in the system for 25 years from the date of acceptance. The performance warranty shall warrant the installed horizontal copper and both the horizontal and the backbone optical fiber portions of the cabling system. Copper and fiber optic links shall be warranted to the link or channel performance as defined in ANSI/EIA-568-C.
2. Upon completion of the project, the customer's technical representative will perform a final inspection of the installed cabling system with the contractor's project foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the customer.
3. Upon receipt of the test documentation, the customer reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Customer testing will use the same method employed by the contractor, and minor variations shall be allowed to account for differences in test equipment and test variability. If significant discrepancies are found, the contractor will be notified for resolution.
4. During the three week period between final inspection and delivery of the test and as-built documentation, the customer will activate the cabling system. The customer will validate operation of the cabling system during this period.
5. Completion of the installation, in-progress and final inspections, receipt of the test, receipt of the as-built documentation, and successful performance of the system for a two week period will constitute acceptance of the system.

E. Special Warranty

1. The contractor shall warrant the cabling system against defects in workmanship for a period of one year (one or two years – see QUALITY ASSURANCE paragraph) from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. All warranty repairs shall be done within fourteen days from being notified in writing by the District. This warranty shall be provided at no additional cost to the District.

END OF SECTION

SECTION 27 41 16.51

CLASSROOM AUDIO-VISUAL SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. The work under this section includes all labor, materials, equipment, and accessories required to furnish and install complete audio visual systems for the classrooms as shown on the plans.

B. The systems shall provide the capability of switching between images from computers, document cameras, or other A/V sources. The images will then be routed to the LCD Projector in the classroom for display on a screen. Audio associated with the images shall be switched simultaneously to an amplifier which feeds ceiling mounted loudspeakers located in the classroom.

1.02 RELATED WORK:

A. Document affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections of Divisions 01 and 26 of these specifications.

B. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.

C. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, backboards, wiring, cables, equipment, devices, etc., shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Communications Contractor for the particular wire and cable fills required for the systems installed. (Conduit sizes shall comply with the California Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for one (1) year after final acceptance under this section shall be the responsibility of the communications contractor.

D. The Installing Communications Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper operation of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.

1.03 GENERAL REQUIREMENTS

A. The Installing Communications Contractor shall hold a valid State of California C-10 License, shall have completed at least 20 projects of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least five years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.

B. The Installing Communications Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work

C. The Installing Communications Contractor shall be a factory authorized distributor and warrantee station for the brand of equipment specified and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Installing Communication Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop. The Contractor shall employ factory-trained technical/service personnel for service and maintenance of the system. Their resumes will be required. The factory-trained technical/service personnel shall have a minimum of five years experience installing the proposed system.

D. The installing Communication Contractor shall have a design staff with a BICSI certified (RCDD) Registered Communications Distribution Designer. The installing Communication Contractor shall have a factory trained service department. The service department shall be on call 24 hours a day, 365 days a year, to arrive and initiate onsite service the specified equipment upon (24) hours notice.

1.04 DEFINITIONS

A. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.05 QUALITY ASSURANCE:

A. In order to establish standards of performance the equipment specified shall be as manufactured by Extron.

B. All of the Electronic Systems Equipment shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the manufacturer of all major equipment, which certifies that the Installing Communication Contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.

C. All communication systems supplied shall be listed by Underwriters Laboratories under UL Standard 1459. A copy of the UL listing card for the proposed system shall be included with the contractor's submittal.

D. Comply with CEC.

1.06 SUBMITTALS

A. Comply with all requirements of the General Conditions, Supplementary Conditions and applicable sections of Divisions 1 and 26 of these specifications.

B. Additional requirements of this section are:

1. Within thirty-five (35) calendar days after the date of award of the Contract, the Contractor shall submit to the Architect for review, eight copies of a complete submission.

2. The submission shall consist of four major sections with each section separated with index tabs. Each page in the submission shall be numbered chronologically and shall be summarized in the index.

3. The first section shall be the "Index" which shall include the project title and address, name of the firm submitting the proposal and name of the Architect.

4. The second section shall include a copy of the Installing Communication Contractors valid C-10 California State Contractors License, letters of Extron factory authorization and guaranteed service, list of 20 projects of equal scope and list of proposed instrumentation to be used by the Contractor.

5. The third section shall contain an original factory data sheet for every piece of equipment in the specifications.

6. The fourth section shall contain a wiring designation schedule for each circuit leaving each piece of equipment and drawings showing system wiring plans for a typical classroom.

PART 2 - PRODUCTS

2.01 AUDIO VISUAL SYSTEM

A. Provide following Audio/Visual equipment including associated outlets, cabling, patch cords and raceways for complete operable Audio/Visual system per Grossmont Union High School District standard in each classroom and in each rooms as indicated on drawings.

1. Ceiling mounted plate with arm and projector mount.

2. Provide (1) Elmo Model #TT-12iD Document Camera with 5 year warranty that shall be located at the teachers' desk.
3. Provide Patch Cables (See section 15)
    a. Provide Patch Cables for all media source devices that must connect to AV system wallplates.

B. Outlets and faceplates as indicated on Classroom multi-media riser diagram. All faceplates shall be white and shall include appropriate modular inserts to conform with system requirements.

1. Classroom Audio/Video Patch cables
    a. All patch cables must be factory manufactured and color coded per owners requirements to match each campus cabling. Do not use cables that come with equipment.

    b. All VGA patch cables shall have ferrites attached by the cable manufacturer to minimize radio frequency interference.

    c. HDMI patch cable shall be made by either Extron, Kramer or Vanco.

    d. HDMI patch cables shall be of appropriate flexibility for the end user's working environment.

    e. HDMI patch cable connectors shall be of a quality that reasonably grips the inside of the port and does not easily slide out.

C. Outlets and faceplates as indicated on Classroom multimedia riser diagram. All faceplates shall be white and shall include appropriate modular inserts to confirm with system requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the contractor shall notify the architect before making any changes. It shall be the responsibility of the factory authorized distributor of the specified equipment to install the equipment and guarantee the system to operate as per plans and specifications.

B. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.

C. The cables within the rack or cabinets shall be carefully cabled and laced with no. 12 Cord waxed linen lacing twine or nylon cable ties. All cables shall be numbered for identification.

D. Splicing of conductors in underground pull boxes is not permitted.

E. The labor employed by the contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the District and architect to engage in the installation and service of this system.

F. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., Caused by the performance of this work.

3.02 WARRANTY

A. The entire system shall be warranted free of mechanical or electrical defects for a period of one (1) year after final acceptance of the installation. The transmitter and receivers shall be warranted for parts and labor for a period of three (3) years by the manufacturer. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District.

B. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the District after the end of the guarantee period.

C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

3.03 TESTING

A. Provide all instruments for testing and demonstrating in the presence of the District's inspector that the frequency response is as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification

B. The District reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject any or all of the equipment on the basis of the results thereby obtained.

C. Check out and final connections to the system shall be made by a factory-trained technician in the employ of a manufacturer of the products installed. In addition, factory-trained technicians shall demonstrate operation of the complete system and each major component to the District.

D. System field wiring diagrams shall be provided to the District by the system manufacturer prior to completion of the installation.

E. Upon completion of the installation of the equipment, contractor shall provide to the District a signed statement from the equipment manufacturer that the system had been tested and functions properly according to the specifications.

F. The contractor shall be responsible to provide service within 24 hours (or by mutual consent) after notification by the District or his representative, within the hours of 8:00 AM to 5:00 PM from Monday to Friday. Service request forms shall be supplied by the Contactor and the faxing or mailing of such request form shall constitute notification by the District of a service request.

3.04 TRAINING

A. Contractor shall provide a minimum of 40 hours of on-site training for site staff on the Classroom video systems. Training for personnel shall be provided by certified technology specialists. The scope of training shall encompass system operation and procedures. Technician training should include an integrated information overview, media retrieval procedures as well as operation procedures for local control configurations. The contractor shall provide a detailed written outline clearly describing the proposed plan for all training, for approval by the Engineer and District's representative.

B. Training for staff will include basic system concepts. Faculty and staff will need to know how to power on/off the system, and how to access one or more media resources via remote control. Training should include use and operation of audio/video devices and techniques and trouble-shooting tips. Trainers should incorporate hands-on techniques to maximize staff opportunity to incorporate and develop curriculum that is both meaningful and targeted for their student needs. Clearly written support materials should be provided to all training participants. Manual describing operation and use of the system shall also be provided.

C. Contractor shall provide a minimum of 4 hours of on-site training for technicians.

D. Trainers shall provide technicians with an in-depth technical overview of head end or control system concepts. Training should include basic overview of head end and local control and troubleshooting concepts. Head end training should include system concepts and hands on usage of media sources. Media center technicians will be trained to provide setup, operation and application of return video. Clearly written documentation and support materials must be provided for each installation. A training manual describing operation and use of the system shall also be provided. Provide control of local resources and will be equipped with the required local switching and control capability. Provide required cables to integrate all local room devices including Plasma displays, DVDNCR and audio I visual control system.

3.05 RECORD DRAWINGS

A. The contractor shall maintain record drawings as specified in accordance with these specifications, and as noted below.

B. Upon completion of the installation, four (4) copies of complete operational instructions shall be furnished, complete with record drawings. Instructions shall include part numbers and names, addresses, and telephone numbers of parts source. Final payment shall not be made until operational and maintenance manuals have been received.

C. Drawings shall show locations of all concealed and exposed conduit runs, giving the number and size of conduit wires. Underground ducts shall be shown with cross section elevations and shall be dimensioned in relation to permanent structures to indicate their exact location. Drawing changes shall not be identified only with referencing CORs and RFIs, the drawings shall reflect all the actual changes made.

D. One set of record drawings shall be delivered to the District in accordance with these specifications.

END OF SECTION

SECTION 27 51 26

ASSISTIVE LISTENING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Provide Assistive Listening System per CBC requirements.

B. The minimum number of receivers shall be equal to 25% of the seating, but not less than two. 25% minimum of receivers provided but no fewer than two shall be hearing-aid compatible in accordance with Section 11B - 706.3.

C. Systems shall be permanently installed in areas with permanent seating for 50 or more occupants or where a public address system is installed.

1.03 DEFINITIONS

A. CBC: California Building Code (CCR Title 24 Part 2)

B. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.

1.04 SUBMITTALS

A. Product Data

1. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

B. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:

1. Operational procedures for the overall systems including the "Sequence of Operation".

2. Instruction for the proper operation and maintenance of the system.

3. Factory issued technical, installation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.

B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Centrum Sound
2. Listen Technologies
3. Phonic Ear
4. Telex
5. Williams Sound
6. Or equal

C. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

B. Assistive-listening systems shall be provided in accordance with CBC Section 11B-219 and shall comply with CBC Section 11B-706.

1. 11B-706.2 Receiver Jacks
   Receivers required for use with an assistive listening system shall include a 1/8 inch (3.2mm) standard mono jack.

2. 11B-706.3 Receiver Hearing-Aid Compatibility
   Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neckloops.

3. 11B-706.4 Sound Pressure Level
   Assistive listening systems shall be capable of providing a sound pressure level of 110 dB minimum and 118 dB maximum with a dynamic range on the volume control of 50 dB.

4. 11B-706.5 Signal-To-Noise Ratio
   The signal-to-noise ratio for internally generated noise in assistive listening systems shall be 18 dB minimum.

5. 11B-706.6 Peak Clipping Level
   Peak clipping shall not exceed 18 dB of clipping relative to the peaks of speech.

C. The minimum number of receivers to be provided shall be equal to 4% of the total number of seats, but in no case less than two. 25% minimum of receivers provided, but no fewer than two, shall be hearing-aid compatible in accordance with CBC Section 11B-706.3.

D. If the system provided is limited to specific areas or seats, then such areas or seats shall be within a 50-foot viewing distance of, and have a complete view of, the stage or playing area CBC Section 11B-219.4.

2.03 Transmitter:

A. Provide assistive listening system transmitter with four preconfigured selectable application resets.

1. Hearing assistance

2. Music

3. Voice

4. An additional auxiliary input feature allowing the user to add another audio source, i.e., MP3 or CD player, providing the ability to mix that auxiliary input with any microphone input.

B. Provide auto-detection of channel interference for automated channel switching as needed.

C. Provide Centrum Sound System type PPA 377 or equal.

2.04 Single Channel Receiver

A. Provide Centrum Sound System Type PPA R37N or equal.

2.05 Multi-channel Receiver

A. Provide Centrum Sound System Type PPA R35-8N or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Perform this work in accordance with acknowledged industry and professional standards and practices, existing build conditions, and as specified herein. Provide and install all materials, devices, components, and equipment for complete, operational systems.

B. Maintain a competent supervisor and supporting technical personnel, acceptable to the Construction Manager, during the entire installation. Change of the supervisor during the project will not be acceptable without prior written approval from the Owner, the Construction Manager, and the Architect.

C. Coordinate all efforts with those of related trades. In the event of any conflicts, delayed or improper preparatory work by others, notify the Architect; the Architect's decision will be binding. Verify all field conditions.

END OF SECTION

SECTION 27 53 13

CLOCK SYSTEMS

PART 1 - GENERAL

1.01 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. All applicable portions of Division 26 and 27 shall apply to this section as though written herein completely.

1.02 SUMMARY

A. The work under this section shall consist of all cabling, outlets, cabinets, patch panels, and associated material for a complete IP speaker-master clock system as shown on the plans and as specified herein.

1.03 RELATED WORK

A. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.

B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, backboards, wiring, cables, equipment, devices, etc. unless existing, shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Electrical Contractor for the particular wire and cable fills required for the systems installed. (Conduit sizes shall comply with the California Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for one (1) year after final acceptance under this section shall be the responsibility of the installing electronic contractor.

C. The Installing Electronic Systems Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.

1.04 QUALIFICATIONS

A. The Installing Electronic Systems Contractor shall hold a valid State of California C-10 License, and be AMP ND&I certified and shall have completed at least twenty projects including five projects with Grossmont Union High School District of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least ten years, and capable of being bonded to assure the owner of performance and satisfactory service during the guarantee period.

B. The Installing Electronic Systems Contractor shall be a factory authorized distributor and warrantee station for the brand of equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop.

1.05 DEFINITIONS

A. Backbone: A facility (e.g., pathway, cable, or conductors) between telecommunications rooms or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.

B. BDF: Building Distribution Frame (same location as MDF)

C. BICSI: Building Industry Consulting Service International

D. CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code

E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

F. EMI: Electromagnetic interference

G. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.

H. IDC: Insulation displacement connector

I. IDF: Intermediate Distribution Frame

J. LAN: Local area network.

K. MDF: Main Distribution Frame

L. MTR: Main Telephone Room

M. RCDD: Registered Communications Distribution Designer

N. RMC: Rigid metallic conduit

O. UTP: Un-shielded twisted pair cable

1.06 APPLICABLE STANDARDS

A. The equipment shall be U.L. listed labeled, and approved for the application shown in the contract documents.

B. The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:

1. ANSI/TIA 568-C.0 Generic Telecommunications Cabling for Customer Premises

2. ANSI/TIA 568-C.1 Commercial Building Telecommunications Cabling Standard

3. ANSI/TIA 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards

4. ANSI/TIA 568-C.3 Optical Fiber Cabling Components Standard

5. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair Cables and all applicable revisions and addendums.

6. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces and all applicable revisions and addendums.

7. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings and all applicable revisions and addendums.

8. J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications and all applicable revisions and addendums.

C. Products, services, and materials provided by the Contractor shall be new and of high quality and free of faults and defects.

D. Provide products, services, and materials as specified in this document. Substitution of products, services, or materials will only be considered if the Contactor follows procedures and requirements specified in Section 013300.

1.07 SUBMITTALS

A. Submit manufacturers' product data sheets for each component of the IP speaker-master clock systems. Certify that the data sheets depict the components to be provided by the Contractor to make up the complete system as described in this specification.

B. Product Data

1. Material List: A material list with names of manufacturers, model numbers, and technical information on all equipment proposed.

2. Product technical information sheets for each principal component in the proposed system. Identify by arrow, circle or similar means products being proposed. Submittals consisting of unmodified catalog pages with no markings will be rejected.

3. Weight, dimensions and shipping splits.

4. Equipment operating and service (maintenance) clearances required around the equipment.

C. Shop Drawings

1. Include scaled plan of telecommunications equipment rooms, labeling each individual component. Identify voice data equipment racks, method of field assembly, workspace requirements, and access for cable connections.

2. Scaled drawings indicating all device locations and connections. Wire and conduit routing and circuit identification.

3. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

4. Cabling Administration Drawings

5. Wiring diagrams to show typical wiring schematics including the following:

a. IP Speaker/Clocks
b. IP Interior and exterior speakers
c. IP interface equipment
d. Analog speaker cables
e. Terminal blocks
f. Equipment racks

D. Qualification Data:

1. For Installer

2. Submit references for a minimum of twenty similar projects successfully undertaken and completed within the last ten years. As a minimum, provide project name and address, client contact name and telephone number, and construction manager name and telephone number. Provide a brief description of each project indicating types of systems installed, quantities and configurations of outlets, and projected time scales.

E. Operating Sequences: Provide a complete written description of the Sequence of Operation of each of the systems including startup and recovery procedures

F. Samples: when requested by Architect

1. Provide three (3) full-size installation samples of the voice, data and IP speaker-clock system outlet. The sample shall include, as a minimum, the faceplate, two data and two voice system connectors (each terminated with a 12" length of distribution cabling) two blanking plates, and back boxes.

2. Submit samples of the labels to be used for labeling cables, and termination blocks.

3. Once samples have been submitted, reviewed by the School District Representative and approved they shall be retained. The samples shall be used as the standards by which the quality of work on the project by the Contractor shall be judged. Any installation, which does not meet this standard once samples have been submitted, reviewed by the School District Representative and approved, they shall be replaced or reworked as approved by the School District Representative.

G. Operation and Maintenance (O&M) Manuals: Furnish composite "Systems Operation and Maintenance" manuals in indexed three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain, but not be limited to:

1. Operational procedures for the overall systems including the "Sequence of Operation".

2. Test procedures and test results.

3. Instruction for the proper operation and maintenance of the system.

4. Factory issued technical, installation, and maintenance manuals.

5. Factory issued operations and programming (software) manuals.

6. A replacement parts list complete with part numbers and name, address, and phone number of suppliers used by the Contractor. A spare parts list recommended for purchase by the District shall be included.

7. All portions of the material list and shop drawings which are not included in the foregoing.

H. Submit details of the warranty (including manufacturer warranties) to be provided for the cabling systems, clearly indicating that all components are covered.

1.08 COORDINATION

A. Coordinate layout and installation of IP speaker- master clock cabling with District’s Representative.

B. Meet jointly with telecommunications and LAN equipment suppliers and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.

1. Record agreements reached in meetings and distribute to other participants.

1.09 SYSTEM TESTING

A. Test Procedures:

1. A written document detailing the proposed test procedures of the system shall be supplied. These procedures shall include all tests required by the equipment manufacturer and by this specification.

2. Submit a testing schedule indicating how each IP speaker-master clock cabling system component is to be tested. Refer to Section 27 15 00 for testing requirements. The scheduled shall, as a minimum, indicate the testing process from factory testing through to final acceptance testing. The schedule shall list (by part number) testing equipment that will be used and detail each step of each test to be performed. The schedule shall list the criteria that will be applied to each test of each component of the telephone and data cabling systems. The schedule shall include the test results form that will be filled in by the tester as each component is tested.

B. Test Results Report: Test Results Report: The results of the execution of the testing procedure, including the items tested or inspected, the date, and by whom.

C. Follow IP speaker-master clock system installation, undertake and record tests to ensure that the cabling and components will perform satisfactorily in service. In addition to the tests detailed in this specification, the Contractor shall carry out any additional tests that he deems necessary to ensure the satisfactory operation of the telephone, data, and fiber optic cable systems. Testing shall be as required in Section 27 15 00. The costs of these additional tests shall be borne by the Contractor.

D. Provide the District’s Representative with the opportunity to witness all testing.

E. Complete the tests identified in all of the IP speaker-master clock system specifications.

F. Notify the District’s Representative fourteen working days before the date of commencement of the cable tests. Provide details, on that advance date, of proposed tests, the test schedule, equipment to be used, its certification and calibration, and the names and qualifications of test personnel.

G. Include the cost of obtaining, calibrating, and maintaining test equipment, and the cost of carrying out and recording the tests, including labor costs, in the bid sum.

H. Ensure that all Test Equipment is in calibration before delivery to site and throughout the testing period. The installer shall be responsible for ensuring that any necessary tests and rework to maintain equipment's calibration status are carried out.

I. Failures detected during the testing shall be duly noted on the test results schedule and rectified. On the fault being rectified, this shall also be noted. These notes shall not be deleted or obliterated.

J. Rectification of all damaged cables shall include replacing damaged cables with new cables in complete runs or remaking poor terminations. In-line cable joints, splices, or distribution points are not acceptable. All damaged cables shall be removed from site.

1.10 QUALITY ASSURANCE

A. Work shall be done by a qualified Contractor holding licenses as required by legally constituted authorities having jurisdiction over the work. Contractor shall have completed at least ten (10) projects of equal scope to systems described herein and shall have been engaged in business of supplying and installing specified type of systems for at least 5 years.

B. Contractor shall warranty all work executed and materials furnished shall be free from defects of material and workmanship for a period of two (2) years from acceptance date of Contract Completion. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at no expense to the District: Any defective material or work which may be discovered before final acceptance or work, or within warranty period; any material or work damaged thereby; and adjacent material or work which may be displaced in repair or replacement.

C. Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.

D. If Contractor fails to repair or replace material or work indicated above within 7 days of receiving written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess cost against Contractor, if Contractor does not respond accordingly.

E. Persons skilled in trade shall install system in accordance with best trade practice. Further, in accordance with all applicable building codes.

F. Contractor and all contractors' employees terminating cable to wiring terminating devices shall be certified by the manufacturer of the wiring device. Copies of certificates shall be provided to the District Representative prior to the start of work.

G. Extend material and Performance Warranties

1. The contractor shall facilitate and extend to the Owner all manufacturers' warranties for all products installed. Extended system (performance) and component warranties shall be provided which warrants functionality of all existing and new components (cable, connecting hardware and patch cords) used in the system for a minimum of (5) five years from the date of acceptance. Each component of the system shall be covered for defects in materials and workmanship. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project.

2. Repair or replace the defective material at the project premise, to comply with the performance standards outlined in the contract documents during the warranty period.

3. Upon successful completion of the installation and subsequent inspection, the District's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

4. All conditions for obtaining the manufacturer's warranty shall be the sole responsibility of the contractor.

1.11 AS BUILT DOCUMENTATION

A. Cable termination numbering, and patch panel labeling shall be coordinated with School District Representative.

B. The as-built documentation shall consist of prints with the device locations, paging zone identification and cable routing.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: The IP Speaker Master Clock system shall be as manufactured by Singlewire/Berbee INFORMACAST. This is a board approved proprietary system. No other system will be considered.

B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

B. Comply with CEC.

2.03 IP SPEAKER / MASTER CLOCK OULTETS

A. Outlet for IP clock/speaker shall be RJ45 enhanced performance type 8-position/8-conductor module jack, and shall comply with enhanced category 6E performance requirements, number of ports and quantities as indicated on drawings. All outlets shall be wired in the TIA 568B configuration.

B. Provide dual-port ACO installation kit, with Category 6 insert, wired per T568B for all IP clock/speaker.

C. Provide 110 SL series single port with almond color modular jack box, with 110 SL series category 6 gray color 110 SL series Category 6 insert, with strain relief cap for IP clocks, IP speakers and IP clock/speakers outlet locations. Locate jack inside enclosure.

D. Provide 110 SL series single port with almond color modular jack box, with one red color 110 SL series category 6 insert, with strain relief cap for IP camera locations.

E. For single port data outlet locations, provide faceplate with space for two connections, one port shall be fully operational and second port shall be covered with blank plate.

F. For dual port data outlet locations, provide faceplate with two fully operational connections.

G. All data outlet faceplates shall be almond color and shall have unique identification number applied to faceplate. Data outlet locations faceplates shall include interchangeable colored icons or color port inserts and label windows. Color scheme shall be approved by the owner and shall match existing site prior to installation.

2.04 COMBINATION IP CLOCK/SPEAKER

A. School District IT Department will furnish, install and program all combination IP clock/speakers. The low voltage contractor shall be responsible to provide enclosures, cables and patch cords for combination IP clock/speakers per School District requirements.

B. The low voltage contractor shall be responsible to provide suitable flush mounted enclosures with vandal resistant for all combination IP clock/speakers location as indicated on drawings. Obtain cut sheets all devices and coordinate enclosure type with School District prior to ordering. Coordinate installation of enclosure with electrical contractor. Submit sample of each enclosure to School District IT Department for approval prior to ordering. Provide following type enclosures:

C. Flush wall mounted enclosure, Atlas Sound #FEST-18C for combination IP clock/speakers.

D. Provide IP zone controllers, Atlas Sound #IP-ZCM1 (single zone) or #IP-ZCM2 (dual zone) for analog speakers as indicated on drawings (OUTDOOR AND CEILING SPEAKERS). Install zone controllers rack mounted at IDF location and connect to amplifiers.

E. Provide 2 foot category 6 gray color patch cable assembly to connect to data drop at each location.

F. Provide 4 foot category 6 gray color patch cable assembly to connect all devices to District provided Ethernet switch at IDF location. Coordinate with School District IT Department for final connections.

G. Coordinate testing and adjusting of speakers as required with School District IT Department.

2.05 ANALOG PAGING SPEAKERS

A. Low voltage contractors shall furnish, install, wire, test, adjust for maximum volume (15W- 1 amplifier for 4 speakers) and program analog speakers including suitable enclosure for complete operable system location as indicated on drawings. Provide vandal resistant screws for attachment of speakers to enclosure.

B. Exterior speakers shall be analog where two or more exists on a building. Where a single speaker is installed on a building it shall be IP type.

C. Flush mounted exterior analog loudspeaker shall be, Atlas Sound #APF-15T with recessed wall mounted square enclosure, Atlas Sound #193-8-6 and vandal-proof square baffle grille, Atlas Sound #VP161-APF. Assembly must be vandal resistant.

D. (option) Exterior surface mounted speaker horn shall be Atlas Sound #APC-30T 30 watt with 100v transformer and 45 ohm tap. Assembly must be vandal resistant.

E. Flush ceiling mounted analog speaker assembly with volume control shall be Atlas Sound #SD72WV with recessed round enclosure, Atlas Sound #95-8.

F. Provide IP zone controllers, Atlas sound #IP-ZCM1 (single zone) and IP-ZCM2 (dual zone) at IDF location and shall be connected to amplifier, Atlas Sound #PA601 with rack mounted kit, Atlas Sound #AARMK2-5. Provide zone controllers and amplifiers quantities as required to connect analog speakers. The contractor shall be responsible to provide sufficient power amplifier to serve all analog speakers. The contractor shall make all connection to IP zone controllers and amplifiers. All amps and zone controllers shall be located in the MDF or IDF equipment rack. Provide separate interior and exterior zones.

G. The contractor shall provide dedicated 1-pair, 18 gauge shielded CMR rated cable run from each analog speaker to IDF location. Terminate speaker cables to terminal block at IDF location. All cable routed in underground conduit shall be UL listed for wet location use. Cable shield for each cable shall be grounded at one location only.

H. The contractor shall be responsible for testing and adjusting all analog speakers to ensure proper volume level to satisfy each school site requirement. Speakers shall be tapped at maximum wattage at time of testing. Provide skilled personnel and minimum 8-hours for re-adjustment of analog speakers per school site requirements after 3 weeks from the final sign-off of the project (Occupancy).

2.06 GROUNDING AND BONDING

A. Grounding and bonding shall comply with CEC, EIA/TIA-607 and UL467.

B. All wires used for telecommunications grounding purposes shall be identified with green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

A. Cables connecting to equipment racks shall be installed with not less than six feet of slack cable between the equipment rack/terminal block and terminal backboard. The slack cable shall be coiled and supported on the backboard and/or cable tray.

B. Cables shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12 inches on center mounted onto the plywood along the entire length of all cables.

C. Provide 36 inches of cable slack at clock outlets.

D. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate manufacturer's recommendations.

E. Cable lengths over 50 feet shall be machine pulled and not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.

F. A dynamometer to measure pulling tension shall be used on all cable runs in excess 200 feet or with more than 180 degrees in bends. The actual pulling tension value shall be calculated and recorded for each pull. A written report shall be provided to the District.

G. The portions of cables installed without raceways or cable tray supports shall be installed with “J-hook” cable supports.

H. The “J-hooks” shall provide multi-tiered “treed” “J” shared hooks, with wide flat cable support base (0.5”W minimum) and smooth rounded corners, specifically designed for Category-6 and fiber optic cable support. As manufactured by Erico Inc. or substitution of equal or better and approved by the District.

1. The individual “J-hook” attachment to the building structure shall be “beam clamp”, “hanger rod”, clevis hanger styles.

2. Install “J-hooks” not more than 36 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between adjacent hooks. Secure cables to “J-hooks” with cable tie wraps. “J-hooks” supported cables, bundle cables together with tie wraps.

3. “Bridle rings” shall not be used to support cables.

4. Cables shall not rest directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.

I. Provide nylon pull strings with all cable runs, conduit stub ups, conduit sleeves, cable trays, open wiring routes, innerduct, and spare. Pull strings shall be free from cable bundles in open wiring routes.

J. Provide Velcro cable management straps on all copper cable bundles, the last 20 feet or upon entry into equipment closet, a maximum of 12 inches apart, on the rear of the equipment racks and on the patch cords within the vertical cable managers. Straps shall be a maximum of 12 inches apart.

3.02 CIRCUIT TERMINAL ROOMS AND CLOSETS

A. Provide conductor/cable training and racking support distribution rings installed on backboards. Support rings shall be spaced a minimum of 10 inches on center along all cable/conductor routing paths on backboards and within 4 inches of each change in cable/conductor direction. As manufactured by Newton 3042 series, Saunders or equal with District approval.

3.03 LABELING AND IDENTIFICATION

A. Each cable run shall be permanently labeled at each end with a unique sequential number which corresponds to a similar number provided for each data outlet and punch down point. A printed label shall be placed at each of the following locations:

B. On cable at the rear of the patch panel or termination block, provide self-laminating wrap around label, Brady Label self-laminating 1.2” by 1.5” wrap around label #29689 or equal to match site condition.

C. On each cable in the j-box behind the faceplate location. Provide self-laminating wrap around label, Brady Label self-laminating 1.2” by 1.5” wrap around label #29689 or equal to match site condition.

D. On the face plate of the patch panel, provide a ¾” by ¾” label with a letter or number identifying the patch panel designation.

E. On the face of the faceplate in the label holder window.

3.04 CABLE SYSTEM TESTING

A. All cables and termination hardware shall be 100% tested for defects in installation to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

B. Each copper cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. All category 6 cables shall be tested to ensure the category 6 standard performance to 500Mhtz is complied with. All tests shall be printed out in hard copy in the quantity called out in the general specifications for O&M and turn over documents as well as one disc copy for the owners use. Data cables shall be tested using a (Fluke – DSP 4000 series or equivalent) cable analyzer.

C. Continuity

1. Each pair of each installed cable shall be tested using a “green light” test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicted by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

3.05 RECORD DRAWINGS

1. The installation contractor will be provided with two sets of drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor’s Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. Contractor shall also redraw, with AutoCAD version 2004 or newer, the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling scheme for all items. These CAD drawings shall be on 8-1/2” x 11” sheets of paper and disk, and be turned over to the owner with the O&M manuals.

2. The Contractor shall provide the central drawing set to the owner at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

3.06 FIRESTOP SYSTEMS

A. A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.

B. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed in the State of California. A drawing showing the proposed firestopped system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system.

D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.07 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminal are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing:

1. Provide all instruments for testing and demonstrating in the presence of the owner's inspector that the system is operating as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification.

2. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at contractor's expense. Verify by the system test that the total system meets the specifications and complies with applicable standards.

3. The owner reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject and or all of the equipment on the basis of the results thereby obtained.

3.08 CLEANING AND PROTECTION

A. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

3.09 WARRANTY

A. The entire system shall be warranted free of mechanical or electrical defects for a period of one (1) year after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District.

B. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the owner after the end of the guarantee period.

C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

D. Manufacturer Warranty

1. The contractor shall facilitate a 5-year system performance warranty between the manufacturer and the owner. An extended component warranty shall be provided which warrants functionality of all cabling and connectivity components used in the system for 5 years from the date of acceptance.

2. Upon completion of the project, the District's technical representative will perform a final inspection of the installed cabling system with the contractor's project foreman.

3. Upon receipt of the test documentation, the District reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. District testing will use the same method employed by the contractor, and minor variations shall be allowed to account for differences in test equipment and test variability. If significant discrepancies are found, the contractor will be notified for resolution.

E. Special Warranty

1. The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. All warranty repairs shall be done within fourteen days from being notified in writing by the District. This warranty shall be provided at no additional cost to the District.

END OF SECTION

SECTION 28 16 00

INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Security Control Panel.
B. Initiation Devices.
C. Notification Devices.

1.02 RELATED WORK

A. Section 26 05 33 - Raceways and Boxes for Electrical Systems
B. Section 26 05 19 - Low Voltage Electrical Power Conductors and Cables
C. Section 28 31 11 - Fire Detection and Alarm Systems

1.03 QUALITY ASSURANCE

A. Manufacturer: The access control system shall be a single-source manufacturer such that the single vendor distributes, supports, warranties and services all components. The manufacturer shall have a minimum of five (5) years documented experience.

B. Installer: The installing dealer must be a factory-authorized service and support company specializing in the selected manufacturer's product, with demonstrated prior experience with the selected manufacturer's system installation and programming.

C. Servicing Contractor: The manufacturer of the system must have local service representatives within 60 miles of the project site.

1.04 REFERENCES

A. CEC - California

B. UL 294 - Standard for Access Control Systems.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 00.

B. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:

1. Manufacturer installation and programming certifications. The first pass submittal will be rejected if this is not submitted along with the remaining submittal items.

2. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item.

3. All component options and accessories specific to this project.

4. Electrical power consumption rating and voltage.

5. Battery calculations to verify the system functionality length provided by the manufacturer.

6. Wiring requirements.

C. System Drawings: Project-specific system CAD drawings shall be provided as follows:

1. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (i.e., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown.

2. Provide schedules describing each system input location by an architecturally familiar reference (i.e., Door 312A). The architectural door schedule shall be used as the basis.

D. Submit detailed description of Owner training to be conducted at project end, including specific training times.

E. Quality Assurance:

1. Provide materials documenting experience requirements of the manufacturer and Installing Contractor.

2. Provide system checkout test procedure to be performed at acceptance. Test procedures shall include all external alarm events.

F. Coordination Drawings:

1. Include all ceiling-mounted devices in composite electronic coordination files. Refer to Section 01 33 00 for coordination drawing requirements.

1.06 SYSTEM DESCRIPTION

A. This specification section describes the furnishing, installation, commissioning and programming of a complete, turnkey security management system.

B. Performance Statement: This specification section and the accompanying access control-specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.

C. Basic System Description: The security management system shall provide an integrated hardware and software solution for access control.

1.07 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 01 33 00.

B. Provide final system block diagram showing any deviations from shop drawing submittal.

C. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.

D. Provide schedules documenting:

1. Controller installation locations including specific door numbers being controlled.

2. All terminal block wiring, including cable numbers.

E. Warranty: Submit written warranty and complete all Owner registration forms.

F. Complete all operation and maintenance manuals as described below.

1.08 OPERATION AND MAINTENANCE DATA

A. Submit documents under the provisions of Section 01 33 00.

B. Operation Data: Provide full system operation instructions for each piece of equipment.

C. Maintenance Data: Document any manufacturer’s recommended preventative maintenance procedures to be performed by the Owner.

1.09 WARRANTY

A. Unless otherwise noted, provide warranty for one (1) year after Date of Substantial Completion for all materials and labor.

B. The warranty shall include emergency service and repair on-site, with acknowledgment response time of one (1) hour from time of notification and on-site response within four (4) hours. The system shall be repaired and restored to operation within twenty-four (24) hours of notification.

C. Refer to the individual product sections for further warranty requirements of individual system components.

PART 2 - INTRUSION DETECTION PRODUCTS

2.01 INTRUSION DETECTION SYSTEM MANUFACTURERS

A. Basis of Design:

1. DMP

B. No other manufacturers will be accepted as part of this project.

2.02 SECURITY CONTROL PANEL

A. Control Panel: Modular construction with surface wall-mounted enclosure.

B. Power Supply: Adequate to serve control panel modules including, but not limited to, remote detectors, remote annunciators, relays, and alarm signaling devices. Include battery operated emergency power supply with capacity for operating system in standby mode for a minimum of 24 hours.

C. System Supervision: Provide electrically supervised system, with supervised alarm initiating and alarm signaling circuits. Component or power supply failure places system in alarm mode.

D. Initiating Circuits: Supervised zone module with alarm and trouble indication.

E. Signal Circuits: Supervised zone coded signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode and does not disable that circuit from transmitting alarm.

1. Each building will be a dedicated zone.

F. Remote Station Signal Transmitter: Electrically supervised, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.

G. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts for each detection zone and door number to provide accessory functions specified.

1. Each building will be a dedicated zone with a door number associated with the alarm.

H. Entry and Exit Time Delays: A maximum of five minutes, unless otherwise noted by the school district.

I. Alarm Sequence of Operation: Actuation of Intrusion Detecting device places system in alarm mode, which causes the following operations:

1. Sound and display local alarm signaling devices with non-coded signal.
2. Transmit zone-coded signal to central station.
3. Indicate location of actuated device on control panel and on remote annunciator panel.
4. Alarm Reset: Key-accessible reset function resets alarm system out of alarm if alarm initiating circuits have cleared.

J. Lamp Test: Manual lamp test function causes alarm indication at each zone at control panel and at annunciator panel.

2.03 ACCESS CONTROL

A. Keypad:

1. Industry standard Wiegand output keypad. 8-Bit word.

2. Vandal and impact resistant construction. Weatherproof design, including in 100% humidity.

3. Refer to the project drawings for additional information.

2.04 INITIATION DEVICES

A. Duress/Panic Switch:

1. SPDT, 12 VDC switch with latching LED light indicating switch activation.

2. LED to provide green light glow for visibility of switch in low light conditions.

3. Small form factor white ABS plastic housing (2" W x 3" H x 1" D) containing electronics and magnetic contacts.

4. Housing to contact actuator lever alarming at 20 to 45-degree movement (approximately 1") from resting position.

5. Refer to the project drawings for locations of Durress/panic switches and additional information.

B. Door Contacts:

1. Contacts shall be single-pole, double-throw (SPDT) suitable for use in a line supervision circuit. Gap length shall be 1" on the latch side.

2. Provide magnetic alarm contacts at each door (recessed in the door header) where shown on the plans. Contacts shall provide a signal to the controller when the contact status changes.

3. The contacts shall have the capability of being shunted by a request-to-exit device. When the system grants access at a controlled point, the system shall shunt the door alarm input for that point.

4. All exterior doors will require a door contact switch for all buildings. Refer to the project drawings for additional information.

C. Motion Detection:

1. Passive infrared, ceiling mounted, 12v DC.

2. Adaptive technology for humidity and temperature stability.

3. 360 coverage, 61” coverage range.

4. Fresnel pattern lens with a minimum of a 30 zone pattern.

2.05 NOTIFICATION DEVICES

A. Alarm Horn

1. External wall mounted near main control panel.

2. Piezo siren type with alternating high/low sound.

3. 106 dB at 10”

4. 6 to 13 EV DC operation

PART 3 - EXECUTION

3.01 PRE-INSTALLATION

A. A series of meetings shall be required to coordinate the functionality and requirements at each door and shall be required prior to the start of installation of any device or cable but after submittals and qualifications have been fully approved. The meeting will include coordination with the security contractor, door hardware contractor, Architect, Owner, Engineer, and any other contractor involved with the installation of the system. The meeting shall be chaired and lead by the Contractor and shall include, but not limited to, the following topics:

1. Zone requirements for each building including but not limited to:

    a. Door hardware coordination and order of operation to each door.

    b. Glass break device zones.

2. Lockdown sequence including arming and disarming requirements.

3. Integration and programming requirements for integrating with the access control system.

4. Sample of the laminated map identifying supporting zones at each building with device locations and door information.

5. Coordinate connection requirements for a third-party monitoring service.

6. Training requirements and review.

3.02 INSTALLATION

A. Comply with the manufacturer’s instructions and recommendations for installation of all products.

B. Provide all system wiring between all components as directed by the manufacturer.

C. Mount all readers where shown on plans in accordance with Americans with Disabilities Act (ADA) requirements.

D. Locate all request to exit motion detectors directly above the door frame, centered on the door opening. Adjust sensitivity to permit operation on motion of persons within 2'-0" of door. Avoid false activation by persons passing by where possible.

E. Provide wiring to the request-to-exit devices located in the electrified door hardware.

F. Install, terminate and test all door alarm contacts. Contacts shall be recessed in the door header.

3.03 FIELD QUALITY CONTROL

A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications, as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.

B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the Contract Documents.

3.04 MANUFACTURER'S FIELD SERVICES

A. Installation shall be performed by a factory-trained and certified Contractor Installer.

B. The Installer shall provide a comprehensive, site-specific customer planning guide for the system. The installer shall conduct a conference with the Owner prior to any installation to discuss the programming options of the system and the planning guide. The result of this planning guide shall be the determination of the system access policies for each point.

C. The Installer shall include labor for all planning and all programming activities required to implement the Owner's access policies for each system point. Any software programmable access policy, within the bounds of the hardware specified, shall be included.

D. It shall be the responsibility of the Contractor/Installer to provide a complete, functional system as described by the Contract Documents. These responsibilities include:

1. Complete hardware setup, installation and wiring, and software configuration of the system.

2. Complete programming of all operator software in accordance with the Owner's access policies determined by the planning guide conference.

3. Complete system diagnostic verification.

E. The Installation Contractor shall be present at two (2) four-hour meetings to coordinate all door hardware requirements with the door hardware vendor.

3.05 SYSTEM ACCEPTANCE

A. The SMS Vendor shall submit for review a formal acceptance and system checkout program. The system checkout procedures shall include all system components and software, including but not limited to all system computers, field controllers, card reader devices, biometric readers and remote system interfaces. The Contractor shall perform the tests and document all results under the supervision of the manufacturer's system engineer.

B. All operational scenarios, as defined by the customer planning guide, shall be tested to simulate the actual use of the system in the normal operating environment. The successful completion of these operational scenarios shall be documented.

3.06 SYSTEM DOCUMENTATION

A. Complete documentation shall be provided for the system. The documentation shall describe:

1. All operational parameters of the system.

2. Complete documentation of programming and access policies.

3. All data sets.

4. Complete operating instructions for all hardware and software.

B. The following sections shall be provided in the system documentation:

1. User Manual: A step-by-step guide and instructions detailing all system user functions.

2. Technical Maintenance Manual: A comprehensive document providing all maintenance actions, system testing schedules, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.

3.07 SYSTEM TRAINING

A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.

B. Provide two weeks advanced notice of training to the Owner.

C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.

D. At a minimum, the following training shall be conducted:

1. Alarm Monitoring Users: Provide a detailed course outlining the operational features of all aspects of the user interface. Topics shall include alarm monitoring functions, reports, error handling, alarm handling, output relay control and general overview of the report hardware.

E. Minimum on-site training times shall be:

1. Alarm Monitoring Users: One day.

END OF SECTION

SECTION 28 31 11

FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Provide a complete and operable system in accordance with the letter and intent of this specification section and with applicable Codes and Regulations as interpreted by the Authorities having jurisdiction. This Section is a performance specification and the detailed system design shall be done by the system manufacturer. The system shall comprise all necessary component parts to provide the functions and facilities described and to obtain the approvals requested. The system layout indicated on the drawings is only tentative and the types and quantities of system devices and raceways are minimums which shall be revised and augmented as required by the system to be provided.

B. The entire system shall conform to applicable Codes. Equipment shall be U.L. listed, Factory Mutual listed and approved, approved, currently listed by the California State Fire Marshal, and shall conform to:

1. California Code of Regulations,

   a. Title 8 Industrial Relations
   b. Title 19 Public Safety
   c. Title 24 Building Standards Code
   d. California Electrical Code (CEC)
   e. California Fire Code (CFC)
   f. California Building Code (CBC).

2. Americans with Disabilities Act (ADA)

3. NFPA 72-2022 National Fire Alarm and Signaling Code

4. Requirements of the local Fire Department.

1.02 ACCEPTABLE MANUFACTURERS

A. New fire alarm systems shall be furnished by the following manufacture only, no substitutions are allowed.

1. Gamewell – FCI

1.03 QUALIFICATIONS OF SYSTEM SUPPLIER

A. Submit qualification of system supplier for approval based on the following minimum criteria:

1. Successful experience in comparable installations which have been in operation for a period of not less than five years. Furnish a list of jobs and locations, with contact name and phone number, which fall in this category upon request.

2. Ability to provide emergency restoration service within 12 hours by factory certified personnel.

3. Installing contractor must have an office within San Diego County. That office must include 7/24 service department and must maintain spare inventory of all equipment used on this project.

1.04 DEFINITIONS

A. Alarm Initiating Device Types: Manual stations, smoke detectors, heat detectors and sprinkler monitor modules.

B. Alarm Signal: Signals from an alarm initiating device that signifies a state of emergency requiring building evacuation.

C. Supervisory Signal: Indicates need for action regarding fire suppression or other protective system.

D. Trouble Signal: Indicates that a fault, such as an open circuit or ground, has occurred in the system.

E. Alarm indicating device: Speaker or visual alarm device (strobe).

1.05 SUBMITTALS

A. Data sheets and shop drawings:

1. Submittals shall include State Fire Marshal Listing Sheets, including listing number with annual update and expiration date, for all system components. Submit installation shop drawings including scaled floor plans, complete point-to-point wiring schematics, list of all equipment with manufacturer's data sheets, the locations of each piece and device, battery and voltage drop calculations, and proposed conduit layout diagram, if conduit is required.

2. Data sheets are required for all system components, including but not limited to: control panels, batteries, battery chargers, signal initiating devices, audible alarms, visual alarms, annunciators, transponders, terminals, cabinets, wiring, and relays.

3. Fire Marshal approval of submittals is for permission to proceed and does not authorize design, products or installation not conforming to referenced codes and standards and this specification.

4. Fire Alarm system central equipment. All cabinets shall be surface mounted on the wall approximately where indicated on drawings. Submit a proposed wall elevation of the cabinet layouts, sketched to scale, with the shop drawing package. Owner's representative will review the shop drawings and provide the Contractor a drawing which will exactly locate the cabinets.

B. Operation and Maintenance Manuals: Manuals shall include all instructions necessary for proper operation and maintenance of the system, complete circuit diagrams, wiring and termination schedule for each circuit entering and/or leaving each piece of equipment and schematic diagrams of each major component, including a replacement parts list with part numbers, name, and telephone number of local supplier. Include all portions of the material list and shop drawings which are not included in the foregoing.

C. Certification: Furnish written certification from the fire alarm system manufacturer that the system is in compliance with all applicable Code requirements.

D. Training Agenda.

E. Testing Documentation.

F. Sequence of Operation: A description of the operation of the system with appropriate operator responses.

G. Record Drawings: Documents shall include installation wiring, schematics, operation and maintenance manuals, complete replacement parts list. Drawings shall be reproducible type and shall be complete to facilitate trouble shooting and repair of the system.

H. Spare Parts List: A list of recommended spare parts.

1.06 SYSTEM DESCRIPTION

A. The system shall be a complete, electrically supervised proprietary style fire detection and evacuation system with microprocessor based local operating system having the following capabilities, features and capacities:

1. Communication between the local panel and the central monitoring station.

2. The local system shall provide status indicators the following functions:

a. Audible and visual evacuation alarm circuit zone control.

1.07 SYSTEM ZONING

A. The basic system shall be addressable.

1.08 SYSTEM OPERATION

A. Activation of any fire alarm initiating device shall cause the following actions and indications at the local control panel:

1. An alarm received shall sound and Temporal Code 3 evacuation alarm throughout the facility, and;

a. Display the initiating device.

b. Perform all control functions as detailed elsewhere in this specification.

B. Receipt of any trouble report, shall cause the following actions and indications:

1. Display at the local fire alarm control panel LED display, the origin of the trouble condition report.

2. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.

a. Audible signals shall be able to be silenced from the fire alarm control panel by a trouble acknowledge switch.

3. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.

C. Automatic Lockdown or Evacuation Voice Announcements:

1. Provide 10 second continuous tone, followed by repeating prerecorded message, announcing either facility lockdown or evacuation as determined by activation of appropriate manual pull station in Administration area.

2. Voice messages shall be submitted to and approved by the District.

D. Manual Lockdown or Evacuation Voice Announcements:

1. The control panel operator shall be able to make announcements via the push-to-talk announcement microphone over preselected speaker zones.

2. Facility for total building announcement shall be accomplished by means of an “All Call” switch.

3. A second backup microphone shall be located at the Administration office unless shown otherwise on drawings.

1.09 TRAINING

A. Submit a proposed training agenda for review. The final, approved training agenda shall be submitted 14 days prior to the final system acceptance test.

B. Train three operators with personal, on job instruction provided by competent personnel representing the manufacturer.

1. Provide each operator with complete, printed operating instructions in manual or handbook form.

2. Provide two distinct training sessions, with minimum training time of four hours each. Sessions shall be scheduled to suit the District. The first session shall be scheduled about the time of the final acceptance test and the second sometime during the firstsix months of operations. District will provide the conference room.

C. Training shall include all system operational functions needed. This shall include, but will not be limited to:

1. Alarm acknowledgment.

2. Interpretation of the scheme used to provide identifiers.

3. System operation.

4. System reset.

5. Basic troubleshooting.

6. Demonstrate that the system address assigned to each smoke detector corresponds correctly to device’s field location.

1.10 SPECIAL TOOLS

A. The Contractor shall supply as a part of the contract, three complete sets of any special tools or keys necessary for normal operation and maintenance of the system.

PART 2 - PRODUCTS

2.01 FIRE ALARM SYSTEM DESCRIPTION

A. Intelligent reporting, networked, fully peer-to-peer, microprocessor-controlled fire detection and emergency voice alarm communication system.

B. Each Signal Line Circuit (SLC) and Appliance Notification Circuit (NAC): Limited to 75 percent of its total capacity during initial installation.

C. Basic Performance:

1. Network Communications Circuit Serving Network Nodes: Wired using single twisted non-shielded 2-conductor cable or connected using approved fiber optic cable between nodes in a modified Class B configuration with #16 AWG minimum conductors.
2. Signal Line Circuits Serving Addressable Devices: Wired Class B with #16 AWG minimum conductors.
3. Initiating Device Circuit Serving Non-addressable Devices Connected to Addressable Monitor Modules: Wired Class B with the EOL resistor at the last device. Conductors shall be #16 AWG minimum.
4. Appliance Notification Circuits Serving Strobes and Speakers: Wired Class B with the EOL resistor at the last device. Conductors shall be #14 AWG minimum for Strobes and #18 AWG minimum for Speakers.
5. Alarm Signals Arriving at FACP: Not be lost following primary power failure until alarm signal is processed and recorded.
6. Network Communications, Audio Evacuation Channels and Fire Phone Communications:

    a. Communicated between panels and transponders on single pair of copper wires or fiber optic cables.

7. Signaling Line Circuits:

    a. Reside in remote transponders with associated audio zones.
    b. Signal Line Circuit modules shall operate in peer-to-peer fashion with all other panels and transponders in system.
    c. On loss of FACP, each transponder shall continue to communicate with remainder of system, including all Signal Line Circuit functions and audio messages located in all transponders.
    d. Systems that provide a “Degraded” mode of operation upon loss of FACP shall not be acceptable.

8. Audio Amplifiers and Tone-Generating Equipment: Electrically supervised for normal and abnormal conditions.
9. Amplifiers: Located in transponder cabinets or in main panel.

10. Speaker Notification Circuits: Arranged such that there is a minimum of 1 speaker circuit per fire alarm zone.
11. Appliance Notification, Speaker Circuits, and Control Equipment: Arranged such that loss of any 1 speaker circuit will not cause loss of any other speaker circuit in system.

12. Speaker Circuits.

    a. Electrically supervised for open and short circuit conditions.
    b. If short circuit exists on speaker circuit, it shall not be possible to activate that circuit.
    c. Arranged for 25 V RMS and shall be power limited in accordance with CEC.
    d. Provide 25 percent spare capacity for future expansion or increased power output requirements.

13. Speaker Circuits and Control Equipment:

    a. Arranged such that loss of any 1 speaker circuit will not cause loss of any other speaker circuit in system.
    b. Systems utilizing “bulk” audio configurations shall not be acceptable.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

F. All components shall be listed by the California State Fire Marshal (CSFM).

2.02 FIRE ALARM SYSTEM OPERATIONAL DESCRIPTION

A. When fire alarm condition is detected and reported by one of the system alarm initiating devices, the following functions shall immediately occur:

1. System Alarm LEDs: Flash.
2. Local Piezoelectric Signal in Control Panel: Sound at a pulse rate.
3. 80-Character LCD Display: Indicated all information associated with fire alarm condition, including type of alarm point and its location within protected premises.
4. Historical Log: Record information associated with fire alarm control panel condition, along with time and date of occurrence.
5. System output programs assigned via control-by-event equations to be activated by particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
6. Audio Portion of System: Sound tone (California Temporal Pattern) until system is reset.

2.03 FIRE ALARM CONTROL PANEL (FACP)

A. Supply user interface, including touch-screen 1/4 VGA display, Intelligent Loop Interface Modules, manual switching, phone, and microphone inputs to the network. INCC shall consist of the following units and components:

1. Power Supply Module with batteries.
2. Intelligent Voice Command Center.
3. 80-Character LCD Display.
4. Intelligent Loop Main Board Interface.
5. Intelligent Loop Supplemental Interface.
6. Ethernet card for network.
7. RS-485 Repeater.
8. Auxiliary Switch Module.

B. System Cabinet:

1. Surface or semi-flush mounted with texture finish. System Cabinet (B-, C-, or D-Size Cabinet) with associated inner door.
2. Available in at least 3 sizes to best fit project configuration.
3. Houses one or more Power Supply Modules, Voice Evacuation system, device zone loops, signal line circuits and other optional modules as specified.
4. Construction: Dead-front steel construction with inner door to conceal internal circuitry and wiring.
5. Wiring Gutter Space: A minimum of 1-inch wiring gutter space behind mounting plate.
6. Wiring: Terminated on removable terminal blocks to allow field servicing of modules without disrupting system wiring.

C. Power Supply Module**:** Use latest technologies to provide power to the FACP and incorporate the following features:

1. Power-saving switching technology using no step-down transformers.
2. 9-amp continuous-rated output to supply up to all power necessary under normal and emergency conditions.
3. Integral battery charger with capacity to charge up to 55 amp-hour batteries while under full load.

D. Batteries:

1. Sufficient capacity to provide power for entire system upon loss of normal AC power for a period of 24 hours with 15 minutes of alarm signaling at end of this 24-hour period, as required by NFPA 72, Local Systems.

E. Loop Interface modules:

1. Alarm Verification: Smoke detector alarm verification shall be standard option while allowing other devices such as manual stations and sprinkler flow to create immediate alarm. This feature shall be selectable for smoke sensors that are installed in environments prone to nuisance or unwanted alarms.

2. Alarm Signals: All alarm signals shall be automatically latched or "locked in" at control panel until operated device is returned to normal and control panel is manually reset. When used for sprinkler flow, "SIGNAL SILENCE" switch may be bypassed, if required by Authority Having Jurisdiction.

3. Electrically Supervised:

   a. Each SLC and NAC circuit shall be electrically supervised for opens, shorts, and ground faults. Occurrence of fault shall activate system trouble circuitry, but shall not interfere with proper operation of other circuits.

4. Analog Smoke Sensor Test: system software shall automatically test each analog smoke sensor a minimum of 3 times daily. Test shall be recognized functional test of each photocell (analog photoelectric sensors) and ionization chamber (analog ionization sensors) as required annually by NFPA 72. Failure of sensor shall activate system trouble circuitry, display "Test Failed" indication, and identify individual device that failed.

5. Signaling Line Circuits: Each module shall provide communication with analog/addressable (initiation/control) devices via 2 signaling line circuits. Each signaling line circuit shall be capable of being wired Class A or Class B. Circuits shall be capable of operating in NFPA Class A configuration when equipped with isolator modules between each module type device and isolator sensor bases. Each circuit shall communicate with a maximum of 99 analog sensors and 98 addressable monitor/control devices. Unique 40-character identifier shall be available for each device. Devices shall be of the Velocity series with capability to poll 10 devices at a time with a maximum polling time of 2 seconds when both SLCs are fully loaded.

6. Notification Appliance Circuits: 2 independent NAC circuits shall be provided, polarized and rated at 2 amperes DC per circuit, individually over current protected and supervised for opens, grounds and short circuits. They shall be capable of being wired Class B or Class A.

7. Alarm Dry Contacts: Provide alarm dry contacts (Form C) rated 2 amps at 30 VDC (resistive) and transfer whenever system supervisory condition occurs.

8. Trouble Dry Contacts: Provide trouble dry contacts (Form C) rated 2 amps at 30 VDC (resistive) and transfer whenever system trouble occurs.

2.04 MANUAL PULL STATIONS

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Manual Fire Alarm Stations: Non-code, non-break glass type, equipped with key lock so they may be tested without operating handle.
2. Operated Station: Visually apparent, as operated, at a minimum distance of 100 feet from front or side.
3. Stations shall be designed so after actual activation, they cannot be restored to normal except by key reset.
4. Manual stations shall be construction of Lexan with clearly visible operating instructions provided on cover. The word FIRE shall appear on front of stations in raised letter, 1.75 inches or larger.
5. Addressable manual stations shall, on command from control panel, send data to panel representing state of manual switch and addressable communication module status.
6. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

2.05 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

B. Photoelectric Smoke Detectors

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

2.06 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 degree F or a rate of rise that exceeds 15 degree F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.07 NOTIFICATION APPLIANCES

A. Speaker

1. Compliance: UL 1480
2. Speaker in Corridors and Public Spaces: Produce nominal sound output of 84 dBA at 10 feet, at one watt tap setting.
3. Frequency Response: Minimum of 400 Hz to 4,000 Hz.
4. Back of Each Speaker: Sealed to protect speaker cone from damage and dust.
5. Audibility: NFPA 72.

B. Strobes

1. Compliance: ADA, CBC, and UL 1971.
2. Maximum Pulse Duration: 0.2 second.
3. Strobe Intensity: UL 1971.
4. Flash Rate: UL 1971.
5. Strobe Candela Rating: Determine by positioning selector switch on back of device.

C. Speaker/Strobes:

1. Compliance: – UL 1480.
2. Speaker in Corridors and Public Spaces: Produce nominal sound output of 84 dBA at 10 feet at one watt tap setting.
3. Frequency Response: Minimum of 400 Hz to 4,000 Hz.
4. Back of Each Speaker: Sealed to protect speaker cone from damage and dust.
5. Audibility: NFPA 72.
6. Maximum Pulse Duration: 0.2 second.
7. Strobe Intensity: UL 1971.
8. Flash Rate: UL 1971.
9. Strobe Candela Rating: Determine by positioning selector switch on back of device.

2.08 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.09 ADDRESSABLE INTERFACE DEVICE

A. Addressable Dry Contact Monitor Modules

1. Provide to connect 1 supervised IDC zone of conventional alarm initiating devices (any N>O> dry contact device) to 1 of the fire alarm control panel SLCs.
2. Mount in standard deep electrical box.
3. IDC Zone: Suitable for Style B operation.

B. Addressable Control Module:

1. Provide to supervise and control operation of 1 conventional NAC of compatible, 24-VDC powered, polarized audio/visual notification appliances or UL-listed polarized relays for fan shutdown and other auxiliary control functions.
2. Mount in standard 4-inch square, 2-1/8-inch deep electrical box or to surface-mounted back box.
3. Control Module NAC: Wire for Style Z or Style Y (Class B/B) with up to 1 amp of inductive signal or 2 amps of resistive signal operation. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires.
4. Audio/Visual Power: Provide by separate supervised power circuit from main fire alarm control panel or from supervised, UL-listed remote power supply.

C. Addressable Relay Module:

1. Available for HVAC control and other building functions. Relay shall have 2 Form C sets of contacts that operate in tandem and are rated for a minimum of 2.0 amps resistive or 1.0 amps inductive. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires.
2. Mount in standard 4-inch square, 2-1/8-inch deep electrical box or to surface-mounted back box.

2.010 SPARE PARTS CABINET

A. NEMA 1 cabinet with hinged lockable door and painted to match FACP, sized to accommodate the Maintenance Materials specified herein. Provide an engraved nameplate to read “FIRE ALARM SYSTEM SPARE PARTS CABINET”.

2.011 NOTIFICATION DEVICES

A. Evacuation Signaling Devices shall be furnished and installed as shown on the drawings, including the following features and capabilities:

1. Visual signals shall be installed in accordance with the requirements of U.L.1971 standard and NFPA 72. Where multiple visual signals are visible from any location, circuitry shall be incorporated for synchronization of the flash rate.

2. UL 1971 Listed for Emergency Devices for the Hearing Impaired in all public mode installations.

   a. Strobes shall meet UL 1971 and produce a flash rate of one (1) flash per second minimum over the listed input voltage of 24 VDC.

3. All visual signals shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens or equivalent with solid state circuitry.

4. The strobe intensity shall be rated per UL 1971 for 15, 75 or 110 Candela.

5. The strobes shall be available for semi-flush or surface mounting and in conjunction with audible signals as required.

6. For outdoor application in the private mode, the strobe shall be UL 1638 Listed and be rated for a temperature range of minus 32°F to 120°F.

B. Audible evacuation signals shall be furnished and installed as shown on the drawings meeting the following requirements:

1. Notification appliance shall be electronic and use solid state components.

2. Each electronic signal shall provide eight (8) field selectable alarm tones. The tones shall consist of: tone, horn, march-time horn, code-3 horn, code-3 tone, slow whoop, siren, and hi/lo. Tone selection shall be by durable dip switch assembly and not clips or jumpers.

3. The device shall have provisions for standard reverse polarity type supervision and in/out field wiring using terminals that accept #12 to #18 AWG wiring.

2.012 OFF SITE DIGITAL ALARM COMMUNICATIONS

A. The control panel shall contain integral facilities for off-site digital reporting via site telephone lines. Upon sensing an alarm condition within the panel, the communicator shall capture an operational telephone circuit and automatically dial the Central Receiving Station. Upon making contact with either the primary or secondary Central Receiving Station numbers using either the primary or secondary outgoing lines, the communicator shall establish its system identity and report the alarm condition. The communicator shall include the following features and capabilities:

B. Integral fire alarm control panel mounting and listing under U.L. standard 864 with the control panel. All operating power shall be derived from the control panel primary and secondary power sources.

C. Operating data base firmware stored in non-volatile memory and permanently installed on the system mother board. Entry into the programming mode shall be password protected to prevent unauthorized modification. The system shall be programmable by use of the software and passcode, on site or remotely using the data reporting telephone line connections.

1. Changes in central station telephone numbers shall be programmable without the requirement for a site visit, from the central station.

2. The communicator shall be capable of reporting up to four conditions present within the control panel, as follows:

a. Fire Alarm Condition.
b. System Trouble Condition.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Installation shall be in accordance with the CEC, NFPA 72, CFC, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of the building.
2. Connect new equipment to existing monitoring equipment at the supervising station.
3. Expand, modify, and supplement existing monitoring equipment as necessary to extend existing monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

D. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.

3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

E. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
4. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

F. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

G. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

H. Signaling line circuit wiring installed in underground conduits shall be a shielded twisted pair cable of water-blocked construction sized as per Fire Alarm manufacturer's requirements. West Penn Aquaseal or equal.

3.02 PATHWAYS

A. Pathways shall be installed in EMT, minimum 1-inch conduit size.

B. Exposed EMT shall be painted red enamel.

3.03 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 08 71 00 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated HVAC duct systems.
2. Magnetically held-open doors.
3. Electronically locked doors and access gates.
4. Alarm-initiating connection to elevator recall system and components.
5. Supervisory connections at valve supervisory switches.
6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
7. Supervisory connections at elevator shunt-trip breaker.
8. Data communication circuits for connection to building management system.
9. Data communication circuits for connection to mass notification system.
10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
11. Supervisory connections at fire-pump engine control panel.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.05 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

C. All grounding shall be in accordance with CEC Art. 250.

3.06 TEST

A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

3.07 FINAL INSPECTION/INSTRUCTION

A. At the final inspection a factory trained representative of the manufacturer shall demonstrate that the systems function properly in every respect.

B. Provide instruction as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

C. Provide the NFPA Certificate to the owner, local fire official, architect, and DSA.

END OF SECTION

MOUNT MIGUEL HIGH SCHOOL
BUILDING 300S MODERNIZATION

FIRE ALARM CUTSHEETS

23009014.00

Submitted By IMEG Engineers

901 Via Piemonte, Suite 400, Ontario, CA 91764
›909.477.6915 ›Fax: 909.477.6916 ›imegcorp.com
D B A TTG ENGINEERS

E3 SERIES® CABINETS

Cabinets used for the E3 Series System

The E3 Series® Cabinets offer a variety of cabinet options to house either the E3 Series or S3 Series fire alarm control panel systems.



E3 Series® Cabinets

GENERAL

The E3 Series® Expandable Emergency Evacuation System by Gamewell-FCI offers several cabinet size options. The E3 Series System is a modular design that allows a wide range of configurations to form an integrated, distributed fire alarm system. These cabinet options allow for sturdy and modern installations. The E3 Series cabinet assembly is a compact, wall-mounted enclosure. A typical cabinet includes a backbox and an outer locking door. In addition, there are several inner door options and mounting plates to accommodate a variety of E3 Series sub-assemblies.

Each cabinet backbox includes mounting patterns for plates to allow the installer to arrange and secure the sub-assemblies to the backbox. The backbox knockouts are also positioned at numerous points to allow a conduit access into the enclosure.

There are four Annunciator cabinet sizes which provide the maximum flexibility that can meet any application:

- Cabinet AA offers 2 slot or 3 slot options to accommodate any of the following configurations:
  - Inner door, 2 slots allows space for one LCD-E3 or LCD-SLP and one ASM-16
  - Inner door, 3 slots allows space for any combination of three modules: ASM-16, NGA or an ANU-48
- Cabinet A1 houses one NGA or one ASM-16/ANU-48.
- Cabinet A2 accommodates a single LCD-E3.
- E3BB-FLUSH-LCD or E3BB-NGA-FLUSH.

The E3BB-R-B-Slim or B-Slim contains the 600 Series cabinet. Cabinet B includes a mounting plate that contains a space for the following modules:

- ILI-MB-E3/ILI95-MB-E3
- PM-9/PM-9G sub-assemblies
- Batteries set inside the backbox

Additional sub-assembly options mounted on the backbox include the DACT-E3 and RPT-E3. The 2 slot inner door houses the following options:

- one LCD-E3 module and
- either one ASM-16/ANU-48 or one NGA module

FEATURES AND BENEFITS

- IBC Seismic Certified
- 16-gauge steel backbox
- Offers cabinets available in either black or red
- Provides removable cabinet outer and inner doors
- Includes an inner door bonding strap used to provide electrical continuity for grounding
- Designed with Lexan® windows that appear on the outer doors of most cabinets, except the following cabinets that contain louvered doors:
  - Cabinet “C” INX
  - Cabinet “D” INX
  - Cabinet INX CAB-B
- Furnished backbox and door ground studs provide positive grounding. 180° opening door with full clearance
- Designed with a 90° opening door with zero clearance
- Contains a keylock with a quarter turn latch
- Optional Trim Ring accessories available

Honeywell

Gamewell FCI

GENERAL

Both the C and D size Command Center cabinets house a variety of E3 Series Broadband sub-assemblies that can be used in multiple configurations that provide a solution to a wide range of applications. Two flexible inner door panel selections are available for C and D size Command Center cabinets that may contain any of the following:

- fire fighter's phone handset
- microphone
- optional modules to meet the facility operation requirements.

Refer to the Inner Door and Backbox Mounting Capacities in the Ordering Information Section.

ORDERING INFORMATION

Inner Door Mounting Capacity:

Cabinet "AA" Size:

Dimensions: 19 1/4"W x 10"H x 4 1/2"D, (49W x 25H x 11.4D cm)
E3BB-BAA: Enclosure, Black, "AA" (LOC) Size
E3BB-RAA: Enclosure, Red, "AA" (LOC) Size
E31D2-TA: Inner Door, 2 Slots, (INCC-TEL & ASM-16)
E3ID2-A: Inner Door, 2 Slots, (LCD-E3 or LCD-SLP & ASM-16)
E3ID3-A: Inner Door, 3 Slots,(NGA, ASM-16 and MIC)

Cabinet "AA1" Size:

Dimensions: 8 3/4"W x 10"H x 4 1/2"D, (22W x 25H x 11.4D cm)
E3BB-BAA1: Remote Enclosure, Black, w/Inner Door, 1 slot, (NGA)
E3BB-RAA1: Remote Enclosure, Red, w/Inner Door, 1 Slot, (NGA)

Cabinet "A2" Size:

Dimensions: 13 1/4"W x 10"H x 4 1/2"D, (40W x 25H x 11.4D cm)
E3BB-BA2: Remote Enclosure, Black, w/Inner Door, 1 Slot, (LCD-E3 or LCD-SLP)
E3BB-RA2: Remote Enclosure, Red, w/Inner Door, 1 Slot, (LCD-E3 or LCD-SLP)

Flush Cabinet A2 Annunciators:

Dimensions: 13 1/4"W x 10"H x 4 1/2"D, (40W x 25H x 11.4D cm)
E3BB-FLUSH-LCD: CAB A2 Remote Flush LCD ANN with Key switch operation
E3BB-NGA-FLUSH: CAB A2 Remote Flush NGA ANN with Password protected

Cabinet "B-Slim" Size: (Retrofit Kits):

Dimensions: 14"W x 20"H x 4 1/2"D, (35.5W x 50.8H x 11D cm)
E3BB-RBSLIM: Assembly, Enclosure, B-SLIM, Red with Backplate and LCD-E3 Keyswitch plate.
IF600-RETROFIT: Door and Cab mounting plates, disable key switch and door lock (PK-625) for E3 Series upgrade.

ORDERING INFORMATION (CONTINUED)

Cabinet "B" Size:

Dimensions: 19 3/8"W x 19 3/8"H x 4 1/2"D, (49W x 49H x 11D cm)
E3BB-BB: Assembly, Backbox Enclosure, Black,"B" Size
E3BB-RB: Assembly, Backbox Enclosure, Red, "B" Size
E3ID2-B: Inner Door, 2 Slots, "B" Size
1100-0460: INX-Transponder 19" (cm) Backbox with Door, Black
Dimensions: 19 3/8"Wx19 3/8"Hx4 1/2"D, (49Wx49Hx11.43 D cm)

Cabinet "C" Size:

Dimensions: 19 3/8"W x 30"H x 4 1/2"D, (49W x 76H x 11D cm)
E3BB-BC/INCC: Enclosure, Command Ctr, Black, "C" Size
E3BB-RC/INCC: Enclosure, Command Ctr, Red, "C" Size
E3ID2-C: Assembly, Inner Door, Command Center, 2- Bay "C" Size
E3ID3-C: Assembly, Inner Door, Command Center, 3-Bay "C" Size
E3BB-BC/INX: Assembly, Transponder, Black, "C" Size
E3BB-RC/INX: Assembly, Transponder, Red, "C" Size
E3-INCC-CPLATE: Command Center module mounting plate, "C" Size
E3-INX-CPLATE: Transponder mounting plate, "C" Size

Inner Door Mounting Capacity:

E3-ILI-CPLATE: Intelligent loop module mounting plate "C" Size

Cabinet "D" Size:

Dimensions: 19 3/8"W x 41"H x 4 1/2"D, (49W x 104H x 11D cm)
E3BB-BD/INCC: Enclosure, Command Center, Black, "D" Size
E3BB-RD/INCC: Enclosure, Command Center, Red, "D" Size
E3ID2-D: Assembly, Inner Door, 2-Bay, "D" Size
E3ID3-D: Assembly, Inner Door, 3-Bay, "D" Size
E3BB-BD/INX: Enclosure, Transponder, Black "D" Size
E3BB-RD/INX: Enclosure, Transponder, Red, "D" Size
E3-INCC-D-PLATE: CommandCentermodulemountingplateD-Size
E3-INX-D-PLATE: Transponder module mounting plate, "D" Size

Optional Extender Plates:

AM-50 Plate: AM-50 Extender Plate
FPT-GATE-3-EXT: FPT-GATE-3 Extender Plate

Optional Accessories:

1100-0450: Command Center, blank plate, single size
E3-BP: Inner door panel, blank, double size
90375: PM-9/PM-9G Adapter Plate Kit, Hardware
E3-TRIMKIT-A: Trim kit for "A"/"AA" size enclosure, black
E3-TRIMKIT-A1: Trim kit for "AA1" size enclosure, black
E3-TRIMKIT-A2: Trim kit for "A2" size enclosure, black
E3-TRIMKIT-B: Trim kit for "B" size enclosure, black
E3-TRIMKIT-C: Trim kit for "C" size enclosure, black
E3-TRIMKIT-D: Trim kit for "D" size enclosure, black

ORDERING INFORMATION (CONTINUED)

Bulk Amplification:

AA-100: 100 W Audio Amplifier, @70.7 V_{RMS} with 120 VAC

AA-120: 120 W Audio Amplifier, @25 V_{RMS} with 120 VAC

ACT-1: Audio coupling transformer, for audio systems w/multiple supplies.

FCI-CHG-120: Battery Charger, 25-120 A/H Gel cell

FCI-LBB: Battery box, accommodates batteries up to 55 A/H, (Black).

Cabinet C:

FCI-DR-C4B: Large Battery Backbox, Blank door, lock & keys, for backbox accepting 3 chassis, (Black).

FCI-DR-C4BR: Blank door, lock & keys, for backbox accepting 3 chassis, (Red).

SBB-C4: Backbox, 3 chassis, (Black)

Cabinet D:

FCI-DR-D4B: Blank door, lock & keys, for backbox accepting 4 chassis, (Black)

FCI-DR-D4BR: Blank door, lock & keys, for backbox accepting 4 chassis, (Red)

SBB-D4: Backbox, 4 chassis, (Black)

90516: 7100-Slim 7 A/H Seismic Battery Bracket Kit

Seismic Battery Bracket Kits:

E3 B-Slim 7 A/H Seismic Battery Bracket Kit

90517: 7100-Slim 12 A/H Seismic Battery Bracket Kit
E3 B-Slim 12 A/H Seismic Battery Bracket Kit

90518: E3 CAB-B 7 A/H Seismic Battery Bracket Kit
E3 CAB-C 7 A/H Seismic Battery Bracket Kit
E3 CAB-D 7 A/H Seismic Battery Bracket Kit
NetSOLO NS-INX 7 A/H Seismic Battery Bracket Kit
NetSOLO 7100 7 A/H Seismic Battery Bracket Kit

90519: E3 CAB-C (INX only) 12 A/H Seismic Battery Bracket Kit
E3 CAB-D (INX only) 12 A/H Seismic Battery Bracket Kit
NetSOLO NS-INX 12 A/H Seismic Battery Bracket Kit

90520: E3 CAB-B 18 A/H Seismic Battery Bracket Kit
E3 CAB-C 18 A/H Seismic Battery Bracket Kit
E3 CAB-D 18 A/H Seismic Battery Bracket Kit

Retrofit Kits:

For information on the Gamewell and 7200 Retrofit Kits, refer to the following Data Sheets.

9021-60678: Gamewell Retrofit Kits Data Sheet

9021-60733: 7200 Retrofit Kits Data Sheet

Inner Door Mounting Capacity

Part Number	Number of Components
Cabinet AA	
E3ID2-A - (Cabinet AA, Inner Door, 2 Slots)	
LCD-E3 Display and	**ONE**
ASM-16/ANU-48	**ONE**
E3ID2-TA - (Assembly, Door, Inner, TEL-E3)	
E3ID3-A - (Cabinet A, Inner Door, 3 Slots)	
NGA or ASM-16	**ONE**
ASM-16s/ANU-48	**TWO**
Cabinet AA1	
E3ID-A1 - (Cabinet AA1, Inner Door (includes Box)	
NGA or ASM-16	**ONE**
Cabinet A2	
E3ID-A2 - (Cabinet A2, Inner Door, (includes Box)	
LCD-E3	**ONE**
Cabinet B	
E3ID2-B - (Cabinet B, Inner Door, (includes Box)	
LCD-E3 Display and one ASM-16/ANU-48	**ONE**
NGA and one ASM-16/ANU-48	**ONE**
B-Slim Cabinet	
LCD-E3 Display & one RPT-E3 or one DACT-E3	**ONE**
ILI-MB-E3 or one ILI95-MB-E3	**ONE**
PM-9 or one PM-9G	**ONE**
Cabinet C	
E3ID2-C - (Cabinet C, Inner Door, 2 Slots)	
LCD-E3 Display and	**ONE**
Any combination of ASM-16/ANU-48, NGA or Microphone Assemblies	**FIVE**
Telephone Assembly	**ONE**
E3ID3-C - (Cabinet C, Inner Door, 3 Slots)	
Any Combination of ASM-16/ANU-48, NGA, or Microphone Assemblies	**SEVEN**
Telephone Assembly	**ONE**
Cabinet D	
E3ID2-D - (Cabinet D, Inner Door, 2 Slots)	
LCD-E3 Display	**ONE**
Any Combination of ASM-16/ANU-48, or NGA or Microphone and	**ELEVEN**
Telephone Assembly	**ONE**
E3ID3-D - (Cabinet D, Inner Door, 3 Slots)	
Any Combination of ASM-16/ANU-48, NGA or Microphone Assemblies	**THIRTEEN**
Telephone Assembly	**ONE**
Backbox Mounting Capacity	
E3BB-BAA - (Enclosure, "AA' (LOC) Size, Black)	
INI-VG Series Voice Gateway	**ONE**
E3BB-BAA1 - (AA1 Size Box/Door, Black)	
RPT-E3 Network Repeater E3BB-BB B-Size Box/Door, Black	**ONE**
PM-9/PM-9G Power Supply	**ONE**
ILI-MB-E3/ILI95-MB-E3 and	**ONE**
Additional ILI-MB-E3/ILI95-MB-E3	**ONE**
Loop Interface or ANX or	**ONE**
DACT-E3 Digital Communicator and	**ONE**
RPT-E3 Network Repeater	**ONE**
INX CAB-B Mounting Plate	
PM-9 or PM-9G	**ONE**
INI-VGX	**ONE**
AM-50 Series amplifiers	**FOUR**

Backbox Mounting Capacity (Continued)

Part Number	Number of Components
E3-INCC-C Plate	
PM-9/PM-9G Power Supply	**ONE**
INI-VG Series Voice Gateway	**ONE**
ILI-MB-E3/ILI95-MB-E3 Loop Interface and Additional ILI-MB-E3/ILI95-MB-E3/ANX Loop Interface or	**ONE**
DACT-E3 Digital Communicator and	**ONE**
RPT-E3 Network Repeater	**ONE**
Optional AM-50 or FPT-GATE-3 Extender Plate	**ONE**
E3-ILI-C Plate	
PM-9/PM-9G Power Supply	**ONE**
ILI-MB-E3 or ILI95-MB-E3	**ONE**
Additional ILI-MB-E3/ILI95-MB-E3 or ILI-S-E3/ILI95-S-E3 or ANX	**TWO**
DACT-E3	**ONE**
RPT-E3	**ONE**
Optional FPT-GATE-3 Extender Plate	**ONE**
E3-INX-C Plate	
PM-9/PM-9G Power Supply with one PM-9/PM-9G Adapter Plate	**ONE**
INI-VGX Voice Gateway	**ONE**
ILI-MB-E3 Loop Interface and	**ONE**
Additional ILI-MB-E3/LI95-MB-E3/ANX	**ONE**
DACT-E3 Digital Communicator and	**ONE**
RPT-E3 Network Repeater	**ONE**
AM-50 Series Amplifier	**FOUR**
Optional FPT-GATE-3 Extender Plate	**ONE**

Backbox Mounting Capacity (Continued)

Part Number	Number of Components
E3-INCC-D Plate	
PM-9/PM-9G Power Supply	**ONE**
ILI-MB-E3 or ILI95-MB-E3	**ONE**
Additional ILI-E3 or ILI95-E3 Series or ANX	**FOUR**
DACT-E3 Digital Communicator	**ONE**
RPT-E3 Network Repeater	**ONE**
INI-VG Series	**ONE**
Optional AM-50 or FPT-GATE-3 Extender Plate	**ONE**
E3-INX-D Plate	
PM-9/PM-9G Power Supply	**ONE**
ILI-MB-E3 or ILI95-MB-E3	**ONE**
DACT-E3 Digital Communicator	**ONE**
RPT-E3 Network Repeater	**ONE**
INI-VG Series	**ONE**
AM-50 Series Amplifier	**FOUR**
Optional FPT-GATE-3 Plate	**ONE**
E3BB-BD - (D Size Box/Command Center (Voice), Black)	
PM-9/PM-9G Power Supply	**ONE**
INI-VG Series Voice Gateway	**ONE**
ILI-MB-E3/ILI95-MB-E3/ANX Loop Interface	**FOUR**
Additional ILI-MB-E3/ILI95-MB-E3/ANX Loop Interface or	**ONE**
DACT-E3 Digital Communicator and	**ONE**
RPT-E3 Network Repeater	**ONE**
Optional FPT-GATE-3 Plate	**ONE**
E3BB-BD - (D Size Box/Command Center, Black)	
PM-9/PM-9G Power Supply	**ONE**
ILI-MB-E3/ILI95-MB-E3/ANX Loop Interface & Additional ILI-MB-E3/ILI95-MB-E3/ANX Loop Interface or	**SEVEN**
DACT-E3 Digital Communicator and	**ONE**
RPT-E3 Network Repeater	**ONE**
Optional Extender Plates	
AM-50 Extender Plate	
AM-50-25 or AM-50-70	**ONE**
FPT-GATE-3 Extender Plate	
FocalPoint® Gateway	**ONE**
PNET-1	**ONE**
Optional FPT-GATE-3 Extender Plate	**ONE**

E3 SERIES® CABINETS TECHNICAL SPECIFICATIONS

STANDARDS

The E3 Series fire alarm control panel cabinets are designed to comply with the following standards:

UL Standards: UL 864, 10th Edition:

- Automatic Fire Detector Alarm
- Manual Fire Alarm
- Waterflow Alarm
- Supervisory
- Releasing Device Service
- Releasing/Pre-Action Deluge
- Releasing/Agent Releasing
- Automatic Smoke Alarm, Non-coded and Master Coded Operation

Underwriters Laboratories Standard UL 2572, 2nd Edition (for Mass Notification Systems)

UUKL for Smoke Control

NFPA Standards

NFPA 13 - Standard for Installation of Sprinkler Systems

NFPA 16 - Standard for Foam-Water Sprinkler and Foam Water Spray Systems

NFPA 72 - National Fire Alarm Code:

- Central Station Fire Alarm Systems
- Auxiliary Fire Alarm Systems
- Proprietary Fire Alarm Systems
- Local Fire Alarm Systems
- Remote Station Fire Alarm Systems

NFPA 13 Sprinkler

NFPA 12A Halon 1301

NFPA 15 Water Spray

NFPA 16 Foam Water

NFPA 750 Water Mist

NFPA 2001 Clean Agent

NFPA 12 CO2 Carbon Dioxide

NFPA 17 Dry Chemical/17A Wet Chemical

Seismic Codes

International Building Codes:

- IBC 2013
- IBC 2009
- IBC 2006
- IBC 2003
- IBC 2000 (Seismic)

California Building Code CBC 2007 (Seismic)

STANDARDS (CONTINUED)

The E3 Series Cabinets are designed to comply with the following standard:

UL Standard: UL 864, 10th Edition
UL 2572, 2nd Edition
for Mass Notification

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

UL Listed: S1869
ULS 864, 10th Edition
UL 2572, 2nd Edition

MEA Approved: 6177

MEA FDNY: COA# 6077

CSFM: 7165-1703-0125

FM Approved: 3025415

City of Chicago

City of Denver

VMA Seismic Certified

ISO 9001 Certification

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Lexan® is a registered trademark of GE Plastics, a subsidiary of General Electric Company.

UL® is a registered trademark of Underwriters Laboratories.

This document is not intended to be used for installation purposes. We try to keep our product information up-to-date and accurate. We cannot cover all specific applications or anticipate all requirements. All specifications are subject to change without notice.

Country of origin: U.S.A.

Honeywell Gamewell-FCI
12 Clintonville Road
Northford, CT 06472-1610
203.484.7161
www.gamewell-fci.com

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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7165-1703:0125
CATEGORY:	7165 - FIRE ALARM CONTROL UNIT (COMMERCIAL)
LISTEE:	GAMEWELL-FCI 12 Clintonville Road, Northford, CT, 06472 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Model E3 Series® BROADBAND and E3 Series® CLASSIC Voice Evacuation System. The E3 Systems may also work in conjunction with all the sub-assemblies of listee's 7100 Series Control Panel and NetSOLO systems (CSFM Listing No. 7165-1703:0105 and 6911-1703:0116, and 6911-1703:0118). Unit conveys all fire alarm, audio evacuation, voice paging, and fire fighter communications. Power-limited; non-coded, automatic, manual, smoke control, water flow, sprinkler supervisory, local auxiliary, central station, remote station, and proprietary service. Refer to listee's data sheet for additional detailed product description and operational considerations. System components: ILI-MB-E3; Intelligent Loop Interface Master Board PM-9, PM-9G; Power Supply ILI-95-MB-E3, ILI-95-S-E3; Loop Interface Subassemblies E3BB-FLUSH-LCD; Enclosure for lCD-E3 E3BB-BA/-RA/-BAA/-RAA/-BB/-RB/-BC/-RC/-BD; Cabinets RPT-E3-FO; or Repeater Sub-assembly, Fiber Optic or RPT-E3-UTP; Repeater Sub-assembly, Unshielded twisted pair wire LCD-E3; LCD Keypad Display *LCD-SLP; LCD Touchscreen Display Screen DACT-E3 sub-assembly; Digital alarm communicator transmitter ILI-S-E3; Intelligent Loop Unit, Expansion Board ANX-SR, ANX-MR-FO, ANX-MR-UTR; Addressable Node Expanders Sub Assembly INCC-E; Intelligent Network Enclosure INCC; Intelligent Network Central Command

	INI-VG, INI-VGC-UTP, INI-VGC-FO, INI-VGX-UTP; Intelligent Network Interface Sub Assembly INI-VGX-FO, INI-VGE-UTP, INI-VGE-FO; Intelligent Network Interface Sub Assembly ASM-16; Annunciator Switch Sub Assembly INX; Network Audio Transponder Enclosure ANU-48; Annunciator Sub Assembly NGA; Touch Screen LCD Display Sub Assembly LCD-7100; Remote LCD Display SBB-C4, SBB-D4; Backbox FCI-VDR-D4B, FCI-DR-C4B, FCI-CR-D4B; Doors with locks AA-100, AA-120; Amplifiers AM-50-25, AM-50-70; Amplifier Sub Assembly CHG120; Battery Charger with Cabinet BC-1/FCI-LBB; Backbox IPDACT-2; IP Digital Alarm Communicator FPJ; Firefighters's Telephone Jack Receptacle FHS; Portable Firefighters's Telephone Handset 7100 Series#; Fire Alarm Control Panel or INI-7100 UTP#; Intelligent Network Interface Sub-assembly, [Twisted, unshielded wire] or INI-7100 FO#; Intelligent Network Interface
RATING:	120 V, 60 Hz, 3.5 A Primary; 24 V dc, 9A Secondary
INSTALLATION:	In accordance with listee's printed installation instructions, NFPA 72, applicable codes and ordinances, and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model designation, electrical rating, and UL label.

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

APPROVAL:	Listed as fire alarm control unit for use with separately listed electrically and functionally compatible initiating and indicating devices. Suitable for high-rise applications when used with the above voice evacuation systems. This control unit can generate a distinctive three-pulse Temporal Pattern Fire Alarm Evacuation Signal (for total evacuation) in accordance with NPFA 72. This control unit meets the requirements of UL Standard 864, 9th Edition.
NOTES:	For Fire Alarm Verification Feature (delay of alarm signaling), the Retard/Reset/Restart period shall be 30 seconds or less.

*Revision 09-18-20 VWW

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: 05/05/2023

Listing Expires: 06/30/2024

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

Honeywell | Analog and Networking Systems

LCD-SLP

LCD Touchscreen Annunciator Display

General

The Gamewell-FCI, Liquid Crystal Display, Smart Loop Panel (LCD-SLP) is a touchscreen annunciator display used with the S3 Series and E3 Series® Systems. The LCD-SLP provides an easy-to-use, intuitive interface for the operator's control. The 4.3" (10.92 cm) color touchscreen display shows the following:

- System Status
- Event Details
- Service Modes

The following identify the LED Indicators that display on the panel.

- AC (green)
- Fire Alarm (red)
- Hazard (blue)
- Supervisory (yellow)
- Trouble (yellow)
- Silenced (yellow)

The five fully-programmable front panel switch/LED combinations provide a direct access to perform the following tasks:

- Device Bypass
- Lamp Test
- Enable/Disable Groups or Devices

The display features the following physical switches.

- Menu
- System Reset
- Drift Walk Test
- Five Programmable Switches



LCD-SLP

Installation

The LCD-SLP panel's adaptable design allows it to be mounted in a variety of S3 Series, E3® Series or Retrofit cabinet installations. For additional information, refer to the E3 Series Cabinets Data Sheet, P/N:9020-0649.

- S3 Series Cabinets
  - SLP-BB basic system enclosure
  - S3BB-BB/S3BB-RB system enclosure
- E3 Series® Cabinets
  - AA size cabinet (E3BB-BAA, E3BB-RAA)
  - A2 size cabinet (E3BB-BA2, E3BB-RA2)
  - A size flush cabinet (E3BB-FLUSH-LCD)
  - B-Slim cabinet (E3BB-RBSLIM)
  - B size cabinet (E3BB-BB, E3BB-RB)
  - C size cabinet (E3BB-BC/INCC, E3BB-RC/INCC)
  - D size cabinet (E3BB-BD/INCC, E3BB-RD/INCC)
- Retrofit Cabinets
  - 600-RETROFIT
  - 7200-B-RETROFIT
  - 7200-C-RETROFIT

Ordering Information

LCD-SLP: LCD Touchscreen display unit

E3BB-BA2: Remote enclosure with inner door, black, one LCD slot

E3BB-RA2: Remote enclosure with inner door, red, one LCD slot

E3BB-FLUSH-LCD: Remote flush mounting enclosure, black, LCD slot

FEATURES & BENEFITS

- Listed per ANSI/UL® Standard 864 9th Edition
- UL Listed and FM approved for Pre-Action/Deluge and Agent Releasing
- Provides 4.3" (10.92 cm) color touchscreen display of System Events
- Includes five custom function buttons with LEDs for direct access to system controls.
- Shows the Hazard LED to indicate gas, carbon monoxide or other toxic gases
- Both the E3 Series (ILI-MB-E3/ILI95-MB-E3) and the S3 Series (SLP) support up to 15 LCD-SLP displays via the RS-485 serial interface
- Offers the following installation options:
  - Locally mounted in the E3 Series and S3 Series panels
  - Remotely mounted in the E3 Series, A2 cabinet
  - LCD Flush enclosure
- Displays the following six LED indicators:
  - AC Power
  - Alarm
  - Hazard
  - NAC Silence
  - Supervisory
  - Trouble

LCD-SLP Technical Specifications

SPECIFICATIONS

Operating Voltage: 24 VDC FWR
Operating Current: 0.030 amp
Alarm Current: 0.065 amp
Operating Temperature: 32°to120° F (0°to49° C)
Relative Humidity: 0 to 93%,non-condensing at 90° F (32° C)

TEMPERATURE AND HUMIDITY RANGES

This system meets NFPA requirements for operation at 0 – 49°C/32 – 120°F and at a relative humidity 93% ± 2% RH (non-condensing) at 32°C ± 2°C (90°F ± 3°F). However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and its peripherals be installed in an environment with a normal room temperature of 15 – 27°C/60 – 80°F.

STANDARDS

The LCD-SLP is designed to comply with the following standard:

UL Standard: UL 864 9th Edition:

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult the factory for the latest listing status.

UL Listed: S1869
FM Approved
MEA FDNY: COA # 6162
CSFM: 7165-1703:0176
City of Chicago Approved: Class 1
Reference Certificate of Compliance: VMA 45894-02C
ISO 9001 Certification

For a complete listing of all compliance approvals and certifications, please visit: http://www.gamewell-fci.com/en-US/documentation/Pages/Listings.aspx

E3 Series® and Gamewell-FCI® are registered trademarks of Honeywell International Inc.

UL® is a registered trademark of Underwriter's Laboratories Inc.

This document is not intended to be used for installation purposes. We try to keep our product information up-to-date and accurate. We cannot cover all specific applications or anticipate all requirements. All specifications are subject to change without notice.

For more information
Learn more about Gamewell-FCI's LCD-SLP and other products available by visiting www.Gamewell-FCI.com

Honeywell Gamewell-FCI
12 Clintonville Road
Northford, CT 06472-1610
203.484.7161
www.honeywell.com

9021-60782 | F | 09/17
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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7165-1703:0176
CATEGORY:	7165 - FIRE ALARM CONTROL UNIT (COMMERCIAL)
LISTEE:	GAMEWELL-FCI 12 Clintonville Road, Northford, CT, 06472 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Model S3 fire alarm control unit. Automatic, manual, waterflow, sprinkler supervisory, local, remote station (PPU), and central station (PPU) services. System components: SLP-E3; Smart Loop Panel Main Board Subassembly LCD-SLP; Liquid Crystal Display- Smart Loop Panel Subassembly FML-E3; Fiber Optic Multi Mode Board FSL-E3; Fiber Optic Single Model Board SLC-PM; Signaling Line Circuit for System Sensor Devices SLC95-PM; Signaling Line Circuit for Apollo Devices SLP-BB; Basic System Enclosure - Backbox, Door, Mounting Plate *DACT-E3; Digital Alarm Communication Transmitter *LCD-E3; LCD Display *FLPS-7-RB; Power Supply *RPT-E3-UPT; Network Repeater *ASM-16 P/N1100-0455; Annunciator Switch *ANU-48; P/N 1100-0503; Annunciator *LCD-7100; Remote LCD Display. Refer to the listee's data sheet for additional detailed product description and operational considerations

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

RATING:	120 V, 60 Hz, 2.75 A 240 V, 50/60 Hz, 1.4 A
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model number, electrical rating and UL label.
APPROVAL:	Listed as fire alarm control units for use with separately listed compatible initiating and indicating devices. Refer to manufacturer's installation manual for details.
NOTES:	For Fire Alarm Verification feature (delay of fire alarm), the retard/reset/restart period shall not exceed 30 seconds.

*Rev 08-30-17 gt

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: **05/04/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

NO EXCUSES!

FDB

FIRE DOCUMENT BOX



The FDB is the perfect fit to meet the demanding code requirements today. SAE's number one goal is to manufacture code compliant solutions and this product allows you to do just that. NFPA 72 2010 section 6.2.2.1 states, "A record of installed software and firmware version numbers shall be maintained at the location of the fire alarm control unit."

This durable 16 gauge steel enclosure with a solid piano hinge and key lock will keep all of your code required documents in one safe place. Along with your fire alarm software you can store your test & inspection documents, service records, manuals & AS built drawings for the system.

The FDB is designed to hold critical manuals and documents with a durable steel retainer. It has designated hooks to organize key rings and hold important business cards for easy access and reference. Inside the cover it has a organized note table that allows for documentation for passwords and other critical system information.

Standard Features:

- 2 Key ring hooks to hold system keys
- Business card holder for key contacts
- Overall Dimensions are 12” x 13” tall and 2 ¼ deep
- 16 gauge steel box and cover for security
- Durable powercoat baked on finish other colors available
- Standard ¾”cat 30 key lock other lock assemblies available
- Solid stainless steel piano hinge
- Permanently screened white ink 1” high “Fire Alarm Documents”
- Legend sheet for passwords and system information

NEMA NFPA Made In U.S.A.

ISO 9001 REGISTERED COMPANY

ADA

ACEBOX
Space Age Electronics, Inc.
www.1sae.com
800.486.1723 Toll Free
508.485.0966 Local
508.485.4740 Fax

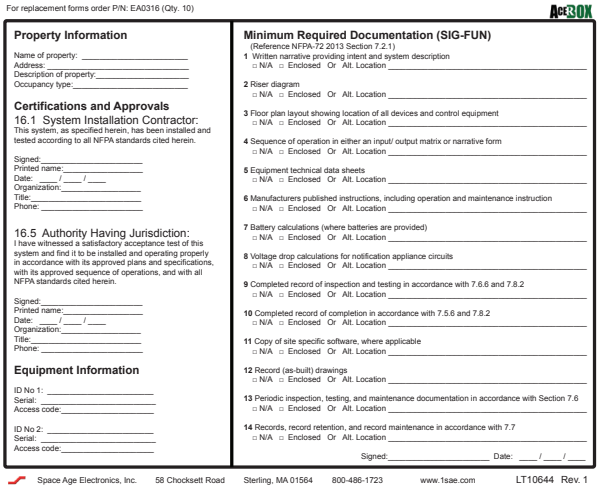
No Excuses, Just Solutions!

SPACE AGE ELECTRONICS, INC.

Specifications:

The fire alarm documents box (FDB) shall be constructed of 18 gauge cold rolled steel. It shall have a red powder coat epoxy finish. The cover shall be permanently screened with 1" high lettering "FIRE ALARM DOCUMENTS " with white indelible ink. The access door shall be locked with a 3/4" barrel lock and the hinge shall be a solid width 12" stainless steel piano hinge. The enclosure will supply 4 mounting holes. Inside the enclosure will accommodate standard 8 1/2 x 11 manuals and loose document records that will be protected within the enclosure. A legend sheet will be permanently attached to the door for system required documentation, key contacts and system information. The enclosure shall also provide 2 key ring holders with a location to mount standard business type cards for key contact personnel.





For replacement forms order P/N: EA0316 (Qty. 10)

Property Information

Name of property: _____
Address: _____
Description of property: _____
Occupancy type: _____

Certifications and Approvals

16.1 System Installation Contractor:
This system, as specified herein, has been installed and tested according to all NFPA standards cited herein.

Signed: _____
Printed name: _____
Date: ___ / ____ / ____
Organization: _____
Title: _____
Phone: _____

16.5 Authority Having Jurisdiction:
I have witnessed a satisfactory acceptance test of this system and find it to be installed and operating properly in accordance with its approved plans and specifications, with its approved sequence of operations, and with all NFPA standards cited herein.

Signed: _____
Printed name: _____
Date: ___ / ____ / ____
Organization: _____
Title: _____
Phone: _____

Equipment Information

ID No 1: _____
Serial: _____
Access code: _____

ID No 2: _____
Serial: _____
Access code: _____

Minimum Required Documentation (SIG-FUN)
(Reference NFPA-72 2013 Section 7.2.1)

1 Written narrative providing intent and system description
□ N/A □ Enclosed Or Alt. Location _____

2 Riser diagram
□ N/A □ Enclosed Or Alt. Location _____

3 Floor plan layout showing location of all devices and control equipment
□ N/A □ Enclosed Or Alt. Location _____

4 Sequence of operation in either an input/ output matrix or narrative form
□ N/A □ Enclosed Or Alt. Location _____

5 Equipment technical data sheets
□ N/A □ Enclosed Or Alt. Location _____

6 Manufacturers published instructions, including operation and maintenance instruction
□ N/A □ Enclosed Or Alt. Location _____

7 Battery calculations (where batteries are provided)
□ N/A □ Enclosed Or Alt. Location _____

8 Voltage drop calculations for notification appliance circuits
□ N/A □ Enclosed Or Alt. Location _____

9 Completed record of inspection and testing in accordance with 7.6.6 and 7.8.2
□ N/A □ Enclosed Or Alt. Location _____

10 Completed record of completion in accordance with 7.5.6 and 7.8.2
□ N/A □ Enclosed Or Alt. Location _____

11 Copy of site specific software, where applicable
□ N/A □ Enclosed Or Alt. Location _____

12 Record (as-built) drawings
□ N/A □ Enclosed Or Alt. Location _____

13 Periodic inspection, testing, and maintenance documentation in accordance with Section 7.6
□ N/A □ Enclosed Or Alt. Location _____

14 Records, record retention, and record maintenance in accordance with 7.7
□ N/A □ Enclosed Or Alt. Location _____

Signed: _____ Date: ___ / ___ / ___

Space Age Electronics, Inc. 58 Chocksett Road Sterling, MA 01564 800-486-1723 www.1sae.com LT10644 Rev. 1

Legend sheet for storing system information including contacts, sign-off , maintenance & test information, and alternate locations of additional records.

Ordering Information:

Part #	Description
SSU00672	**Fire Document Box RED**
SSU00673	**Custom screening with your Logo**

Check out our Infinity line eFAD single gang 2 Gig digital storage solutions (IAMEFAD)

Space Age Electronics, Inc.
www.1sae.com
800.486.1723 Toll Free
508.485.0966 Local
508.485.4740 Fax

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NO EXCUSES!

UL LISTED

YJ9645



32 Point Terminal Cabinet

The TC2 32 point “FIRE ALARM TERMINAL CABINET” is designed to enhance your fire alarm systems. Ideally suited for trouble shooting and maintenance with easy identification of system wiring.

This surface mount cabinet is fabricated from 16 gauge steel with a durable, baked on, red textured powder coat finish. White 2” highly visible lettering and a “lift-a-way” hinged door contribute to fast cabinet location and access. The door incorporates a high security CAT 30 keyed door lock. The TC2 is UL listed for life safety.

Standard Features:

- Dimensions:
  14” wide x 14” high x 3 1/4” deep
- 16 gauge steel construction
- Wall mounting holes
- Durable red textured finish
- White 2” indelible lettering “FIRE ALARM TERMINAL CABINET”
- Lift-a-way hinge with CAT 30 keyed door lock
- Interior labeling of terminal strip
- Field identification label inside cover
- 1/2”, 3/4”, 1”, 1 1/2” and 2” EMT knockout clusters
- Dual 16 point high barrier terminal strips
- Terminal points rated for 12 gauge wire
- Terminal strips rated for 20 amp max
  250V (Class B/UL) 300V (CSA)

Life Safety installations demand code compliant products. The TC2 uses only UL Recognized components.



ADA

NEMA

Uses UL Recognized Components

NFPA

Made In U.S.A.

ISO 9001 REGISTERED COMPANY

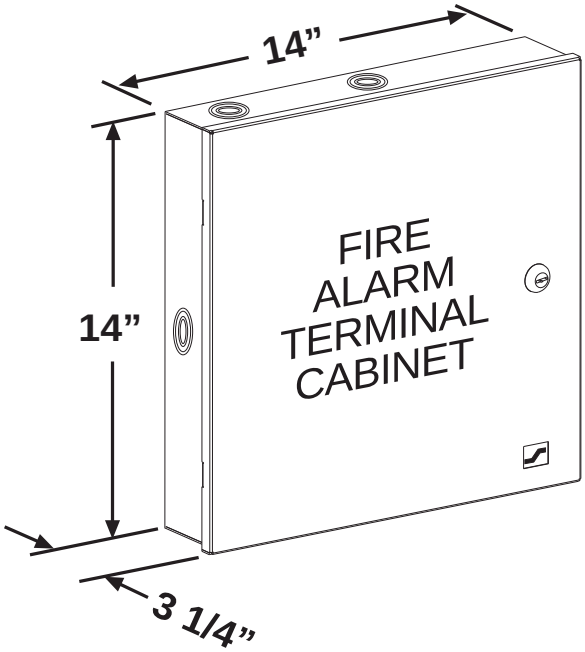
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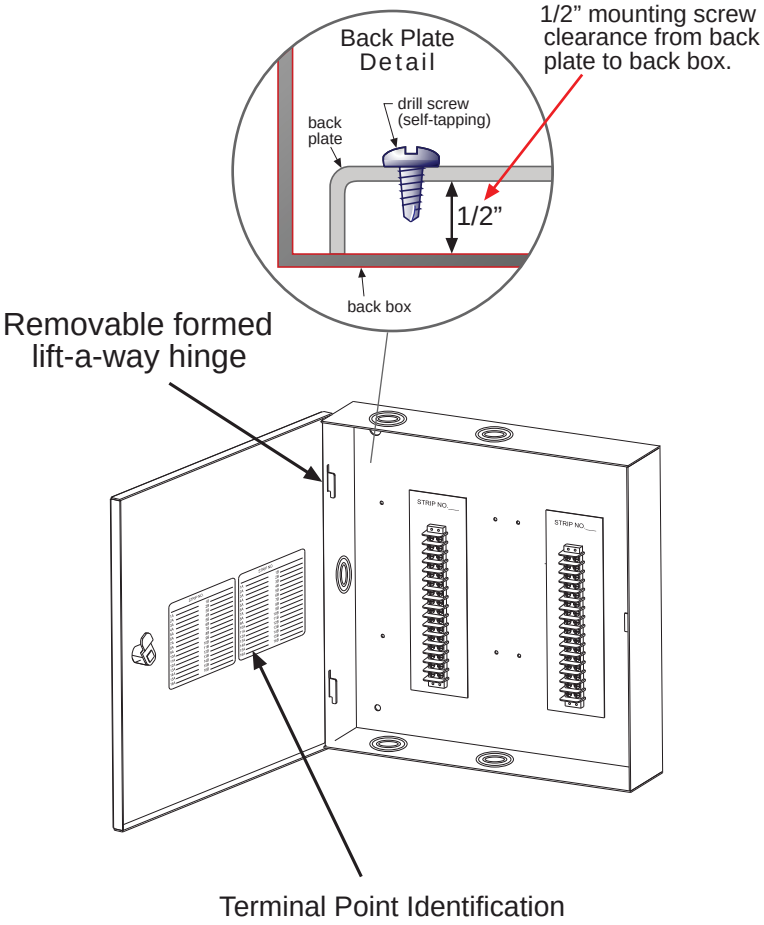
No Excuses, Just Solutions!

SPACE AGE ELECTRONICS, INC.

Specifications:

The TC2 32 Point Terminal Cabinet is constructed of 16 gauge (.062 thk.) cold rolled steel and finished with a durable red textured, heat-resistant baked-on enamel finish. The front cover is engineered with a removable formed lift-a-way hinge and displays “FIRE ALARM TERMINAL CABINET” in 2” white screened indelible lettering. A CAT 30 keyed door lock secures the front cover. The interior of the box has field identification labels on the inside cover corresponding to the terminal strip’s labeling inside the back box. Overall dimensions measure 14” wide by 14” high by 3 1/4” deep. The cabinet includes 1/2”, 3/4”, 1”, 1 1/2” and 2” EMT knockout clusters on the top, bottom and left side. Interior dual 16 point high barrier terminal strips are rated for 12 gauge wire and 20 amp max 250V (Class B/UL) 300V (CSA).





Ordering Information:

Part #	Description
SSU00645	TC2 32 Point Terminal Cabinet

Agency Approvals:

UOXX.S2580	UL Listed Control Unit Accessories

ACEBOX
Space Age Electronics, Inc.
www.1sae.com
800.486.1723 Toll Free
508.485.0966 Local
508.485.4740 Fax

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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7300-0553:0110
CATEGORY:	7300 - FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES
LISTEE:	SPACE AGE ELECTRONICS 58 Chockett Road, Sterling, MA, 01564 Contact: Scholl, Robert (508) 485-0966 (508) 485-4740 Email: bob.scholl@1sae.com
DESIGN:	Models TC2-32, TC1-18, TCX/A 64, TCX/D 128, ACE/A, AC2, ACE/D, IF-2, IF1, IFX/A and IFX/D enclosures. Models ACE-11, ACE-12 and ACE-13, *ACE2424, *ACE 3036, *ACE 2436, *ACE 3048 document cabinets. Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model number and UL label.
APPROVAL:	Listed as fire alarm equipment enclosures and document cabinets for use with listee's fire alarm equipment. Refer to listee's Installation Instruction Manual for details.
NOTES:	

02-09-16 dc

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: 03/22/2023

Listing Expires: 06/30/2024

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

PS SERIES

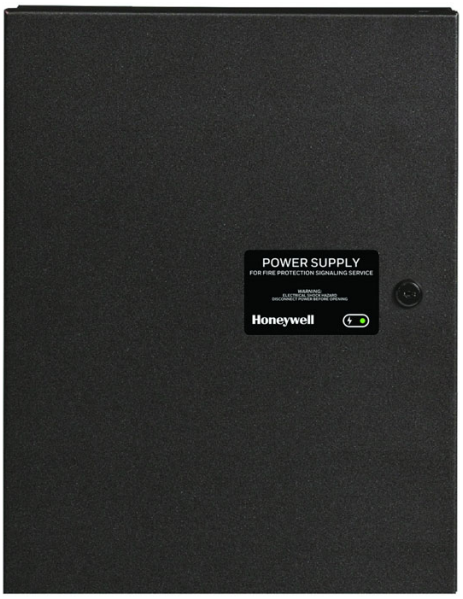
6 Amp and 10 Amp, 24 Volt Power Supplies

The PS Series are independently configurable power supplies, allowing you to pair any input with any output, and feature LED diagnostics for troubleshooting.

The PS Series is a remote power supply line from Gamewell-FCI. The HPF-PS6 is a 6 amp and the HPF-PS10 is a 10 amp, remote power supply with battery charger that may be connected to any 12 or 24 volt fire alarm control panel (FACP) or used as a standalone power supply. The PS Series provides 24 VDC power for NACs (notification appliance circuits) configured as either Class B or Class A (requires the ZNAC-PS option card) with multiple sync protocol options. The PS Series also provides auxiliary power, constant or resettable, suited for detectors, annunciators, door holders, and other fire alarm system peripherals. The PS Series cabinet can hold two 7 AH or 18 AH batteries and can charge up to 33 AH batteries in a separate cabinet.



HPF-PS6/10



HPF-PS6/10B

FEATURES AND BENEFITS

- Up to five (6 amp model) or seven (10 amp model) independently-configurable, power-limited output circuits for:
  –Class B and/or Class A NACs
  –Class B and/or Class A resettable or non-resettable 24V auxiliary power
  –door holder power
- Converts from Class B to Class A wiring without losing any outputs using the ZNAC-PS converter card (sold separately)
- Optimal for powering four-wire smoke detectors, annunciators, and other system peripherals requiring regulated power
- Optional addressable control, monitor, and relay modules and power-supervision relay (EOLR-1)
- Configurable for ANSI® Temporal 3 or Temporal 4 coded output
- UL-Listed NAC synchronization using System Sensor®, Wheelock®, Gentex®, or AMSECO® appliances
- Synchronization can be triggered from FACP NAC/remote sync outputs, cascaded power supply, or a control module, single or multi, which may be housed within the power supply cabinet
- Ability to cascade up to four power supplies
- Two (6 amp model) or three (10 amp model) fully-isolated input/control circuits which can be programmed to any output
- Two Form C normally-closed trouble relays for AC Trouble and General Trouble
- 6 or 10 amp full load output, respectively, with 3 A maximum/circuit
- Individual NAC power and trouble LEDs for diagnostic efficiency
- Trouble history mode for diagnostic support
- Wide range end-of-line supervision value (normal: 2-27K ohms)
- Selectable earth fault detection (enable or disable)
- AC trouble report delay timer
- Completely configurable via onboard DIP switches, no extra software required
- Self-contained in compact, locking cabinet constructed of heavy gauge steel with a corrosion-resistant powder coat chip and scratch-resistant finish
- Cabinet designed with ten double knockouts and a removable door for ease of installation and wiring
- Includes integral battery charger capable of charging up to 33 AH batteries
- Cabinet can house two 7 AH or 18 AH batteries
- Battery charger may be disabled via DIP switch for applications requiring larger batteries and external battery charger
- Removable terminal blocks accommodate up to 12 AWG (3.1mm^2) wire
- Works with any UL 864 FACP which utilizes an industry-standard reverse-polarity notification circuit
- HPF-PS6/10 include the - Honeywell Power Products lock set (PN: 17059) and key (PN: 17051)

Honeywell

Gamewell FCI FIRE CONTROL INSTRUMENTS

ORDERING INFORMATION

HPF-PS6: 6.0 A, 120 VAC remote charger power supply in a lockable, metal enclosure, red

HPF-PS6B: 6.0 A, 120 VAC remote charger power supply in a lockable, metal enclosure, black

HPF-PS10: 10.0 A, 120 VAC remote charger power supply in a lockable, metal enclosure, red

HPF-PS10B: 10.0 A, 120 VAC remote charger power supply in a lockable, metal enclosure, black

ZNAC-PS: Optional Class A converter card, sold separately

AOM-2SF: Addressable Control Module for one Class B or Class A zone of supervised, polarized Notification Appliances. Notification Appliance Circuit option requires external 24 VDC to power notification appliances.

AOM-2RF: Addressable relay module containing two isolated sets of Form-C contacts, which operate as a DPDT switch

AMM-4F: Addressable Monitor Module for one zone of normally open dry-contact initiating devices. Includes plastic cover plate and end-of-line resistor. Module may be configured for either a Class B or Class A

AMM-2IF: Dual Monitor Module. Same as AMM-4F except it provides two inputs for Class B wiring only

AMM-2RIF: Provides two monitored inputs and two Form-C relays. Functions in Class B wiring only

MMO-6SF: Six-circuit supervised control module

MMO-6RF: Six Form-C relay control module

EOLR-1: 12/24 VDC end-of-line relay for monitoring four-wire smoke detector power

BAT-1270-BP: Battery, 12 volt, 7.0 AH, 5-pack (two required)

BAT-12180-BP: Battery, 12 volt, 18AH, 2-pack

BAT-12330: Battery, 12 volt, 33AH

SEISKIT-MULTI-1: Seismic kit for the PS Series. Includes bracket and hardware for two 7AH or two 18AH batteries.

17070: Alternate Honeywell Gamewell-FCI lock set, PK-625, 3/8" cam

HPS SERIES TECHNICAL SPECIFICATIONS

PRIMARY (AC) POWER

HPF-PS6(B): 120 VAC, 50/60 Hz, 5.0A maximum

HPF-PS10(B): 120VAC, 50/60 Hz, 6.2 A maximum

Wire Size: #12-14 AWG with 600 V insulation

COMMAND INPUT CIRCUIT

Trigger Input Voltage: 9 to 32 VDC

Trigger Current: 2.0 mA (16 - 32 V); Per Input: 1.0 mA (9 - 16 V)

RELAY CIRCUITS

Trouble Contact Rating: 4 A at 24 VDC

OUTPUT CIRCUITS

- 24 VDC filtered
- HPF-PS6B: TB8-TB9 – 1A Regulated, 3A special applications; TB10-TB12 – 0.3A Regulated, 3A special applications
- HPF-PS10B: TB8-TB11 – 1.5A Regulated, 3A special applications; TB12-TB14 – 0.3A Regulated, 3A special applications
- 6.0 A (HPF-PS6B) or 10.0 (HPF-PS10B) maximum total continuous current for all outputs

SECONDARY POWER (BATTERY) CHARGING CIRCUIT

- Supports lead-acid batteries only
- Float-charge voltage: 27.6 VDC
- Maximum current charge: 1.5 A
- Maximum battery capacity: 18 AH (inside cabinet)
- Maximum battery charging capacity: 33 AH (external cabinet)

PHYSICAL

Dimensions: 20.0"H x 14.5"W x 3.5"D (cm: 50.8H x 36.83W x 8.9D)

Weight: with two 7Ah batteries is 24 pounds (10.9 kg), with two 18 AH batteries is 39 pounds (17.7 kg)

STANDARDS AND CODES

The HPF-PS complies with the following standards:

NFPA 72: National Fire Alarm Code

UL 864: Standard for Control Units for Fire Alarm Systems (NAC expander mode)

UL 1481: Power Supplies for Fire Alarm Systems

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

UL Listed: S24562

CSFM: 7315-1637:0505

FDNY Approved

FM Approved

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This document is not intended to be used for installation purposes. We try to keep our product information up-to-date and accurate. We cannot cover all specific applications or anticipate all requirements. All specifications are subject to change without notice.

Country of origin: USA

Honeywell Gamewell-FCI
12 Clintonville Road
Northford, CT 06472-1610
203.484.7161
www.gamewell-fci.com

9021-61096 | B | 01/21
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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7315-1637:0505
PARENT LISTING No.:	7315-0028:0513
CATEGORY:	7315 - POWER UNITS
LISTEE:	Honeywell International Inc. One Fire-Lite Place, Northford, CT, 06472 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Models HPF-PS6, HPF-PS6B, HPF-PS6E, HPF-PS10, HPF-PS10B, and HPF-PS10E Power Supply Expander. Model ZNAC-PS Class A Converter Module. Model Variations:All HPF-PS6 Models: Maximum 6A Capacity; 5 Class B NAC's; 2 Command Inputs; Trouble and AC Loss Relays All HPF-PS10 Models: Maximum 10A Capacity; 7 Class B NAC's; 3 Command Inputs; Trouble and AC Loss Relays With Suffix "E": Nominal 240V, 50/60 Hz AC Input Without Suffix "E": Nominal 120V, 50/60 Hz AC Input Models HPF-PS6 and HPF-PS10: Red Enclosure Models HPF-PS6B, HPF-PS6E, HPF-PS10B, and HPF-PS10E: Black Enclosure Model ZNAC-PS: Optional Class A Conversion Module Refer to listee's printed data sheet for detailed product description and operational considerations.
RATING:	Models HPF-PS6 and HPF-PS6B: 120V AC, 50/60 Hz, 5.0A Maximum Model HPF-PS6E: 240V AC, 50/60 Hz, 2.7A Maximum Models HPF-PS10 and HPF-PS10B: 120V AC, 50/60 Hz, 6.2A Maximum Model HPF-PS10E: 240V AC, 50/60 Hz, 3.5A Maximum Model ZNAC-PS: 24V DC

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances, and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model number, electrical rating, and UL label.
APPROVAL:	Listed as a power supply extender when used with separately listed compatible fire alarm control units. Refer to listee's Installation Instruction Manual for details.
NOTES:	

10-08-20 VWW

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test resultsand/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria.Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: **05/04/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo** , Program Coordinator
Fire Engineering & Investigations Division

Honeywell | Voice Evacuation

INX

Intelligent Network Transponder

General

The Gamewell-FCI, INX Intelligent Network Transponder serves as the point of distribution for the system's audio and fire fighter telephone risers. It is a component of the following systems.

- E3 Series® Expandable Emergency Evacuation System
- E3 Series Combined Fire and Mass Notification System
- E3 Series Broadband Audio Evacuation System

The INX occupies a single node on the E3 Broadband network and it is connected by a single pair of unshielded, twisted wires, fiber-optic cable or any combination of the two. Each E3 Broadband node can be spaced on the network up to a maximum distance of 3,000 feet (914.4 m) or up to an 8 dB loss using a fiber-optic cable. Built-in isolation at each node permits Style 4, Style 6, and Style 7 network configurations.

The E3 Broadband Audio Evacuation System is a peer-to-peer, self-regenerating, token ring network comprised of up to 64 individual nodes. In addition, the Addressable Node Expander (ANX) board expands the network to 122 nodes.

The E3 Broadband employs proven technology and extends it to accomplish emergency voice evacuation, two-way fire fighter communications, and building control applications. It is unique in the industry since it requires only a single pair of wires or fiber-optic cable connections between nodes to convey all fire alarm, digital voice, fire fighter communications, paging, and building control signals. This system provides a 16 message capacity with up to a three minute duration per each INX. Messages are easily field-configurable with a laptop computer.

A typical INX assembly consists of the following:

- an Intelligent Network Interface-Voice Gateway (INI-VGX) module
- a PM-9/PM-9G power supply
- up to four AM-50 Series amplifiers including a minimum of one backup amplifier



INX

FEATURES & BENEFITS

- IBC Seismic Certified
- Listed under UL® Standard 864, 9th Edition
- Listed under UL Standard UL2572 for Mass Notification
- Each AM-50 Series amplifier provides two individually activated speaker circuits supplying 50 watts total
- Integrates with INCC command centers and additional INX transponders to create a complete audio evacuation system with up to 122 nodes
- Uses state-of-the-art digital signal processor (DSP) technology for efficient audio compression and filtering
- Distributed architecture, including Style 7 wiring configurations, allow system components to continue normal operation with NO loss of function during single line fault conditions
- Software-programmable multi-channel digital audio applications
- One Style 4 signaling line circuit (SLC) supporting up to 32 addressable speaker circuits (AOM-2SF used for single channel circuits and 16 addressable phones circuits AOM-TELF)
- Up to 150 watts of audio power provided by the AM-50 Series amplifiers with an 50 watts of standby amplifier enclosed in a single, compact wall-mounted cabinet
- Offers all communication signals and control-by-event sequences over two wires or fiber-optic cable including: audio evacuation, voice paging, fire fighter intercom, and building control signals

General

The INX is enclosed in a compact 19" enclosure capable of accommodating up to 12 A/H size batteries. The modular approach of the E3 Broadband greatly simplifies the design and the installation and allows the complete flexibility in retrofit or add-on situations. This system is ideal to use for a wide range of complex system applications including high-rise or campus installations.

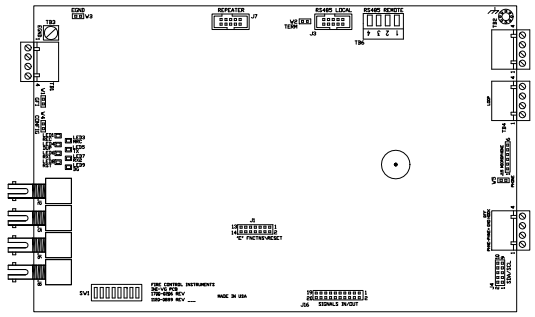


Figure 1 INI-VGX

INI-VGX

The INI-VGX is a multi-function module which incorporates the following:

- Network interface using twisted, unshielded wire or fiber-optic cable
- Fully digital message generator
- One signaling line circuit for local peripheral devices
- Local fire fighter phone riser

It occupies a single DIP switch selectable address on the network and provides termination points for the network connection using either a pair of twisted, non-shielded wire (12 AWG max.) or fiber-optic cable.

The INI-VGX uses advanced Digital Signal Processing (DSP) technology for audio compression and filtering allowing E3 Broadband to produce the clearest audio possible. Background noise is automatically filtered during voice paging and fire fighter communications which increase audibility and eliminates the need for the Push-to-Talk devices.

The INI-VGX can accommodate up to 16 different messages with a total combined duration of three minutes. Each message can be field installed via a laptop computer and the messages can be in the form of a voice message or an evacuation tone. The INI-VGX provides a fire fighter phone riser that would connect to phone jacks or warden stations through AOM-TELF modules.

The INI-VGX provides one Signaling Line Circuit (SLC) to control and supervise Addressable Output Modules (AOM) serving as speaker circuits and fire fighter telephone circuits. The INI-VGX SLC can support up to 32 speaker circuits using the AOM-2SF for single channel applications. In addition, each INI-VGX SLC can support up to 16 fire fighter intercom circuits using the AOM-TELF.

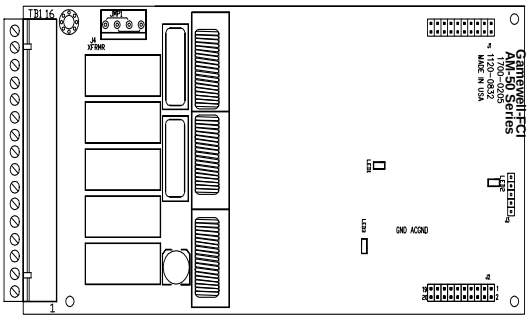


Figure 2 AM-50 Series Amplifiers

AM-50 Series Amplifiers

The AM-50 Series amplifiers offer 2 types of AM-50 Series amplifiers:

- AM-50-25 amplifier produces a $25V_{RMS}$ audio output
- AM-50-70 amplifier produces a $70V_{RMS}$ audio output

The AM-50 Series amplifiers are a component of the following systems.

- E3 Series, Expandable Emergency Evacuation System
- E3 Series Combined Fire and Mass Notification System

E3 Broadband Audio Evacuation System

Both AM-50 Series amplifiers produce 50 watt, digital, switching power. As many as four AM-50 Series amplifier modules can be installed in each INX CAB-B cabinet and are supervised and controlled by an INI-VGX Voice Gateway.

Each AM-50 Series amplifier provides two speaker circuits that can be wired Style Y (Class "B") or Style Z (Class "A"). The terminal connections can accommodate up to 12 AWG, twisted-pair, shielded wire. Both speaker circuits can produce a combined 50 watt power that can be divided between the two integral Class A/B speaker circuits. The two speaker circuits may be individually activated and supervised by an INI-VGX Voice Gateway.

The AM-50 Series amplifiers may be installed in an INX CAB-B cabinet or an INCC command center using the expander plates whenever the E3 control panel is used in conjunction with the E3 Series®, Expandable Emergency Evacuation System.

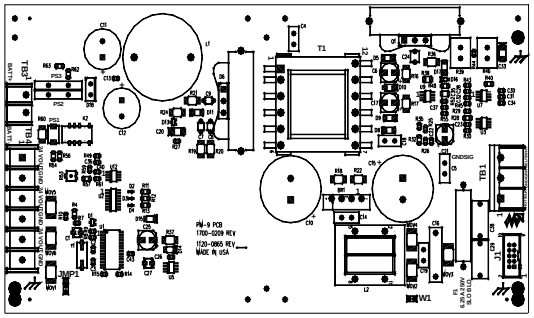


Figure 3 PM-9

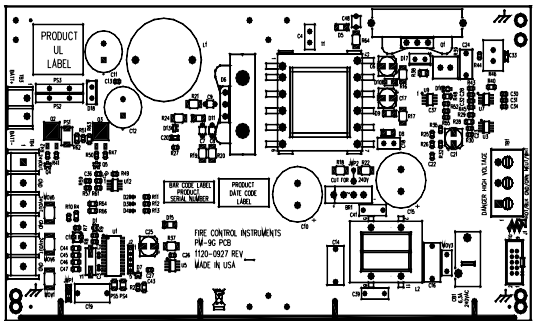


Figure 4 PM-9G

PM-9

The PM-9 is a switching power supply that provides 9 amps of filtered and regulated 24 VDC (nominal) to power the INX transponder. It has an internal battery charging circuit capable of accommodating up to 55 A/H batteries as well as an auxiliary continuous duty 24 VDC output @ 5 amps max.

PM-9G

The PM-9G is a switching power supply that provides 9 amps of filtered and regulated 24 VDC (nominal) to power the INX transponder. It has an internal battery charging circuit capable of accommodating up to 55 A/H batteries as well as an auxiliary continuous duty 24 VDC output @ 5 amps max.

Figure 5 illustrates the dimensions for the INX cabinet configuration.

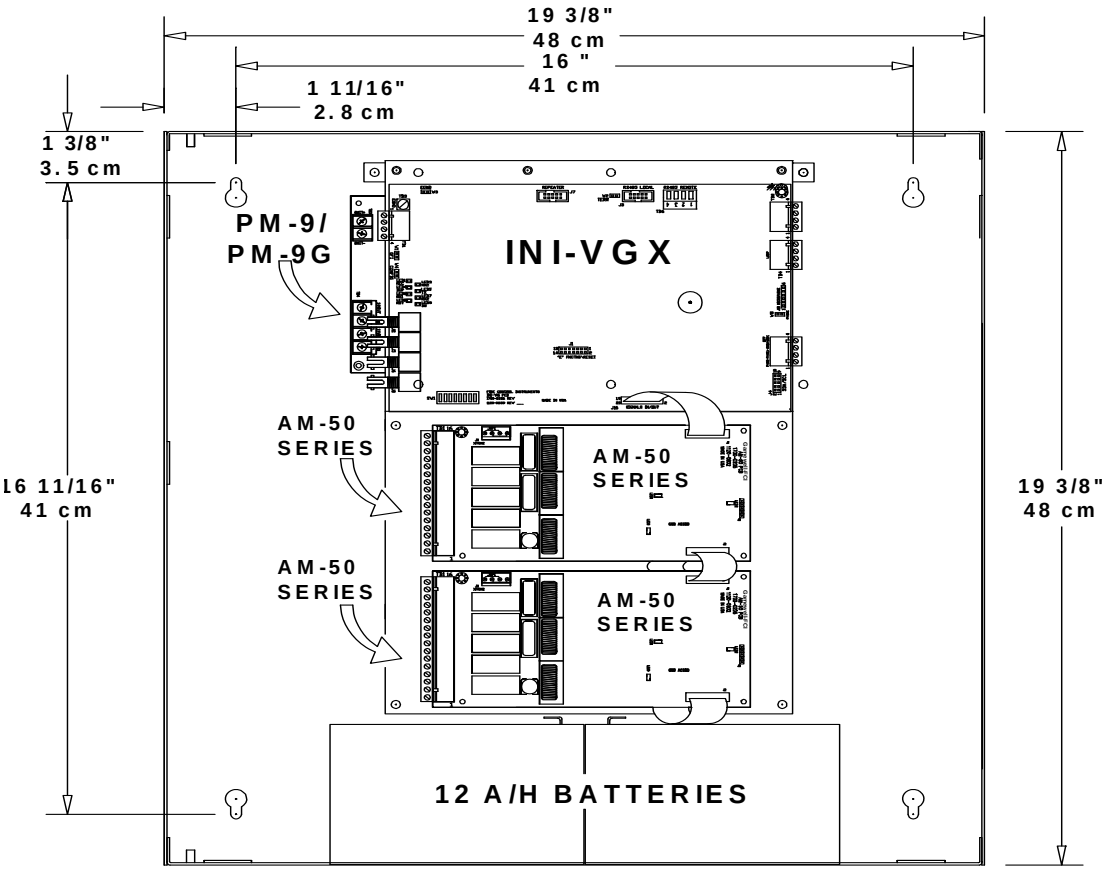


Figure 5 INX Cabinet Dimensions

INX Technical Specifications

SPECIFICATIONS

PM-9G	
Input Voltage:	240 VAC @ 50/60 Hz
Input Current:	2.4 amps max. @ 240 VAC, 50/60 Hz
Output Voltage:	24 VDC FWR
Output Current:	9 amperes Alarm max. continuous
Output Current:	5 amperes max. continuous Standby (when the PM-9G is used with the ILI-E3 or the ILI95-E3 Series, see Note 1).
Output Current:	4 amperes max. continuous Standby (when the PM-9G is used with any AM-50 Series amplifier, see Note 2).
Operating Temperature:	32° to 120° F (0° to 49° C)
Relative Humidity:	0 to 93%, non-condensing at 90° F (32° C)
Supervised	
Non Power-Limited	

Continuous standby loads in excess of .560 Amps up to 5 Amps may require a Generator Backup or load shedding during an AC power failure. Continuous standby loads in excess of .560 Amps up to 4 Amps may require a Generator Backup or load shedding during an AC power failure.

PM-9	
Input Voltage:	120 VAC, 60 Hz
Input Current:	4.6 amps max. @ 120 VAC 60 Hz
Output Voltage:	24 VDC FWR
Output Current:	9 amperes Alarm max. continuous
Output Current:	5 amperes max. continuous Standby (when the PM-9 is used with the ILI-E3 or the ILI95-E3 Series, see Note 1).

TEMPERATURE AND HUMIDITY RANGES

This system meets NFPA requirements for operation at 0 – 49°C/32 – 120°F and at a relative humidity 93% ± 2% RH (non-condensing) at 32°C ± 2°C (90°F ± 3°F). However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and its peripherals be installed in an environment with a normal room temperature of 15 – 27°C/60 – 80°F.

Ordering Information

Part Number	Description
INX	Intelligent Network Transponder, (Distributed Voice Network Sub-Assembly Enclosure)
INI-VGX	Transponder Voice Gateway PM-9
PM-9	INX 9 ampere Power Supply
PM-9G	INX 9 ampere Power Supply
AM-50 Series:	
1100-0456	AM-50-25, INX 50 watt 25 V_{RMS} audio amplifier
AM-50-70	INX 50 watt 70.7 V_{RMS} audio amplifier
Cabinets:	
INX-CAB	Backbox with Black Door
Dimensions:	INX 19" W x 19" H x 4" D, (48 x 48 x 10 cm)
INX-CABR	Backbox with Red Door
Dimensions:	INX 19" W x 19" H x 4" DM (48 x 48 x 10 cm)
INX-CAB-B	Backbox/ louvered door & INX-CAB-B Mounting Plate
Dimensions:	19 3/8" W x 19 3/8" H x 4.5" D, (49 x 49 x 11 cm)

Seismic Battery Bracket Kits

Part Number	Description
90518	NetSOLO NS-INX 7 A/H Seismic Battery Bracket Kit NetSOLO 7100 7 A/H Seismic Battery Bracket Kit
90519	NetSOLO NS-INX 12 A/H Seismic Battery Bracket Kit

Note: For information on the types of Seismic Battery Bracket Kits available and the Seismic Battery Bracket Kit Part Numbers, refer to the following documents:

Seismic Battery Bracket Installation Guide, P/N: 53839

E3 Series Cabinets Data Sheet, P/N: 9020-0649

STANDARDS

The INX is designed to comply with the following standard:

UL Standard: UL 864 9th Edition

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult the factory for the latest listing status.

UL Listed: S1869
2572 for Mass Notification
FM Approved: 3017416
MEA Approved FDNY: COA #:-217-03-E
CSFM: 6911-1703:0118
City of Chicago: Class 1, Class 2, High Rise
City of Denver Approved
VMC Reference of Certification: VMA-45894-02C
ISO 9001 Certification

For a complete listing of all compliance approvals and certifications, please visit: http://www.gamewell-fci.com/en-US/documentation/Pages/Listings.aspx

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UL® is a registered trademark of Underwriters Laboratories Inc.

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For more information

Learn more about Gamewell-FCI's INX and other products available by visiting www.Gamewell-FCI.com

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12 Clintonville Road
Northford, CT 06472-1610
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Gamewell FCI

AM-50 Series Amplifiers

50 Watt Digital Amplifiers

General

The Gamewell-FCI, AM-50 Series amplifiers are a 50 watt, digital, switching power amplifier. The following lists the two types of AM-50 Series amplifiers that may be ordered.

- The AM-50-25 amplifier produces 25 V_{RMS} audio output.
- The AM-50-70 amplifier produces 70.7V_{RMS} audio output.

The amplifiers are components of the following E3 Series® Systems.

- E3 Series Expandable Emergency Evacuation System
- E3 Series Combined Fire and Mass Notification System
- E3 Series Broadband Voice Evacuation System

Each AM-50 Series amplifier provides two speaker circuits that can be wired Style Y (Class "B") or Style Z (Class "A"). The terminal connections can accommodate up to 12 AWG, twisted-pair, shielded wire. Both speaker circuits produce a combined total of 50 watts of power. The 50 watts of power can be divided between the two integral Class A/B speaker circuits. The two speaker circuits may be individually activated and supervised by an INI-VGX Transponder Voice Gateway.

The AM-50 Series amplifier can be programmed to broadcast sixteen messages generated from its local INI-VGX Voice Gateway. In addition, the AM-50 Series amplifiers produce superior clarity for intelligible LIVE voice paging.

When the selected System Sensor, speakers are used with the Manufacturer's 520 Hz audiophile, the E3 Series® System is compliant with UL Standard 464 Low Frequency requirements.



AM-50-25



AM-50-70

Installation

As many as four AM-50 Series amplifiers can be installed in the following cabinets when supervised and controlled by an INI-VGX Voice Gateway.

- Cabinet B, INX CAB-B • Cabinet C, INX-CAB-C • Cabinet D, INX-CAB-D

WARNING: AM-50 Series Amplifiers Node Restriction:
The INI-VGX can support up to four AM-50 Series amplifiers with the same output voltage. However, you cannot wire an AM-50-25 amplifier and an AM-50-70 amplifier to the same INI-VGX Voice Gateway Node between the four amplifiers, max. of 150 watts are allowed.

The AM-50 Series amplifiers can be installed using the AM-50 Extender Plate whenever the E3 Series control panel is used in conjunction with the Autonomous Control Unit (ACU) of the E3 Series Combined Fire and Mass Notification System.

FEATURES & BENEFITS

- Listed under UL® Standard 864, 9th Edition
- Listed under UL Standard UL2572 for Mass Notification
- Complies with UL Standard 464 for 520 Hz Low Frequency
- Provides digital, switching amplifier technology
- Produces 50 watts of digital power
- Includes 2 speaker circuits, wired Style Y (Class B) or Style Z (Class A)
- Up to 4 AM-50 Series amplifiers with the same output voltage can be controlled by the INI-VGX voice gateway

AM-50 Series Amplifiers Technical Specifications

SPECIFICATIONS

AM-50-25 Amplifier

Operating Voltage: 27.3 to 20.4 VDC

Operating Current: 0.086 amp normal standby

Alarm Current: 2.206 amp max. alarm @ 50 Watt

Audio Output: 50 watts max. @ 25 V_{RMS}

AM-50-70 Amplifier

Operating Voltage: 27.3 to 20.4 VDC

Operating Current: 0.049 amp normal standby

Alarm Current: 2.30 amp max. alarm @ 50 watt

Audio Output: 50 watts max. @ 70.7 V_{RMS}

AM-50 Series Amplifiers

Relative Humidity: 0 to 93% max., (non-condensing) at 90° F (32° C)

Operating Temperature: 32° to 120° F (0° to 49° C)

Dimensions: 7 1/2" W x 3 1/2" H x 1 1/4" D
(19 W x 9 H x 3 D cm)

TEMPERATURE AND HUMIDITY RANGES

This system meets NFPA requirements for operation at 0 – 49°C/32 – 120°F and at a relative humidity 93% ± 2% RH (noncondensing) at 32°C ± 2°C (90°F ± 3°F). However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and its peripherals be installed in an environment with a normal room temperature of 15 – 27°C/60 – 80°F.

Ordering Information

1100-0456: AM-50, 25V_{RMS} audio output, 50 watt amplifier

AM-50-70: AM-50, 70.7V_{RMS} audio output, 50 watt amplifier

STANDARDS

The AM-50 Series amplifiers are designed to comply with the following standards:

UL Standards: 864 9th Edition
2572 for Mass Notification
464 Low Frequency

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult the factory for the latest listing status.

UL Listed: S1869

FM Approved: 3017416

MEA Approved, Fire Dept. of New York: COA# 6077

CSFM: 7165-1703-0125

City of Chicago: Class 1, Class 2, High Rise

City of Denver Approved

ISO 9001 Certification

For a complete listing of all compliance approvals and certifications, please visit: http://www.gamewell-fci.com/en-US/documentation/Pages/Listings.aspx

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For more information

Learn more about Gamewell-FCI's AM-50 Series Amplifiers and other products available by visiting www.Gamewell-FCI.com

Honeywell Gamewell-FCI
12 Clintonville Road
Northford, CT 06472-1610
203.484.7161
www.honeywell.com

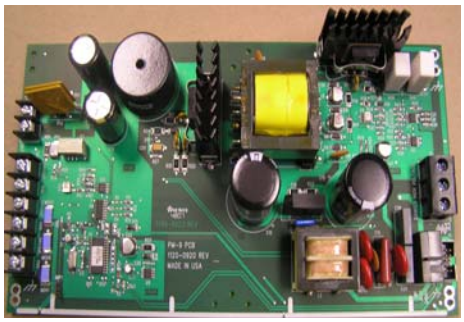
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Honeywell

PM-9

120 VAC Power Supply

The PM-9 is a 9 ampere power supply used with the E3 Series® Fire, Mass Notification and Voice Evacuation Systems.



PM-9

GENERAL

The Gamewell-FCI, PM-9 Power Supply is a 120 VAC, 60 Hz switching power supply that provides 9 amperes of filtered and regulated 24 VDC (nominal). It provides the power to all of the E3 Series components.

It is a component of the following systems:

- E3 Series® Expandable Emergency Evacuation System
- E3 Series Combined Fire and Mass Notification System
- E3 Series Broadband Voice Evacuation System

The PM-9 has an internal battery charging circuit capable of maintaining up to 55 A/H batteries.

Installation

Typically, the PM-9 Module can be mounted in the following E3 Series cabinets:

- Cabinet B backbox
- Cabinet C, INX-E3 sub-assembly plate
- Cabinet C, INCC-E3 sub-assembly plate
- Cabinet D, E3-INX-D Plate
- Cabinet D, E3-ILI-D Plate
- Retrofit Kits

For information on the installation of the PM-9, refer to the following documents:

- E3 Series Expandable Emergency Evacuation Manual, P/N: LS10080-000GF-E
- PM-9 Installation Instructions, P/N: 9000-0548
- Mass Notification System Manual, P/N:LS10013-000GF-E

ORDERING INFORMATION

PM-9: Power supply and battery charger, 120 VAC

29229: AC Line Filter Kit

FEATURES AND BENEFITS

- Listed under UL® Standard 864, 10th Edition
- Listed under UL Standard UL2572, 2nd Edition for Mass Notification
- Includes 9 ampere, filtered, regulated power supply
- Provides 1 ampere battery charging current
- Offers energy and space saving switching technology
- Contains an integral battery charger capable of recharging up to 55 AH batteries. (Batteries not furnished)

Honeywell

Gamewell FCI

PM-9 TECHNICAL SPECIFICATIONS

SYSTEM

Input Voltage: 120 VAC 60 Hz @ 3.5 A. max.
Output Voltage: 24 VDC (nominal) FWR
Output Current: 9 amperes
Output Current: 1 ampere battery charging current
Alarm Current: 0.050 amp
Operating Temperature: 32° to 120° F (0° to 49° C)
Relative Humidity: 0 to 93% (non-condensing) at 90° F (32° C)
Dimensions: 10 1/2" W x 5" H x 2" D (27 x 13 x 5 cm)

TEMPERATURE AND HUMIDITY RANGES

This system meets NFPA requirements for operation at 0 – 49°C/32 – 120°F and at a relative humidity 93% ± 2% RH (noncondensing) at 32°C ± 2°C (90°F ± 3°F). However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and its peripherals be installed in an environment with a normal room temperature of 15 – 27°C/60 – 80°F.

STANDARDS

The PM-9 is designed to comply with the following standards:
UL Standards: UL 864, 10th Edition
UL 2572, 2nd Edition for Mass Notification

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult the factory for the latest listing status.
UL Listed: S1869, Vol. 14
UL 864, 10th Edition
S1949, Vol. 19
UL 2572, 2nd Edition
FM Approved: 3017416
MEA FDNY: COA 6077
CSFM: 7165-1703:0125
City of Chicago Approved:
Class 1, Class 2,High Rise
City of Denver Approved:
ISO 9001 Certification:

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Country of origin: U.S.A.

Honeywell Gamewell-FCI
12 Clintonville Road
Northford, CT 06472-1610
203.484.7161
www.gamewell-fci.com

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Honeywell | Voice Evacuation

INI-VG Series

Intelligent Network Interface Voice Gateway

General

The INI-VG Series (Intelligent Network Interface-Voice Gateway) is a network interface with superior Audio and Command/Control that is used for E3 Series fire alarm and voice evacuation systems. The modular design allows the INI-VG Series to be used in any type of system configuration to function as a voice network interface for any of the following:

- Fire Command Center
- Digital Audio Voice Transponder
- Analog Audio Voice Transponder
- Autonomous Control Unit (ACU) for Mass Notification
- Local Operating Console (LOC) for Mass Notification

With a Class B signaling line circuit (SLC), the INI-VG can monitor and control up to sixteen AOM-TELF telephone modules to use with the fire fighter telephones or serve as value Local Operating Consoles (LOC). In addition, it can support up to 16 AOM-2SF, signal output modules that can be used for distributed audio control.

Networked through single-mode fiber optics, multi-mode fiber optics, and/or twisted-pair wire, the INI-VG Series resides on the E3 Series and/or S3 Series network, represented as a node with fully independent control. Each INI-VG Series provides its own internal recorded message storage that operates as a redundant back-up in case another panel is no longer functional.

Each version of the INI-VG Series features a unique functionality that can operate as any of the following, depending on how each version is used with the application:

- Digital Audio Voice Transponder (INI-VGX) connects up to three main amplifiers and one back-up amplifier to control over 150 watts of audio per board.
- Analog Audio Voice Transponder (INI-VGE) connects to analog bulk amplifiers and distributes audio using 16 AOM-2SF modules.
- Fire Command Center (INI-VGC) connects hand-held microphones and main fire fighter telephones.



INI-VG Series

FEATURES & BENEFITS

- Listed under UL® Standard 864, 9th Edition
- Listed under UL Standard UL2572 for Mass Notification
- Supports a network data transfer rate at 625K baud
- Controls all communication signals and control-by-event sequences over twisted, unshielded pair of wires or fiber-optic cable
- All INI-VG Series Modules connect to a voice page microphone and fire fighter's handset
- Uses advanced Digital Signal Processor (DSP) technology that provides efficient audio compression and filtering
- Offers the following fiber-optic plug-in modules used for fiber-optic connectivity
  - FML-E3 (fiber-optic multi-mode)
  - FSL-E3 (fiber-optic single-mode)
- Supports Distributed Architecture, including Style 7 wiring configuration, that allows system components to continue normal operation with NO loss of function during single line fault conditions
- Provides Redundant Command Centers with a microphone and a fire fighter's handset which can easily be configured by adding INCCs

INI-VGC

The INI-VGC Voice Gateway Module is optimized to provide command and control functions for the INCC Command Center. The INCC serves as the point of interface between an operator and the system's audio evacuation, fire fighter intercom, and building control circuits.

A typical INCC assembly consists of the following:

- an Intelligent Network Interface-Voice Gateway (INI-VGC) Module
- one or more Addressable Switch Modules (ASM-16)
- a Voice Page Microphone (INCC-MIC)

Each INI-VGC can support up to 16 ANU-48 LED Driver Modules or ASM-16s for a total of 256 fully programmable switches and 768 LEDs that light in red, yellow, and green.

The INI-VGC occupies a single node on the E3 Broadband network and it is connected by a single, pair of twisted, unshielded wire, fiber-optic cable or any combination of the two. The INCC Command Center's INI-VGC module also provides connections for an optional fire fighter telephone handset.

The INI-VGC is a fully digital voice/tone generator using state-of-the-art Digital Signal Processing (DSP) technology to produce superior audio signals. The INI-VGC provides an output to a local speaker for message verification and testing.

INI-VGE

The INI-VGE Voice Gateway Module provides an audio interface to the bulk analog amplifiers and command and control functions for the INCC Command Center.

A typical INCC assembly consists of the following:

- an Intelligent Network Interface-Voice Gateway (INI-VGE) Module
- one or more Addressable Switch Modules (ASM-16)
- a Voice Page Microphone (INCC-MIC)

Each INI-VGE can support up to 16 ANU-48 LED Driver Modules or ASM-16s for a total of 256 fully programmable switches and 768 LEDs that light in red, yellow, and green.

The INI-VGE occupies a single node on the E3 Series Classic network and is connected by a single pair of twisted, unshielded wire, fiber-optic cable or any combination of the two. The INCC Command Center's INI-VGE module also provides connections for an optional fire fighter telephone handset. The INI-VGE's one Signaling Line Circuit (SLC) loop supports the following:

- 16 remote Fire Fighter Phones
- 32 Supervised Audio Control Relays

The INI-VGE is a fully digital voice/tone generator using state-of-the-art Digital Signal Processing (DSP) technology to produce superior audio signals. The INI-VGE provides an audio output capable of driving up twenty 100 watt (AA-100) or 120 watt (AA-120) amplifiers.

INI-VGX

The INI-VGX Transponder Voice Gateway is a component of the E3 Broadband Audio Evacuation System and an optional component of the E3 Series Expandable Emergency Evacuation System. It is a multi-function module that incorporates the following:

- Software-programmable multi-channel digital audio applications.
- One Class B, Style 4 Signaling Line Circuit (SLC) supporting up to 32 addressable speaker circuits (AOM-2SF) and 16 addressable phone circuits (AOM-TELF).
- Supports up to 150 watts of audio power (using the AM-50 Series amplifiers operating at 50 watts of power @ either $25V_{RMS}$ or $70.7V_{RMS}$ output) with backup amplifier support.
- Offers a sixteen message capacity with up to 3 minute total duration per INI-VGX. The messages are easily field-configured via a laptop computer.
- Network interface using twisted, unshielded wire or fiber-optic cable.
- Local fire fighter phone riser.

The INI-VGX provides command and control for up to four AM-50 Series amplifiers, operating at 50 watts of power @ either $25V_{RMS}$ or $70.7V_{RMS}$ audio output (up to 150 W of audio may be delivered at any given time). The amplifiers are installed in a single cabinet. The INI-VGX uses advanced Digital Signal Processing (DSP) technology for audio compression and filtering. This feature allows the E3 Series Broadband System to produce superior clarity for intelligible LIVE voice paging. The background noise is automatically filtered during voice paging and fire fighter communications which increases the audibility and eliminates the need for Push-to-Talk devices.

INI-VG Series Technical Specifications

SPECIFICATIONS

INI-VGC, INI-VGE and INI-VGX:
Operating Voltage: 24 VDC (nominal) from the PM-9/PM-9G Power Supply
Operating Current: 0.150 amp. supervisory and alarm
Operating Temperature: 32 - 120° F (0 - 49° C)
Relative Humidity: 0 to 93% (non-condensing)
Supervised
Class 2 Power-Limited
Protocol: Asynchronous with half-duplex data flow

Wiring Specifications:
INI-VG Series (Third Generation Voice Gateway and Legacy-UTP Models):
Copper Wire: 16 to 18 AWG twisted-pair, unshielded. Up to 3,000 ft. (914.4 m) between each node.

Fiber-Optic Cable:
FML-E3 (Multi-Mode): Up to 200 microns (optimized for 62.5/125 microns). Up to 8dB loss between each node.
FSL-E3 (Single-Mode): Up to 1310nm (nanometer) (optimized for 9/125microns). Up to 30dB loss between nodes.

TEMPERATURE AND HUMIDITY RANGES

This system meets NFPA requirements for operation at 0 – 49°C/32 – 120°F and at a relative humidity 93% ± 2% RH (non-condensing) at 32°C ± 2°C (90°F ± 3°F). However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and its peripherals be installed in an environment with a normal room temperature of 15 – 27°C/60 – 80°F.

ORDERING INFORMATION

INI-VG Series (Third Generation-Voice Gateway Models):
INI-VGC: (Command Center Voice Gateway (UTP only)
INI-VGE: Command Center Classic Voice Gateway (UTP only)
INI-VGX: Transponder Voice Gateway (UTP only)

Accessories:
FML-E3: Multi-Mode Fiber-Optic Module
FSL-E3: Single-Mode Fiber-Optic Module

INI-VG Series Legacy Models:
1100-1321: INI-VGC-FO (Command Center Voice Gateway-fiber-optic module)
1100-1322: INI-VGC-UTP (Command Center Voice Gateway-unshielded twisted-pair only)
1100-1325: INI-VGE-FO (Classic Bulk Voice Gateway-fiber-optic module)
1100-1326: INI-VGE-UTP (Classic Bulk Voice Gateway-unshielded twisted-pair only)
1100-1323: INI-VGX-FO (Voice Transponder Gateway-fiber-optic module)
1100-1324: INI-VGX-UTP (Voice Transponder Gateway-unshielded twisted-pair only)

STANDARDS

The INI-VG Series is designed to comply with the following standards:
UL Standards: UL 864 9th Edition
UL 2572 for Mass Notification

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult the factory for the latest listing status.
UL Listed: S1869
S1949
2572 for Mass Notification
FM Approved: 30006578
MEA Approved FDNY: COA #:-6077
CSFM: 7165-1703:125
City of Chicago Approved: Class 1 Class 2 High Rise
City of Denver Approved
ISO 9001 Certification

For a complete listing of all compliance approvals and certifications, please visit: http://www.gamewell-fci.com/en-US/documentation/Pages/Listings.aspx

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UL® is a registered trademark of Underwriters Laboratories, Inc.

This document is not intended to be used for installation purposes. We try to keep our product information up-to-date and accurate. We cannot cover all specific applications or anticipate all requirements. All specifications are subject to change without notice.

For more information
Learn more about Gamewell-FCI's INI-VG Series and other products available by visiting www.Gamewell-FCI.com

Honeywell Gamewell-FCI
12 Clintonville Road
Northford, CT 06472-1610
203.484.7161
www.honeywell.com

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Mass Notification, E3 Series, In-Building

INCC-MIC

Paging Microphone Module

General

The Gamewell-FCI, INCC-MIC Paging Microphone Module is a microphone interface used for emergency microphone paging. It is a component of the following Systems:

- E3 Series® Combined Fire and Mass Notification System
- E3 Series Broadband Voice Evacuation System

The INCC-MIC microphone provides a cost-effective microphone interface module that can be used for paging. When it is installed with the ASM-16 Addressable Switch Module, it provides easy paging to the selected speaker zones with visual indications of paging and zone status.



INCC-MIC

Installation

The INCC-MIC Paging Microphone Module can be installed in any of the following types of E3 Series cabinets:

- Cabinet AA
- Cabinet B
- Cabinet C
- Cabinet D

Note: Gamewell-FCI recommends that you install the speakers at 4 ft. (1.2 m) or more from the microphone.

Ordering Information

1100-0452: Paging Microphone Module

FEATURES & BENEFITS

- Listed under UL® Standard UL2572 for Mass Notification
- Listed under UL Standard S1869 9th Edition
- Delivers audio feedback cancellation
- Contains a supervised microphone
- Provides status bit activation when the microphone is in use
- Offers an easy installation
- Built with a pre-assembled microphone box and a microphone holder
- Includes a terminal block with an easy-to-use plug-in cable

INCC-MIC Technical Specifications

SYSTEMS

INCC-MIC : Paging Microphone Module
Microphone Box : Durable gauge steel construction with microphone holder
Dimensions: 5.5" W x 6.5" H x 2.75" D
(14 W x 16.5 H x 7 D cm)

TEMPERATURE AND HUMIDITY RANGES

This system meets NFPA requirements for operation at 0 – 49°C/32 – 120°F and at a relative humidity 93% ± 2% RH (non-condensing) at 32°C ± 2°C (90°F ± 3°F). However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and its peripherals be installed in an environment with a normal room temperature of 15 – 27°C/60 – 80°F.

STANDARDS

The INCC-MIC is designed to comply with the following standards:
UL Standards: 864 9th Edition
2572 for Mass Notification

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult the factory for the latest listing status.
UL Listed: S1869, 2572 for Mass Notification
MEA FDNY Approved: COA # 6077
ISO 9001 Certification

For a complete listing of all compliance approvals and certifications, please visit: http://www.gamewell-fci.com/en-US/documentation/Pages/Listings.aspx

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For more information
Learn more about Gamewell-FCI's INCC-MIC and other products available by visiting www.Gamewell-FCI.com

Honeywell Gamewell-FCI
12 Clintonville Road
Northford, CT 06472-1610
203.484.7161
www.honeywell.com

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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7165-1703:0125
CATEGORY:	7165 - FIRE ALARM CONTROL UNIT (COMMERCIAL)
LISTEE:	GAMEWELL-FCI 12 Clintonville Road, Northford, CT, 06472 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Model E3 Series® BROADBAND and E3 Series® CLASSIC Voice Evacuation System. The E3 Systems may also work in conjunction with all the sub-assemblies of listee's 7100 Series Control Panel and NetSOLO systems (CSFM Listing No. 7165-1703:0105 and 6911-1703:0116, and 6911-1703:0118). Unit conveys all fire alarm, audio evacuation, voice paging, and fire fighter communications. Power-limited; non-coded, automatic, manual, smoke control, water flow, sprinkler supervisory, local auxiliary, central station, remote station, and proprietary service. Refer to listee's data sheet for additional detailed product description and operational considerations. System components: ILI-MB-E3; Intelligent Loop Interface Master Board PM-9, PM-9G; Power Supply ILI-95-MB-E3, ILI-95-S-E3; Loop Interface Subassemblies E3BB-FLUSH-LCD; Enclosure for lCD-E3 E3BB-BA/-RA/-BAA/-RAA/-BB/-RB/-BC/-RC/-BD; Cabinets RPT-E3-FO; or Repeater Sub-assembly, Fiber Optic or RPT-E3-UTP; Repeater Sub-assembly, Unshielded twisted pair wire LCD-E3; LCD Keypad Display *LCD-SLP; LCD Touchscreen Display Screen DACT-E3 sub-assembly; Digital alarm communicator transmitter ILI-S-E3; Intelligent Loop Unit, Expansion Board ANX-SR, ANX-MR-FO, ANX-MR-UTR; Addressable Node Expanders Sub Assembly INCC-E; Intelligent Network Enclosure INCC; Intelligent Network Central Command

	INI-VG, INI-VGC-UTP, INI-VGC-FO, INI-VGX-UTP; Intelligent Network Interface Sub Assembly INI-VGX-FO, INI-VGE-UTP, INI-VGE-FO; Intelligent Network Interface Sub Assembly ASM-16; Annunciator Switch Sub Assembly INX; Network Audio Transponder Enclosure ANU-48; Annunciator Sub Assembly NGA; Touch Screen LCD Display Sub Assembly LCD-7100; Remote LCD Display SBB-C4, SBB-D4; Backbox FCI-VDR-D4B, FCI-DR-C4B, FCI-CR-D4B; Doors with locks AA-100, AA-120; Amplifiers AM-50-25, AM-50-70; Amplifier Sub Assembly CHG120; Battery Charger with Cabinet BC-1/FCI-LBB; Backbox IPDACT-2; IP Digital Alarm Communicator FPJ; Firefighters's Telephone Jack Receptacle FHS; Portable Firefighters's Telephone Handset 7100 Series#; Fire Alarm Control Panel or INI-7100 UTP#; Intelligent Network Interface Sub-assembly, [Twisted, unshielded wire] or INI-7100 FO#; Intelligent Network Interface
RATING:	120 V, 60 Hz, 3.5 A Primary; 24 V dc, 9A Secondary
INSTALLATION:	In accordance with listee's printed installation instructions, NFPA 72, applicable codes and ordinances, and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model designation, electrical rating, and UL label.

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

APPROVAL:	Listed as fire alarm control unit for use with separately listed electrically and functionally compatible initiating and indicating devices. Suitable for high-rise applications when used with the above voice evacuation systems. This control unit can generate a distinctive three-pulse Temporal Pattern Fire Alarm Evacuation Signal (for total evacuation) in accordance with NPFA 72. This control unit meets the requirements of UL Standard 864, 9th Edition.
NOTES:	For Fire Alarm Verification Feature (delay of alarm signaling), the Retard/Reset/Restart period shall be 30 seconds or less.

*Revision 09-18-20 VWW

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: **05/05/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

Addressable Devices

Velociti® Series 3 Detectors

Photoelectric Detectors

Description

The Gamewell-FCI, Velociti® Series 3 intelligent photoelectric detectors with integral communication provide point location for alarm communication and selective maintenance. Designed in a modern bright white color, the Velociti Series 3 is aesthetically pleasing for today's contemporary buildings.

The Velociti Series 3 smoke detectors are intelligent addressable detectors with point ID capability that enable each detector address to be set with rotary address switches providing exact device locations. The photoelectric detector continually monitors the detected temperature and reports it to the fire alarm control panel. The modern design and expanded color options support a variety of contemporary aesthetic demands. In addition, each detector is constructed for exceptional installation and maintenance efficiency.

The Gamewell-FCI, ASD-PL3 photoelectric detector's re-designed optical sensing chamber is engineered to sense smoke produced by a wide range of combustion sources in accordance with more stringent code standards. The sensitivity of Velociti series detectors can be programmed using the control panel software to suit the environment. The ASD-PL3R photoelectric detector is also remote test capable that may be used with a DNR (DNRW) duct smoke detector housing. The ASD-PTL3 multi-sensor detector offers either photoelectric detection or thermal detection through dual electronic thermistors at 135°F fixed temperature thermal sensing.

For legacy installations, service detectors are available in the classic ivory color that will operate in both Velociti and CLIP protocol for backwards compatibility. Service models are designated by the -IV part number after the detector model.

Note: Although the E3 Series® and S3 Series panels support both the Velociti® and CLIP™ protocols, the GWF-7075 panel does not support the CLIP protocol. To obtain a complete list of panels that are listed to Velociti Series 3 detectors, refer to the Compatibility Addendum for Gamewell-FCI Manuals, P/N:9000-0427-L8.



Photoelectric Detector

FEATURES & BENEFITS

- Complies with UL® Standard 268 7th Edition
- Designed with a new profile to offer modern and improved aesthetics
- Contains a built-in functional test switch activated by external magnet
- Supports a low standby current
- Provides rotary address switches (01-159)
- Supplies optional relay, isolator, or sounder bases (standard or low frequency)
- Includes dual LEDs for 360° visibility
- Offers expanded color options

Ordering Information

NOTE: "-IV" suffix indicates Ivory color model.
NOTE: "-BL" suffix indicates Black color model.
NOTE: "WH" suffix indicates Bright White color model.
ASD-PL3: Photoelectric smoke detector, bright white, Velociti

ASD-PL3R: Photoelectric smoke detector, remote test capable, for use with DNR(W) duct smoke detectors, bright white, Velociti

ASD-PTL3: Photoelectric smoke detector with thermal sensing, bright white, Velociti

ASD-PL3-IV : Photoelectric smoke detector, ivory, Velociti/CLIP

ASD-PL3R-IV: Photoelectric smoke detector, remote test capable, for use with DNR(W) duct smoke detectors, ivory, Velociti/CLIP

ASD-PTL3-IV : Photoelectric smoke detector with thermal sensing, ivory, Velociti/CLIP

Intelligent Bases

For details on intelligent bases, refer to Data Sheet P/N: 9021-60540.

Note: "IV" suffix indicates Flashscan and CLIP devices.

"WH" suffix indicates bright white

B501-WHITE: 4" Flangeless mounting base, bright white

B501-WHITE-BP: 4" Flangeless mounting base bulk pack, bright white

B501-IV: 4" Flangeless mounting base, ivory

B300-6: 6" Flanged mounting base, bright white

B300-6-IV: 6" Flanged mounting base, ivory

B300-6-BP: 6" Flanged mounting base bulk (Pack of 10)

B200SR-WH: Standard sounder base, bright white

B200SR-IV: Standard sounder base, ivory

B200S-WH: Intelligent addressable sounder base, bright white

B200S-IV: Intelligent addressable sounder base, ivory

B200SR-LF-WH: Standard low frequency sounder base, bright white

B200SR-LF-IV: Standard low frequency sounder base, ivory

B200S-LF-WH: Intelligent addressable low frequency sounder base, bright white

B200S-LF-IV: Intelligent addressable low frequency sounder base, ivory

B224RB-WH: Relay base, bright white

B224RB-IV: Relay base, ivory

B224BI-WH: Isolator base, bright white

B224BI-IV: Isolator base, ivory

DNR: Intelligent duct detector housing, non-relay

DNRW: Intelligent duct detector housing, non-relay, watertight

Ordering Information

Accessories

SMB600: Surface Mounting Kit (flanged)

TR300: Accessory Flange Ring for B300 6" Base, bright white

TR300-IV: Accessory Flange Ring for B300 6" Base, ivory

RA100Z: Remote LED annunciator, 3-32 VDC

The annunciator mounts to a U.S. single-gang electrical box. For use with B501 and B300-6.

CK300: Bright White detector kit (Pack of 10)

CK300-IR: White, detector color kit for use with MCS-COF Series Detectors. (Pack of 10)

CK300-IV: Ivory, detector color kit. (Pack of 10)

CK300-IR-IV: Ivory, detector color kit for use with MCSCOF Series detectors. (Pack of 10)

CK300-BL: Black detector kit. (Pack of 10)

CK300-IR-Bl: Black, detector color kit for use with MCSCOF Series detectors. (Pack of 10)

M02-04-01: Detector test magnet.

M02-09-00: Test magnet with telescoping handle.

XR2B: Detector removal tool. Allows the installation and/or removal of the detector heads from the bases in high ceiling applications.

XP-4: Extension pole for XR2B. Shipped with three, 5-foot (1.524,m) sections.

Velociti® Series 3 Detectors Technical Specifications

SYSTEMS

Photoelectric Intelligent Detector:

Physical Specifications

Height: 2.0 inches (51 mm) installed in B300-6 base

Diameter:

6.1 inches (15.49 cm) installed in B300-6 base

4 inches (10.16 cm) installed in B501 base

Shipping Weight: 3.4 oz (96.4 g)

Operating Temperature Range:

Photo: 32° F to 122° F (0° C to 50° C)

Photo in Duct Applications: -4° F to 158° F (-20° C to 70° C)

Photo with Thermal: 32° F to 100° F (0° C to 38° C)

Operating Humidity Range: 10% to 93% non-condensing

Rate-of-Rise Detection: Responds to greater than 15°F/minute or 135°F (8.3° C/minute or 57°C

Air Velocity Range: 0 to 4,000 ft/min (0 to 1219.2 m/min)

Electrical Specifications

Voltage Range: 15 to 32 VDC

Standby Current (@ 24 VDC): 200 UA (one communication every 5 seconds with green LED enabled)

Max Alarm Current (max.): 2 mA @ 24 VDC (one communication every 5 seconds with red LED enabled)

Max Current (max.): 4.5 mA @ 24 VDC (one communication every 5 seconds with amber LED enabled)

Isolator Load Rating: 0.0063

STANDARDS

The Velociti® Series 3 Photoelectric Detectors are designed to comply with the following standard:

UL Standard: UL 268

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

UL: S2332

FM: 3023594

MEA FDNY: COA-219-02-E Vol. VI

CSFM: 7272-1703:0501

ISO 9001 Certification

For a complete listing of all compliance approvals and certifications, please visit: http://www.gamewell-fci.com/en-US/documentation/Pages/Listings.aspx

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For more information

Learn more about Gamewell-FCI's Velociti® Series 3 Detectors and other products available by visiting www.Gamewell-FCI.com

Honeywell Gamewell-FCI

12 Clintonville Road

Northford, CT 06472-1610

203.484.7161

www.honeywell.com

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OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7272-1703:0501
PARENT LISTING No.:	7272-0028:0503
CATEGORY:	7272 - SMOKE DETECTOR-SYSTEM TYPE-PHOTOELECTRIC
LISTEE:	GAMEWELL-FCI 12 Clintonville Road, Northford, CT, 06472 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Models ASD-PL3, ASD-PL3R, and ASD-PTL3 analog addressable, photoelectric smoke detectors for open area and duct installations. Model ASD-PTL3 has a complementary heat detector. All models are similarl except for population/depopulation of components on the Printed Wiring Board for the intended features. All above models may be followed by two digit Suffix indicating the color of the detector enclosure: no suffix for white, -IV for ivory, -BL for black. Refer to listee's Installation and Maintenance Instruction for additional detailed product description and operational considerations
RATING:	24 VDC.
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model number, electrical rating, and UL label.
APPROVAL:	Listed as photoelectric smoke detectors. Detectors are for use with separately listed System Sensor base Models *B501, *B210LP (CSFM Listing 7300-1653:0109), B200S and B200SR (CSFM Listing 7300-1653:0213), B200S-LF and B200SR-LF (CSFM Listing 7300-1653:0238), B300-6 and B300-6-IS bases (CSFM Listing 7300-1653:0109), *B224BI and *B224RB (CSFM Listing 7300-1653:0126), System Sensor duct detector housings Models DNR and DNRW (CSFM listing 3240-1653:0209) and separately listed compatible fire alarm control units. Refer to manufacturer's Installation Manual for details. *All models comply with the applicable requirements in ANSI/UL 268, Smoke Detectors for Fire Alarm Systems, 7th Edition, January 11, 2016.
NOTES:	

*Revision
12/17/19 DCC

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

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Date Issued: **05/04/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo** , Program Coordinator
Fire Engineering & Investigations Division

Select Series Mounting Base Options

System Sensor mounting bases and kits provide a variety of installation options for detectors in any application.



Features

- Bases enable quick and secure detector plug-in
- SEMS screws provide easy wiring connection
- Support for 12-24 AWG provides installation flexibility
- Multiple base formats meet application requirements
- Standard white color with ivory and black options
- UL 268 compliant
- Mechanical locking feature restricts removal of attached sensor head

Specialty Base Features

- Pre-wired mounting plate simplifies installation
- Application driven feature sets
- Sounder bases both UL 268 and UL 464 compliant

Agency Listings

SIGNALING UL LISTED S911

FM APPROVED 3062622

4" & 6" bases: 7300-1653:0109
Relay & Isolator bases: 7300-1653:0126
Sounder bases: 7135-1653:0213
Low-frequency bases: 7300-1653:0238

To meet local code and application requirements, System Sensor offers **standard 4" and 6" bases**, as well as, specialty base designs including relay, isolator, sounder and low frequency sounder options for Select Series detectors.

The standard 4" and 6" bases offer a plug-in detector base intended for use in intelligent systems, with screw terminals provided for power (+ and –), and remote annunciator connections. Communication takes place over the power (+ and –) lines. The 4" base offers a compact design while the 6" base provides compatibility with a wider range of junction boxes.

The Select Series specialty bases support application driven requirements. The bases employ a separate mounting plate that installs on various junction box sizes to eliminate unsightly surface-mount boxes. The mounting plate enables pre-wiring of all connections to speed and simplify installation.

Relay bases (B224RB-WH/B224RB-IV) provide one form C contact relay for control of auxiliary functions, such as door closure and elevator recall. The relay can operate in two different modes (short and long delay). The activation time for the short delay is 60 ms to 100 ms, while the activation time for the long delay is 6 sec to 10 sec. A shunt with pin headers, located on the base PC board, is used to set the delay timing.

Isolator bases (B224BI-WH/B224BI-IV) allow the Signaling Line Circuit (SLC) loop to operate under fault conditions created from a short circuit preventing an entire communication loop from being disabled. The base isolates the section of the loop containing the short circuit from the remainder of the circuit and automatically restores when the fault is corrected.

The Select Series **sounder and low frequency sounder bases** are designed for new and existing dwelling unit applications. They offer maximum flexibility in installation, configuration, and operation to meet or exceed UL 268 and UL 464 requirements. The

† Consult your fire alarm control panel manufacturer for compatibility with the addressable model of the sounder base.

Select Series low frequency sounder bases are designed to meet the NFPA 72 sleeping space requirement to produce a fundamental frequency of 520 Hz +/- 10% with a square wave or its equivalent. Studies show that a lower frequency, centered around 520 Hz, is the most ideal to wake sleeping occupants, even those with mild to severe hearing loss. The B200SR sounder and LF sounder bases (B200SR-WH/B200SR-IV/B200SR-LF-WH/B200SR-LF-IV) are fully compatible with existing B501BH-Series sounder base installations. The device enables users to select one of two B501-supported tones (ANSI Temporal 3 or Continuous) through a jumper.

The B200S sounder and LF sounder bases (B200S-WH/B200S-IV/B200S-LF-WH/B200S-LF-IV) adopt the same address as the detector, but use a unique device type on the loop. The Fire Alarm Control Panel (FACP) can use that address to command an individual sounder — or a group of sounders — to activate. The command set from the FACP can be tailored to multiple event-driven tone outputs allowing selection of volume (75 or 85 dBA), tone (ANSI Temporal 3, ANSI Temporal 4 or March Time) and group. In addition, some FACPs will enable custom tone patterns. The B200S series sounder bases recognize the System Sensor synchronization protocol. This enables it to be used as a component of the general evacuation signal — along with other System Sensor AV appliances — when connected to a power supply or FACP output capable of generating the System Sensor synchronization pulses.

Specifications – Select Series Bases

Physical Specifications	
Diameter	B501-WHITE, B501-IV, B501-BL: 4.0" (10.2 cm) B200S-WH, B200S-IV, B200S-LF-WH, B200S-LF-IV, B200SR-WH, B200SR-IV, B200SR-LF-WH, B200SR-LF-IV: 6.85" (17.4 cm) B300-6, B300-6-IV: 6.1" (155 mm) B224BI-WH, B224BI-IV, B224RB-WH, B224RB-IV: 6.85" (17.4 cm)
Base Height (without sensor)	B501-WHITE, B501-IV, B501-BL: 0.74" (18.8 mm) B200S-WH, B200S-IV, B200S-LF-WH, B200S-LF-IV, B200SR-WH, B200SR-IV, B200SR-LF-WH, B200SR-LF-IV: 1.6" (4.1 cm) B300-6, B300-6-IV: 0.76" (19 mm) B224BI-WH, B224BI-IV, B224RB-WH, B224RB-IV: 1.61" (4.1 cm)
Weight:	B501-WHITE 0.32 lb (145 gm) B200S-WH, B200S-IV, B200SR-WH, B200SR-IV: 0.50 lb (227 gm) B200S-LF-WH, B200S-LF-IV, B200SR-LF-WH, B200SR-LF-IV: Weight: 0.6 lb (272 gm) B300-6, B300-6-IV: 0.32 lb (145 gm) B224RB-WH, B224RB-IV, B224BI-WH, B224BI-IV 0.50 lb (227 gm)
Wire Gauge	B501-WHITE, B501-IV, B501-BL, B224BI-WH, B224BI-IV, B224RB-WH, B224RB-IV, B300-6, B300-6-IV: 18 AWG (0.823 mm^2) to 12 AWG (3.31 mm^2) B200S-WH, B200S-IV, B200S-LF-WH, B200S-LF-IV, B200SR-WH, B200SR-IV, B200SR-LF-WH, B200SR-LF-IV: 14 AWG to 12 AWG
Temperature Range	Refer to applicable sensor Operating Temperature Range using the Base/Sensor Cross Reference Chart at systemsensor.com
Humidity Range	10% to 93% RH non-condensing

Electrical Specifications: B501-WHITE, B501-IV, B501-BL (Includes base and detector)	
Operating Voltage	15 to 32 VDC
Standby Current	150 µA

Electrical Specifications: B300-6, B300-6-IV	
Operating Voltage	15 to 32 VDC
Standby Current	170 µA max.

Electrical Specifications: B224BI-WH, B22BI-IV	
Operating Voltage	15 to 32 VDC
Standby Current	450 µA max.
Isolation Current	15 mA max

Electrical Specifications: B224RB-WH, B22RB-IV	
Operating Voltage	15 to 32 VDC
Standby Current	170 µA max.
Set Time	Position 1, Short Delay: 60 to 100 ms Position 2, Long Delay: 6 to 10 sec
Reset Time	20 ms max.
Relay Characteristics	2 coil latching relay 1 Form C contact UL/ULC Rating:

CURRENT RATING	MAXIMUM VOLTAGE	LOAD DESCRIPTION	APPLICATION
2 A	25 VAC	PF = 0.35	Non-coded
3 A	30 VDC	Resistive	Non-coded
2 A	30 VDC	Resistive	Coded
0.46 A	30 VDC	(L/R = 20ms)	Non-coded
0.7 A	70.7 VAC	PF = 0.35	Non-coded
0.9 A	125 VDC	Resistive	Non-coded
0.5 A	125 VAC	PF = 0.75	Non-coded
0.3 A	125 VAC	PF = 0.35	Non-coded

Electrical Specifications: B200S-WH, B200S-IV	
External Supply Electrical Ratings	
External Supply Voltage	16 to 33 VDC (VFWR)
Standby Current:	500 µA maximum
Alarm Current:	35 mA maximum (at high volume setting); 15 mA maximum (at low volume setting)
SLC Electrical Ratings	
SLC Operating Voltage:	15 to 32 VDC
SLC Standby Current:	300 µA maximum
Sound Output	
High Volume:	Greater than 85 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)
Low Volume:	Greater than 75 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)

Electrical Specifications: B200S-LF-WH, B200S-LF-IV	
External Supply Electrical Ratings	
External Supply Voltage	16 to 33 VDC (VFWR)
Standby Current:	550 µA maximum VDC
Alarm Current, High-volume setting	70 mA maximum @ 33.0 VDC 90 mA maximum @ 24.0 VDC 140 mA maximum @16.0 VDC
Alarm Current, Low-volume setting	15 mA maximum @ 33.0 VDC 20 mA maximum @ 24.0 VDC 25 mA maximum @ 16.0 VDC
SLC Electrical Ratings	
SLC Operating Voltage:	15 to 32 VDC
SLC Standby Current:	300 µA maximum (base only, refer to applicable sensor specification)
Sound Output	
High Volume:	Greater than 85 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)
Low Volume:	Greater than 75 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)

Electrical Specifications: B200SR-WH, B200SR-IV	
External Supply Electrical Ratings	
External Supply Voltage	16 to 33 VDC (VFWR)
Standby Current:	500 µA maximum
Alarm Current:	35 mA maximum
SLC Electrical Ratings	
SLC Operating Voltage:	15 to 32 VDC
SLC Standby Current:	300 µA maximum
Sound Output	Greater than 85 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)

Electrical Specifications: B200SR-LF-WH, B200SR-LF-IV	
External Supply Electrical Ratings	
External Supply Voltage	16 to 33 VDC (VFWR)
Standby Current:	1 mA maximum VDC
Alarm Current	65 mA maximum @ 33.0 VDC 90 mA maximum @ 24.0 VDC 125 mA maximum @16.0 VDC
SLC Electrical Ratings	
SLC Operating Voltage:	15 to 32 VDC
SLC Standby Current:	Refer to applicable sensor specification.
Sound Output	Greater than 85 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)

Select Series Junction Box Selection Guide

Model	Single Gang	Double Gang	3.5" Octagonal	4" Octagonal	4" Square	4" Square with mud ring*	50 mm	60 mm	70 mm	75 mm
B501-WHITE, B501-IV, B501-BL	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No
B200S-WH, B200S-IV, B200S-LF-WH, B200S-LF-IV, B200SR-WH, B200SR-IV, B200SR-LF-WH, B200SR-LF-IV	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
B300-6, B300-6-IV	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
B224BI-WH, B224BI-IV	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
B224RB-WH, B224RB-IV	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No

* with 3.0" mud ring

Note: Box depth contingent on base and wire size. Refer to National Electric Code or applicable local codes for appropriate recommendations.

Ordering Information

Model			Description
White	Ivory	Black	
B501-WHITE	B501-IV	B501-BL	4" Flangeless mounting base
B501-WHITE-BP	—	—	4" Flangeless mounting base bulk pack, white
B300-6	B300-6-IV	—	6" Flanged mounting base
B300-6-BP	—	—	6" Flanged mounting base bulk pack, white
B200S-WH	B200S-IV	—	Intelligent addressable sounder base
B200S-LF-WH	B200S-LF-IV	—	Intelligent addressable sounder base, low-frequency
B200SR-WH	B200SR-IV	—	Standard sounder base (compatible with B501BH series)
B200SR-LF-WH	B200SR-LF-IV	—	Low-frequency sounder base (compatible with B501BH series)
B224BI-WH	B224BI-IV	—	Isolator base
B224RB-WH	B224RB-IV	—	Relay base

Related Accessories			
White	Ivory	Black	
CK300	CK300-IV	CK300-BL	Color kit (includes cover and trim ring)
CK300-IR	CK300-IR-IV	CK300-IR-BL	PTIR Color kit (includes cover and trim ring)
TR300	TR300-IV	—	Trim ring
—	SMB600		Surface mounting kit (flanged), ivory
RA100Z	—	—	Remote LED annunciator
M02-04-00			Detector test magnet
M02-09-00			Test magnet with telescoping handle

Accessories

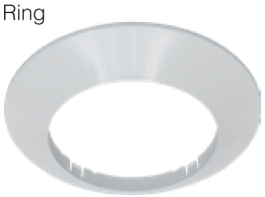
RA100Z
Remote LED Annunciator



CK300-BL
Color Kit



TR300
Trim Ring



SYSTEM SENSOR®

3825 Ohio Avenue • St. Charles, IL 60174
Phone: 800-SENSOR2 • Fax: 630-377-6495
www.systemsensor.com

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Product specifications subject to change without notice. Visit systemsensor.com for current product information, including the latest version of this data sheet.
SPDS901-00 • 04/04/2018

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7300-1653:0109
CATEGORY:	7300 - FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES
LISTEE:	System Sensor, Unincorporated Div of Honeywell Int'l Inc. 3825 Ohio Ave, St. Charles, IL, 60174 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Models B401, B401B, B401R, B401BR, B401BR-750, B401R-750, B402B, B404B, B404BT, B406B, B501, B501B, 14506587-002, B501BH, B501BHT, B401BH, B110LP, B110RLP, B110RLP750, B112LP, B114LP, B114LPBT, B116LP, B210LP, B501-BL, B50 IV, *B501-WHITE, B300-6, B300-6-IV, B300-6-IS detector bases. Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, *model number, *electrical rating and UL label.
APPROVAL:	Listed as detector bases for use with separately listed compatible detectors. *Refer to Manufacturers Installation Instruction Manual for details.
NOTES:	Formerly 7300-1209:128

*Rev 04-03-18 gt

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: **04/21/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

Addressable Devices

Velociti® Series 3 Detectors

Thermal Detectors

Description

The Gamewell-FCI, Velociti® Series 3 intelligent thermal detectors with integral communication provide point location for alarm communication and selective maintenance. Designed in a modern bright white color, the Velociti Series 3 is aesthetically pleasing for today's contemporary buildings.

The Velociti Series 3 heat detectors are intelligent addressable detectors with point ID capability that enable each detector address to be set with rotary address switches providing exact device locations. The thermal detector continually monitors the detected temperature and reports it to the fire alarm control panel. The modern design and expanded color options support a variety of contemporary aesthetic demands. In addition, each detector is constructed for exceptional installation and maintenance efficiency. Velociti Series 3 thermal detectors provide cost-effective, intelligent property protection using the following single thermistor:

- ATD-L3 offers 135°F fixed thermal detection.
- ATD-L3R offers 135°F fixed and rate-of-rise thermal detection.
- ATD-L3H provides fixed high-temperature detection at 190°F .

For legacy installations, service detectors are available in the classic ivory color that will operate in both Velociti and CLIP protocol for backwards compatibility. Service models are designated by the -IV part number that appears after the detector model.

Note: The E3 Series® and S3 Series panels support both the Velociti® and CLIP™ protocols, and the GWF-7075 panel supports only the Velociti® protocol. To obtain a complete list of panels that are listed to Velociti Series 3 detectors, refer to the Compatibility Addendum for Gamewell-FCI Manuals, P/N:9000-0427-L8.



Thermal Detector

FEATURES & BENEFITS

- Complies with UL® 268 7th Edition
- Designed with a new profile to offer modern and improved aesthetics
- Contains a built-in functional test switch activated by an external magnet
- Supports a low standby current
- Provides rotary address switches (01-159)
- Supplies optional relay, isolator, or sounder bases (standard or low frequency)
- Includes dual LEDs used for 360° visibility
- Offers expanded color options

Ordering Information

NOTE: "-IV" suffix indicates Ivory color model.

NOTE: "-BL" suffix indicates Black color model.

NOTE: "WH" suffix indicates Bright White color model.

ATD-L3: Thermal heat detector, 135°F fixed, bright white, Velociti

ATD-L3-IV: Thermal heat detector, 135°F fixed, ivory, Velociti/CLIP

ATD-L3R: Thermal heat detector, 135°F rate of rise, bright white, Velociti

ATD-L3R-IV: Thermal heat detector, 135°F rate of rise, ivory, Velociti/CLIP

ATD-L3H: Thermal heat detector, 190°F high temp, bright white, Velociti

ATD-L3H-IV: Thermal heat detector, 190°F high temp, ivory, Velociti/CLIP

Intelligent Bases

For details on intelligent bases, refer to Data Sheet P/N: 9021-60540.

B501-White: 4" Flangeless mounting base, bright white

B501-White-BP: 4" Flangeless mounting base bulk pack, bright white

B501-IV: 4" Flangeless mounting base, ivory

B501-BL

4" Flangeless mounting base,

B300-6: 6" Flanged mounting base, bright white

B300-6-IV: 6" Flanged mounting base, ivory

B300-6-BP: 6" Flanged mounting base bulk pack

B200SR-WH: Standard sounder base, bright white

B200SR-IV: Standard sounder base, ivory

B200S-WH: Intelligent addressable sounder base, bright white

B200S-IV: Intelligent addressable sounder base, ivory

B200SR-LF-WH: Standard low frequency sounder base, bright white

B200SR-LF-IV: Standard low frequency sounder base, ivory

B200S-LF-WH: Intelligent addressable low frequency sounder base, bright white

B200S-LF-IV: Intelligent addressable low frequency sounder base, ivory

B224RB-WH: Relay base, bright white

B224RB-IV: Relay base, ivory

B224BI-WH: Isolator base, bright white

B224BI-IV: Isolator base, ivory

Ordering Information

Accessories

SMB600: Surface Mounting Kit (flanged)

TR300: Accessory Flange Ring for B300 6" Base, bright white

TR300-IV: Accessory Flange Ring for B300 6" Base, ivory

RA100Z: Remote LED annunciator, 3-32 VDC

The annunciator mounts to a U.S. single-gang electrical box. For use with B501 and B300-6.

CK300: Bright White detector kit (Pack of 10)

CK300-IR: White, detector color kit for use with MCS-COF Series Detectors. (Pack of 10)

CK300-IV: Ivory, detector color kit. (Pack of 10)

CK300-IR-IV: Ivory, detector color kit for use with MCS-COF Series detectors. (Pack of 10)

CK300-BL: Black detector kit (Pack of 10)

CK300-IR-Bl: Black, detector color kit for use with MCS-COF Series detectors. (Pack of 10)

M02-04-01: Detector test magnet.

M02-09-00: Test magnet with telescoping handle.

XR2B: Detector removal tool. Allows the installation and/or removal of the detector heads from the bases in high ceiling applications.

XP-4: Extension pole for XR2B. Shipped with three, 5-foot (1.524,m) sections.

Velociti® Series 3 Detectors Technical Specifications

SYSTEMS

Thermal Intelligent Detector

Physical Specifications

Height: 2.0 inches (51 mm) installed in B300-6 base

Diameter:

6.1 inches (15.6 cm) installed in B300-6 base

4 inches (10.2 cm) installed in B501 base

Shipping Weight: 3.4 oz (95 g)

Operating Temperature Range:

Thermal 135° F fixed: -4° F to 100° F (-20° C to 38° C)

Thermal 135° F rate-of-rise: -4° F to 100° F (-20° C to 38° C)

Thermal 190° F rate-of-rise: -4° F to 135° F (-20° C to 57° C)

Operating Humidity Range: 10% to 93% non-condensing

Rate-of-Rise Detection: : Responds to greater than 15°F/minute or 135°F (8.3° C/minute or 57°C

Electrical Specifications

Voltage Range: : 15 to 32 VDC

Standby Current (@ 24 VDC): 200 uA (one communication every 5 seconds with green LED enabled)

Max Alarm Current (max.): : 2 mA @ 24 VDC (one communication every 5 seconds with red LED enabled)

Max Current (max.): : 4.5 mA @ 24 VDC (one communication every 5 seconds with amber LED enabled)

Isolator Load Rating: : 0.0063

STANDARDS

The Velociti® Series 3 Thermal Detectors are designed to comply with the following standard:

UL Standard: UL 268

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

UL: S2332

FM: 3023594

MEA-FDNY: 219-02-E Vol. VI

CSFM: 7270-1703-0502

ISO 9001 Certification

For a complete listing of all compliance approvals and certifications, please visit: http://www.gamewell-fci.com/en-US/documentation/Pages/Listings.aspx

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UL® is a registered trademark of Underwriter's Laboratories Inc.

This document is not intended to be used for installation purposes. We try to keep our product information up-to-date and accurate. We cannot cover all specific applications or anticipate all requirements. All specifications are subject to change without notice.

For more information

Learn more about Gamewell-FCI's Velociti® Series 3 Detectors and other products available by visiting www.Gamewell-FCI.com

Honeywell Gamewell-FCI
12 Clintonville Road
Northford, CT 06472-1610
203.484.7161
www.honeywell.com

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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7270-1703:0502
PARENT LISTING No.:	7270-0028:0502
CATEGORY:	7270 - HEAT DETECTOR
LISTEE:	GAMEWELL-FCI 12 Clintonville Road, Northford, CT, 06472 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Models ATD-L3, ATD-L3H (fixed temperature) and ATD-L3R (fixed temperature with Rate-of-Rise) electronic heat detectors. Suffix -IV for ivory color and -BL for black color. Refer to listee's data sheet for additional detailed product description and operational considerations.
RATING:	Model ATD-L3 (fixed temperature): 135°F. Model ATD-L3H (fixed temperature): 190°F. Model ATD-L3R (fixed temperature with rate of rise):135°F.
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model number, electrical ratings, and UL label.
APPROVAL:	Listed as heat detectors for use with Notifier base B710LP (CSFM#7300-0028:173); System Sensor bases B501, B210LP, B300-6, B300-6-IS (CSFM#7300-1653:0109); B224BI, B224RB (CSFM#7300-1653:0126); B200S, B200SR (CSFM#7300-1653:0213); B200S-LF, B200SR-LF (CSFM#7300-1653:238); and separately listed compatible fire alarm control units. Refer to listee's Installation Instructions Manual for details.
NOTES:	

02-01-18 gt

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

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Date Issued: **05/04/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo** , Program Coordinator
Fire Engineering & Investigations Division

Select Series Mounting Base Options

System Sensor mounting bases and kits provide a variety of installation options for detectors in any application.



Features

- Bases enable quick and secure detector plug-in
- SEMS screws provide easy wiring connection
- Support for 12-24 AWG provides installation flexibility
- Multiple base formats meet application requirements
- Standard white color with ivory and black options
- UL 268 compliant
- Mechanical locking feature restricts removal of attached sensor head

Specialty Base Features

- Pre-wired mounting plate simplifies installation
- Application driven feature sets
- Sounder bases both UL 268 and UL 464 compliant

Agency Listings

SIGNALING UL LISTED S911

FM APPROVED 3062622

4" & 6" bases: 7300-1653:0109
Relay & Isolator bases: 7300-1653:0126
Sounder bases: 7135-1653:0213
Low-frequency bases: 7300-1653:0238

To meet local code and application requirements, System Sensor offers **standard 4" and 6" bases**, as well as, specialty base designs including relay, isolator, sounder and low frequency sounder options for Select Series detectors.

The standard 4" and 6" bases offer a plug-in detector base intended for use in intelligent systems, with screw terminals provided for power (+ and –), and remote annunciator connections. Communication takes place over the power (+ and –) lines. The 4" base offers a compact design while the 6" base provides compatibility with a wider range of junction boxes.

The Select Series specialty bases support application driven requirements. The bases employ a separate mounting plate that installs on various junction box sizes to eliminate unsightly surface-mount boxes. The mounting plate enables pre-wiring of all connections to speed and simplify installation.

Relay bases (B224RB-WH/B224RB-IV) provide one form C contact relay for control of auxiliary functions, such as door closure and elevator recall. The relay can operate in two different modes (short and long delay). The activation time for the short delay is 60 ms to 100 ms, while the activation time for the long delay is 6 sec to 10 sec. A shunt with pin headers, located on the base PC board, is used to set the delay timing.

Isolator bases (B224BI-WH/B224BI-IV) allow the Signaling Line Circuit (SLC) loop to operate under fault conditions created from a short circuit preventing an entire communication loop from being disabled. The base isolates the section of the loop containing the short circuit from the remainder of the circuit and automatically restores when the fault is corrected.

The Select Series **sounder and low frequency sounder bases** are designed for new and existing dwelling unit applications. They offer maximum flexibility in installation, configuration, and operation to meet or exceed UL 268 and UL 464 requirements. The

† Consult your fire alarm control panel manufacturer for compatibility with the addressable model of the sounder base.

Select Series low frequency sounder bases are designed to meet the NFPA 72 sleeping space requirement to produce a fundamental frequency of 520 Hz +/- 10% with a square wave or its equivalent. Studies show that a lower frequency, centered around 520 Hz, is the most ideal to wake sleeping occupants, even those with mild to severe hearing loss. The B200SR sounder and LF sounder bases (B200SR-WH/B200SR-IV/B200SR-LF-WH/B200SR-LF-IV) are fully compatible with existing B501BH-Series sounder base installations. The device enables users to select one of two B501-supported tones (ANSI Temporal 3 or Continuous) through a jumper.

The B200S sounder and LF sounder bases (B200S-WH/B200S-IV/B200S-LF-WH/B200S-LF-IV) adopt the same address as the detector, but use a unique device type on the loop. The Fire Alarm Control Panel (FACP) can use that address to command an individual sounder — or a group of sounders — to activate. The command set from the FACP can be tailored to multiple event-driven tone outputs allowing selection of volume (75 or 85 dBA), tone (ANSI Temporal 3, ANSI Temporal 4 or March Time) and group. In addition, some FACPs will enable custom tone patterns. The B200S series sounder bases recognize the System Sensor synchronization protocol. This enables it to be used as a component of the general evacuation signal — along with other System Sensor AV appliances — when connected to a power supply or FACP output capable of generating the System Sensor synchronization pulses.

Specifications – Select Series Bases

Physical Specifications	
Diameter	B501-WHITE, B501-IV, B501-BL: 4.0" (10.2 cm) B200S-WH, B200S-IV, B200S-LF-WH, B200S-LF-IV, B200SR-WH, B200SR-IV, B200SR-LF-WH, B200SR-LF-IV: 6.85" (17.4 cm) B300-6, B300-6-IV: 6.1" (155 mm) B224BI-WH, B224BI-IV, B224RB-WH, B224RB-IV: 6.85" (17.4 cm)
Base Height (without sensor)	B501-WHITE, B501-IV, B501-BL: 0.74" (18.8 mm) B200S-WH, B200S-IV, B200S-LF-WH, B200S-LF-IV, B200SR-WH, B200SR-IV, B200SR-LF-WH, B200SR-LF-IV: 1.6" (4.1 cm) B300-6, B300-6-IV: 0.76" (19 mm) B224BI-WH, B224BI-IV, B224RB-WH, B224RB-IV: 1.61" (4.1 cm)
Weight:	B501-WHITE 0.32 lb (145 gm) B200S-WH, B200S-IV, B200SR-WH, B200SR-IV: 0.50 lb (227 gm) B200S-LF-WH, B200S-LF-IV, B200SR-LF-WH, B200SR-LF-IV: Weight: 0.6 lb (272 gm) B300-6, B300-6-IV: 0.32 lb (145 gm) B224RB-WH, B224RB-IV, B224BI-WH, B224BI-IV 0.50 lb (227 gm)
Wire Gauge	B501-WHITE, B501-IV, B501-BL, B224BI-WH, B224BI-IV, B224RB-WH, B224RB-IV, B300-6, B300-6-IV: 18 AWG (0.823 mm^2) to 12 AWG (3.31 mm^2) B200S-WH, B200S-IV, B200S-LF-WH, B200S-LF-IV, B200SR-WH, B200SR-IV, B200SR-LF-WH, B200SR-LF-IV: 14 AWG to 12 AWG
Temperature Range	Refer to applicable sensor Operating Temperature Range using the Base/Sensor Cross Reference Chart at systemsensor.com
Humidity Range	10% to 93% RH non-condensing

Electrical Specifications: B501-WHITE, B501-IV, B501-BL (Includes base and detector)	
Operating Voltage	15 to 32 VDC
Standby Current	150 µA

Electrical Specifications: B300-6, B300-6-IV	
Operating Voltage	15 to 32 VDC
Standby Current	170 µA max.

Electrical Specifications: B224BI-WH, B22BI-IV	
Operating Voltage	15 to 32 VDC
Standby Current	450 µA max.
Isolation Current	15 mA max

Electrical Specifications: B224RB-WH, B22RB-IV	
Operating Voltage	15 to 32 VDC
Standby Current	170 µA max.
Set Time	Position 1, Short Delay: 60 to 100 ms Position 2, Long Delay: 6 to 10 sec
Reset Time	20 ms max.
Relay Characteristics	2 coil latching relay 1 Form C contact UL/ULC Rating:

CURRENT RATING	MAXIMUM VOLTAGE	LOAD DESCRIPTION	APPLICATION
2 A	25 VAC	PF = 0.35	Non-coded
3 A	30 VDC	Resistive	Non-coded
2 A	30 VDC	Resistive	Coded
0.46 A	30 VDC	(L/R = 20ms)	Non-coded
0.7 A	70.7 VAC	PF = 0.35	Non-coded
0.9 A	125 VDC	Resistive	Non-coded
0.5 A	125 VAC	PF = 0.75	Non-coded
0.3 A	125 VAC	PF = 0.35	Non-coded

Electrical Specifications: B200S-WH, B200S-IV	
External Supply Electrical Ratings	
External Supply Voltage	16 to 33 VDC (VFWR)
Standby Current:	500 µA maximum
Alarm Current:	35 mA maximum (at high volume setting); 15 mA maximum (at low volume setting)
SLC Electrical Ratings	
SLC Operating Voltage:	15 to 32 VDC
SLC Standby Current:	300 µA maximum
Sound Output	
High Volume:	Greater than 85 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)
Low Volume:	Greater than 75 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)

Electrical Specifications: B200S-LF-WH, B200S-LF-IV	
External Supply Electrical Ratings	
External Supply Voltage	16 to 33 VDC (VFWR)
Standby Current:	550 µA maximum VDC
Alarm Current, High-volume setting	70 mA maximum @ 33.0 VDC 90 mA maximum @ 24.0 VDC 140 mA maximum @16.0 VDC
Alarm Current, Low-volume setting	15 mA maximum @ 33.0 VDC 20 mA maximum @ 24.0 VDC 25 mA maximum @ 16.0 VDC
SLC Electrical Ratings	
SLC Operating Voltage:	15 to 32 VDC
SLC Standby Current:	300 µA maximum (base only, refer to applicable sensor specification)
Sound Output	
High Volume:	Greater than 85 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)
Low Volume:	Greater than 75 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)

Electrical Specifications: B200SR-WH, B200SR-IV	
External Supply Electrical Ratings	
External Supply Voltage	16 to 33 VDC (VFWR)
Standby Current:	500 µA maximum
Alarm Current:	35 mA maximum
SLC Electrical Ratings	
SLC Operating Voltage:	15 to 32 VDC
SLC Standby Current:	300 µA maximum
Sound Output	Greater than 85 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)

Electrical Specifications: B200SR-LF-WH, B200SR-LF-IV	
External Supply Electrical Ratings	
External Supply Voltage	16 to 33 VDC (VFWR)
Standby Current:	1 mA maximum VDC
Alarm Current	65 mA maximum @ 33.0 VDC 90 mA maximum @ 24.0 VDC 125 mA maximum @16.0 VDC
SLC Electrical Ratings	
SLC Operating Voltage:	15 to 32 VDC
SLC Standby Current:	Refer to applicable sensor specification.
Sound Output	Greater than 85 dBA minimum measured in a UL reverberant room at 10 feet, 24 Volts (in continuous tone)

Select Series Junction Box Selection Guide

Model	Single Gang	Double Gang	3.5" Octagonal	4" Octagonal	4" Square	4" Square with mud ring*	50 mm	60 mm	70 mm	75 mm
B501-WHITE, B501-IV, B501-BL	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No
B200S-WH, B200S-IV, B200S-LF-WH, B200S-LF-IV, B200SR-WH, B200SR-IV, B200SR-LF-WH, B200SR-LF-IV	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
B300-6, B300-6-IV	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
B224BI-WH, B224BI-IV	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
B224RB-WH, B224RB-IV	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No

* with 3.0" mud ring

Note: Box depth contingent on base and wire size. Refer to National Electric Code or applicable local codes for appropriate recommendations.

Ordering Information

Model			Description
White	Ivory	Black	
B501-WHITE	B501-IV	B501-BL	4" Flangeless mounting base
B501-WHITE-BP	—	—	4" Flangeless mounting base bulk pack, white
B300-6	B300-6-IV	—	6" Flanged mounting base
B300-6-BP	—	—	6" Flanged mounting base bulk pack, white
B200S-WH	B200S-IV	—	Intelligent addressable sounder base
B200S-LF-WH	B200S-LF-IV	—	Intelligent addressable sounder base, low-frequency
B200SR-WH	B200SR-IV	—	Standard sounder base (compatible with B501BH series)
B200SR-LF-WH	B200SR-LF-IV	—	Low-frequency sounder base (compatible with B501BH series)
B224BI-WH	B224BI-IV	—	Isolator base
B224RB-WH	B224RB-IV	—	Relay base

Related Accessories			
White	Ivory	Black	
CK300	CK300-IV	CK300-BL	Color kit (includes cover and trim ring)
CK300-IR	CK300-IR-IV	CK300-IR-BL	PTIR Color kit (includes cover and trim ring)
TR300	TR300-IV	—	Trim ring
—	SMB600		Surface mounting kit (flanged), ivory
RA100Z	—	—	Remote LED annunciator
M02-04-00			Detector test magnet
M02-09-00			Test magnet with telescoping handle

Accessories

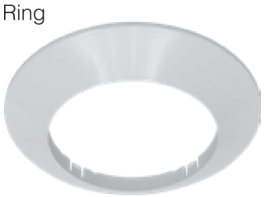
RA100Z
Remote LED Annunciator



CK300-BL
Color Kit



TR300
Trim Ring



SYSTEM SENSOR®

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SPDS901-00 • 04/04/2018

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7300-1653:0109
CATEGORY:	7300 - FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES
LISTEE:	System Sensor, Unincorporated Div of Honeywell Int'l Inc. 3825 Ohio Ave, St. Charles, IL, 60174 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Models B401, B401B, B401R, B401BR, B401BR-750, B401R-750, B402B, B404B, B404BT, B406B, B501, B501B, 14506587-002, B501BH, B501BHT, B401BH, B110LP, B110RLP, B110RLP750, B112LP, B114LP, B114LPBT, B116LP, B210LP, B501-BL, B50 IV, *B501-WHITE, B300-6, B300-6-IV, B300-6-IS detector bases. Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, *model number, *electrical rating and UL label.
APPROVAL:	Listed as detector bases for use with separately listed compatible detectors. *Refer to Manufacturers Installation Instruction Manual for details.
NOTES:	Formerly 7300-1209:128

*Rev 04-03-18 gt

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: **04/21/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

Addressable Devices

Velociti® Series 3 Detectors

Thermal Detectors

Description

The Gamewell-FCI, Velociti® Series 3 intelligent thermal detectors with integral communication provide point location for alarm communication and selective maintenance. Designed in a modern bright white color, the Velociti Series 3 is aesthetically pleasing for today's contemporary buildings.

The Velociti Series 3 heat detectors are intelligent addressable detectors with point ID capability that enable each detector address to be set with rotary address switches providing exact device locations. The thermal detector continually monitors the detected temperature and reports it to the fire alarm control panel. The modern design and expanded color options support a variety of contemporary aesthetic demands. In addition, each detector is constructed for exceptional installation and maintenance efficiency. Velociti Series 3 thermal detectors provide cost-effective, intelligent property protection using the following single thermistor:

- ATD-L3 offers 135°F fixed thermal detection.
- ATD-L3R offers 135°F fixed and rate-of-rise thermal detection.
- ATD-L3H provides fixed high-temperature detection at 190°F .

For legacy installations, service detectors are available in the classic ivory color that will operate in both Velociti and CLIP protocol for backwards compatibility. Service models are designated by the -IV part number that appears after the detector model.

Note: The E3 Series® and S3 Series panels support both the Velociti® and CLIP™ protocols, and the GWF-7075 panel supports only the Velociti® protocol. To obtain a complete list of panels that are listed to Velociti Series 3 detectors, refer to the Compatibility Addendum for Gamewell-FCI Manuals, P/N:9000-0427-L8.



Thermal Detector

FEATURES & BENEFITS

- Complies with UL® 268 7th Edition
- Designed with a new profile to offer modern and improved aesthetics
- Contains a built-in functional test switch activated by an external magnet
- Supports a low standby current
- Provides rotary address switches (01-159)
- Supplies optional relay, isolator, or sounder bases (standard or low frequency)
- Includes dual LEDs used for 360° visibility
- Offers expanded color options

Ordering Information

NOTE: "-IV" suffix indicates Ivory color model.

NOTE: "-BL" suffix indicates Black color model.

NOTE: "WH" suffix indicates Bright White color model.

ATD-L3: Thermal heat detector, 135°F fixed, bright white, Velociti

ATD-L3-IV: Thermal heat detector, 135°F fixed, ivory, Velociti/CLIP

ATD-L3R: Thermal heat detector, 135°F rate of rise, bright white, Velociti

ATD-L3R-IV: Thermal heat detector, 135°F rate of rise, ivory, Velociti/CLIP

ATD-L3H: Thermal heat detector, 190°F high temp, bright white, Velociti

ATD-L3H-IV: Thermal heat detector, 190°F high temp, ivory, Velociti/CLIP

Intelligent Bases

For details on intelligent bases, refer to Data Sheet P/N: 9021-60540.

B501-White: 4" Flangeless mounting base, bright white

B501-White-BP: 4" Flangeless mounting base bulk pack, bright white

B501-IV: 4" Flangeless mounting base, ivory

B501-BL

4" Flangeless mounting base,

B300-6: 6" Flanged mounting base, bright white

B300-6-IV: 6" Flanged mounting base, ivory

B300-6-BP: 6" Flanged mounting base bulk pack

B200SR-WH: Standard sounder base, bright white

B200SR-IV: Standard sounder base, ivory

B200S-WH: Intelligent addressable sounder base, bright white

B200S-IV: Intelligent addressable sounder base, ivory

B200SR-LF-WH: Standard low frequency sounder base, bright white

B200SR-LF-IV: Standard low frequency sounder base, ivory

B200S-LF-WH: Intelligent addressable low frequency sounder base, bright white

B200S-LF-IV: Intelligent addressable low frequency sounder base, ivory

B224RB-WH: Relay base, bright white

B224RB-IV: Relay base, ivory

B224BI-WH: Isolator base, bright white

B224BI-IV: Isolator base, ivory

Ordering Information

Accessories

SMB600: Surface Mounting Kit (flanged)

TR300: Accessory Flange Ring for B300 6" Base, bright white

TR300-IV: Accessory Flange Ring for B300 6" Base, ivory

RA100Z: Remote LED annunciator, 3-32 VDC

The annunciator mounts to a U.S. single-gang electrical box. For use with B501 and B300-6.

CK300: Bright White detector kit (Pack of 10)

CK300-IR: White, detector color kit for use with MCS-COF Series Detectors. (Pack of 10)

CK300-IV: Ivory, detector color kit. (Pack of 10)

CK300-IR-IV: Ivory, detector color kit for use with MCS-COF Series detectors. (Pack of 10)

CK300-BL: Black detector kit (Pack of 10)

CK300-IR-Bl: Black, detector color kit for use with MCS-COF Series detectors. (Pack of 10)

M02-04-01: Detector test magnet.

M02-09-00: Test magnet with telescoping handle.

XR2B: Detector removal tool. Allows the installation and/or removal of the detector heads from the bases in high ceiling applications.

XP-4: Extension pole for XR2B. Shipped with three, 5-foot (1.524,m) sections.

Velociti® Series 3 Detectors Technical Specifications

SYSTEMS

Thermal Intelligent Detector

Physical Specifications

Height: 2.0 inches (51 mm) installed in B300-6 base

Diameter:

6.1 inches (15.6 cm) installed in B300-6 base

4 inches (10.2 cm) installed in B501 base

Shipping Weight: 3.4 oz (95 g)

Operating Temperature Range:

Thermal 135° F fixed: -4° F to 100° F (-20° C to 38° C)

Thermal 135° F rate-of-rise: -4° F to 100° F (-20° C to 38° C)

Thermal 190° F rate-of-rise: -4° F to 135° F (-20° C to 57° C)

Operating Humidity Range: 10% to 93% non-condensing

Rate-of-Rise Detection: : Responds to greater than 15°F/minute or 135°F (8.3° C/minute or 57°C

Electrical Specifications

Voltage Range: : 15 to 32 VDC

Standby Current (@ 24 VDC): 200 uA (one communication every 5 seconds with green LED enabled)

Max Alarm Current (max.): : 2 mA @ 24 VDC (one communication every 5 seconds with red LED enabled)

Max Current (max.): : 4.5 mA @ 24 VDC (one communication every 5 seconds with amber LED enabled)

Isolator Load Rating: : 0.0063

STANDARDS

The Velociti® Series 3 Thermal Detectors are designed to comply with the following standard:

UL Standard: UL 268

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

UL: S2332

FM: 3023594

MEA-FDNY: 219-02-E Vol. VI

CSFM: 7270-1703-0502

ISO 9001 Certification

For a complete listing of all compliance approvals and certifications, please visit: http://www.gamewell-fci.com/en-US/documentation/Pages/Listings.aspx

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UL® is a registered trademark of Underwriter's Laboratories Inc.

This document is not intended to be used for installation purposes. We try to keep our product information up-to-date and accurate. We cannot cover all specific applications or anticipate all requirements. All specifications are subject to change without notice.

For more information

Learn more about Gamewell-FCI's Velociti® Series 3 Detectors and other products available by visiting www.Gamewell-FCI.com

Honeywell Gamewell-FCI
12 Clintonville Road
Northford, CT 06472-1610
203.484.7161
www.honeywell.com

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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7270-1703:0502
PARENT LISTING No.:	7270-0028:0502
CATEGORY:	7270 - HEAT DETECTOR
LISTEE:	GAMEWELL-FCI 12 Clintonville Road, Northford, CT, 06472 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Models ATD-L3, ATD-L3H (fixed temperature) and ATD-L3R (fixed temperature with Rate-of-Rise) electronic heat detectors. Suffix -IV for ivory color and -BL for black color. Refer to listee's data sheet for additional detailed product description and operational considerations.
RATING:	Model ATD-L3 (fixed temperature): 135°F. Model ATD-L3H (fixed temperature): 190°F. Model ATD-L3R (fixed temperature with rate of rise):135°F.
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model number, electrical ratings, and UL label.
APPROVAL:	Listed as heat detectors for use with Notifier base B710LP (CSFM#7300-0028:173); System Sensor bases B501, B210LP, B300-6, B300-6-IS (CSFM#7300-1653:0109); B224BI, B224RB (CSFM#7300-1653:0126); B200S, B200SR (CSFM#7300-1653:0213); B200S-LF, B200SR-LF (CSFM#7300-1653:238); and separately listed compatible fire alarm control units. Refer to listee's Installation Instructions Manual for details.
NOTES:	

02-01-18 gt

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test resultsand/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria.Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: **05/04/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo** , Program Coordinator
Fire Engineering & Investigations Division

INTELLIGENT BASES

Standard, Relay, Isolator, Sounder, and Low Frequency Sounder Bases

To meet local code and application requirements, Gamewell-FCI® offers standard 4" and 6" bases, as well as specialty base designs including relay, isolator, sounder and low frequency sounder bases that are UL listed for low frequency operation and comply with NFPA 72 requirements for sleeping spaces for the new Gamewell-FCI Series of addressable detectors as well as previous generations.

The standard 4" and 6" bases offer a plug-in detector base intended for use in intelligent systems, with screw terminals provided for power (+ and –), and remote annunciator connections. Communication takes place over the power (+ and –) lines. The 4" base offers a compact design while the 6" base provides compatibility with a wider range of junction boxes.

The specialty bases support application driven requirements. These bases employ a separate mounting plate that installs on various junction box sizes to eliminate unsightly surface-mount boxes. The mounting plate enables pre-wiring of all connections to speed and simplify installation.

Relay bases (B224RB-WH/B224RB-IV) provide one form-C contact relay for control of auxiliary functions, such as door closure and elevator recall. The relay can operate in two different modes (short and long delay). The activation time for the short delay is 60-100 milliseconds, while the activation time for the long delay is 6-10 seconds. A shunt with pin headers, located on the base PC board, is used to set the delay timing.

Isolator bases (B224BI-WH/B224BI-IV) allow the Signaling Line Circuit (SLC) loop to operate under fault conditions created from a short circuit preventing an entire communication loop from being disabled. The base isolates the section of the loop containing the short circuit from the remainder of the circuit and automatically restores when the fault is corrected.

Sounder and low frequency (-LF) sounder bases are designed for new and existing dwelling unit applications. They offer maximum flexibility in installation, configuration, and operation to meet or exceed UL 268 and UL 464 requirements. The low frequency sounder bases are designed to meet the NFPA 72 sleeping space requirement to produce a fundamental frequency of 520 Hz +/- 10% with a square wave or its equivalent. Studies show that a lower frequency, centered around 520 Hz, is the most ideal to wake sleeping occupants, even those with mild to severe hearing loss.



B300-6 Standard 6" Base (White)



B200S-WH Sounder Base (White)



B501-WHITE Flangeless 4" Base (White)



B501-BL Flangeless 4" Base (Black)

FEATURES AND BENEFITS

- Bases enable quick and secure detector plug-in
- SEMS Screws provide easy wiring connection
- UL 268 compliant
- Support for 12-24 AWG provides installation flexibility
- Multiple base formats meet application requirements
- Standard white color with ivory and black options
- Mechanical locking feature restricts removal of attached sensor head
- Specialty Base Features:
- Pre-wired mounting plate simplifies installation
- Application driven feature sets
- Sounder bases both UL268 and UL464 compliant

Honeywell

Gamewell FCI FIRE CONTROL INSTRUMENTS

The B200S sounder and LF sounder bases (B200S-WH/B200S-IV/B200S-LF-WH/B200S-LF-IV) adopt the same address as the detector, but use a unique device type on the loop. The Fire Alarm Control Panel (FACP) can use that address to command an individual sounder — or a group of sounders — to activate. The command set from the FACP can be tailored to multiple event-driven tone outputs allowing selection of volume (75 or 85 dBA), tone (ANSI Temporal 3, ANSI Temporal 4, or March Time) and group. In addition, some FACPs will enable custom tone patterns. The B200S series sounder bases recognize the System Sensor synchronization protocol. This enables them to be used as a component of the general evacuation signal — along with other System Sensor AV appliances — when connected to a power supply or FACP output capable of generating the System Sensor synchronization pulses.

The B200SR sounder and LF sounder bases (B200SR-WH/B200SR-IV/B200SR-LF-WH/B200SR-LF-IV) are fully compatible with existing B501BH Series sounder base installations. The device enables users to select one of two B501-supported tones (ANSI Temporal 3 or Continuous) through a jumper.

PRODUCT LINE INFORMATION

INTELLIGENT BASES

"-IV" suffix indicates Ivory color model.

"-BL" suffix indicates Black color model.

"-WH" and "-WHITE" suffix indicates White color model.

B210LP: Flanged mounted base.

B210LPA: Same as B210LP; ULC listed.

B210LPBP: Bulk pack of B210LP, contains 10.

B300-6: White, 6" base, standard flanged low-profile mounting base

B300-6-BP: Bulk pack of B300-6, package contains 10

B300-6-IV: Ivory,6" base, standard flanged low-profile mounting base.

B501-WHITE: White, 4" standard European flangeless mounting base. UL/ULC listed

B501-WHITE-BP: Bulk pack of B501-WHITE, contains 10

B501-BL: Black, 4" standard European flangeless mounting base

B501-IV: Ivory color, 4" standard European flangeless mounting base

B224RB-WH: White, relay base

B224RB-IV: Ivory, relay base

B224BI-WH: White, isolator detector base

B224BI-IV: Ivory isolator detector base

B200S-WH: White, Intelligent addressable sounder base capable of producing sound output in high or low volume with ANSI Temporal 3, ANSI Temporal 4, continuous tone, marching tone, and custom tone; Uses Velociti® protocol

B200S-IV: Ivory, Intelligent addressable sounder base capable of producing sound output in high or low volume with ANSI Temporal 3, ANSI Temporal 4, continuous tone, marching tone, and custom tone; Uses Velociti® protocol

B200S-LF-WH: White, Low Frequency Intelligent, programmable sounder base, produces a fundamental frequency of 520 Hz +/- 10% with a square wave or its equivalent; designed to meet the NFPA 72 sleeping space requirement

B200S-LF-IV: Ivory, Low Frequency Intelligent, programmable sounder base, produces a fundamental frequency of 520 Hz +/- 10% with a square wave or its equivalent; designed to meet the NFPA 72 sleeping space requirement

B200SR-WH: White, Intelligent sounder base capable of producing sound output with ANSI Temporal 3 or continuous tone; Intended for retrofit applications

B200SR-IV: Ivory, Intelligent sounder base capable of producing sound output with ANSI Temporal 3 or continuous tone; Intended for retrofit applications

B200SR-LF-WH: White, Low Frequency Intelligent, programmable sounder base, produces a fundamental frequency of 520 Hz +/- 10% with a square wave or its equivalent; designed to meet the NFPA 72 sleeping space requirement; intended for retrofit applications

B200SR-LF-IV: Ivory, Low Frequency Intelligent, programmable sounder base, produces a fundamental frequency of 520 Hz +/- 10% with a square wave or its equivalent; designed to meet the NFPA 72 sleeping space requirement. Intended for retrofit applications.

MOUNTING KITS AND ACCESSORIES

TR300: White, replacement flange for B210LP, B300-6 base

TR300-IV: Ivory, replacement flange for B210LP, B300-6-IV base

RA100Z: Remote LED annunciator, 3 – 32 VDC, mounts to a U.S. single-gang electrical box; For use with B501 and B300-6

M02-04-00: Test magnet

M02-09-00: Test magnet with telescoping handle

CK300: White, detector color kit, pack of 10

CK300-IV: Ivory, detector color kit, pack of 10

CK300-BL: Black, detector color kit, pack of 10

JUNCTION BOX SELECTION GUIDE

Base Models	Single Gang	Double Gang	3.5" Oct.	4.0" Oct.	4.0" Square	4.0" Square with 3.0" mud ring	50 mm	60 mm	70 mm	75 mm
B200S,B200SR	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
B501	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No
B300-6	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No
B224BI, B224RB	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No

Box depth contingent on base and wire size.
Refer to National Electric Code or applicable local codes for appropriate recommendations.
Applies to all model variants "BL", "-LF", "-IV", "-WH", and "-WHITE". See Product Line Information for detailed model description.

INTELLIGENT BASES TECHNICAL SPECIFICATIONS

ELECTRICAL

For B300-6 Series bases:
- **Operating voltage:** 15 to 32 VDC
- **Standby current:** 170 µA maximum

For B501 Series bases:
- **Operating voltage:** 15 to 32 VDC
- **Standby current:** 150 µA maximum

For B200 Series bases:
- **External supply voltage:** 16 to 33 VDC (FWR)
- **Standby current:** 500 µA maximum
- **Alarm current for B200S(-IV)(-WH):**
  35 mA maximum at high-volume setting
  15 mA maximum at low-volume setting
- **Alarm current for B200S-LF(-IV)(-WH)** High-volume setting:
  70 mA maximum @ 33.0 VDC
  90 mA maximum @ 24.0 VDC
  140 mA maximum @16.0 VDC
- **Alarm current for B200S-LF(-IV)(-WH)** Low-volume setting:
  15 mA maximum @ 33.0 VDC
  20 mA maximum @ 24.0 VDC
  25 mA maximum @ 16.0 VDC
- **Alarm current for B200SR(-IV)(-WH):** 35 mA maximum
- **Alarm current for B200SR-LF(-IV)(-WH):**
  65 mA maximum @ 33.0 VDC
  90 mA maximum @ 24.0 VDC
  125 mA maximum @16.0 VDC

SLC operating voltage: 15 to 32 VDC

SLC standby current: See applicable sensor specification

Sound output: Greater than 85 dBA minimum; measured in a UL reverberant room at 10 feet, 24 Volts (continuous tone)

For B224BI, B224RB (-IV) (-WH) bases:
- **Operating voltage:** 15 to 32 VDC (powered by SLC)
- **Standby ratings:** <450 µA maximum @ 24 VDC
- **Set time: (B224RB(-IV)(-WH) only):** short delay 60-100 msec; long delay 6-10 seconds
- **Reset time: (B224RB/-IV/-WH only):** 20 milliseconds maximum
- **Relay characteristics: (B224RB/-IV/-WH only):** two-coil latching relay; one Form-C contact; ratings (UL/CSA): 0.9 A @ 125 VAC, 0.9 A @ 110 VDC, and 3.0 A @ 30 VDC

PHYSICAL

Note: Specifications applies to all model variants "-BL", "-LF", "-IV", -WH, -WHITE. See Product Line Information for detailed model description.

Diameter:
- **B501-WHITE:** 4" (10.16 cm)
- **B300-6, B210LP:** 6.1" (15.49 cm)
- **B224BI, B224RB:** 6.2" (15.748 cm)
- **B200S, B200SR:** 6.875" (17.46 cm)

Wire gauge:
- **B224BI, B224RB:** 14 to 24 AWG
- **B300-6, B210LP, B501, B200S, B200SR**12 to 24 AWG

Temperature range:
- **B224BI, B224RB, B200S, B200SR:** 32°F to 120°F (0°C to 49°C)
- **B300-6, B210LP, B501:** -4°F to 150°F (-20°C to 66°C)

Humidity range: 10% to 93% RH, non-condensing

System temperature and humidity ranges: This system meets NFPA requirements for operation at 0°C to 49°C (32°F to 120°F); and at a relative humidity (non-condensing) of 85% at 30°C (86°F) per NFPA, and 93% ± 2% at 32°C ± 2°C (89.6°F ± 1.1°F) per ULC. However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and all peripherals be installed in an environment with a nominal room temperature of 15°C to 27°C (60°F to 80°F).

AGENCY LISTINGS AND APPROVALS

The listings and approvals below apply to intelligent bases as noted. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

UL Listed: S911

FM Approved

CSFM: 7300-1653:0109, 7300-1653:0126, 7300-1653:0213, 7300-1653:0238

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This document is not intended to be used for installation purposes. We try to keep our product information up-to-date and accurate. We cannot cover all specific applications or anticipate all requirements. All specifications are subject to change without notice.

Country of origin: Mexico

Honeywell Gamewell-FCI
12 Clintonville Road
Northford, CT 06472-1610
203.484.7161
www.gamewell-fci.com

9021-60540 | K | 07/19
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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7300-1653:0109
CATEGORY:	7300 - FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES
LISTEE:	System Sensor, Unincorporated Div of Honeywell Int'l Inc. 3825 Ohio Ave, St. Charles, IL, 60174 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Models B401, B401B, B401R, B401BR, B401BR-750, B401R-750, B402B, B404B, B404BT, B406B, B501, B501B, 14506587-002, B501BH, B501BHT, B401BH, B110LP, B110RLP, B110RLP750, B112LP, B114LP, B114LPBT, B116LP, B210LP, B501-BL, B50 IV, *B501-WHITE, B300-6, B300-6-IV, B300-6-IS detector bases. Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, *model number, *electrical rating and UL label.
APPROVAL:	Listed as detector bases for use with separately listed compatible detectors. *Refer to Manufacturers Installation Instruction Manual for details.
NOTES:	Formerly 7300-1209:128

*Rev 04-03-18 gt

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: **04/21/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

Outdoor Selectable-Output Horns, Strobes, and Horn Strobes for Wall Applications



SPECTRAlert ADVANCE from System Sensor

SpectrAlert® Advance outdoor audible visible products are rich with features that cut installation times and maximize profits.

Features

- Weatherproof per NEMA 4X, IP56
- Listed to UL 1638 (strobe) and UL 464 (horn)
- Compatible with System Sensor synchronization protocol and legacy SpectrAlert products
- Field-selectable candela settings: 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, and 185
- Automatic selection of 12- or 24-volt operation at 15 and 15/75 candela
- Rotary switch for horn tone and three volume selections
- Horn rated at 88+ dBA at 16 volts
- Rated from –40°F to 151°F
- Universal mounting plate with an onboard shorting spring that tests wiring continuity before devices are installed
- Plug-in design with minimal intrusion into the back box
- Tamper-resistant construction
- Listed for ceiling or wall mounting

Agency Listings

SIGNALING UL LISTED
S4011 (chimes, horn strobes, horns)
S3593 (outdoor and alert strobes)

FM APPROVED
3023572

MEA approved
MEA452-05-E

7300-1653:187 (outdoor strobes)
7125-1653:188 (horn strobes, chime strobes)
7135-1653:189 (horns, chimes)

SpectrAlert Advance offers the broadest line of outdoor horns, strobes, and horn strobes in the industry. With white or red plastic housings, wall or ceiling mounting options, and plain or FIRE-printed devices, SpectrAlert Advance can meet virtually any application requirement, including indoor, outdoor, wet, and dry applications in temperatures from –40°F to 151°F.

Like the entire SpectrAlert Advance line, outdoor horns, strobes, and horn strobes for wall applications include a variety of features that increase application flexibility and simplify installation. First, field-selectable settings, including candela, automatic selection of 12- or 24-volt operation, horn tones, and three volume options enable installers to easily adapt devices to meet requirements.

Next, SpectrAlert Advance devices use a universal mounting plate for both wall and ceiling applications. This mounting plate includes an onboard shorting spring that ensures wiring continuity before devices are installed, so installers can verify proper wiring without mounting the devices and exposing them to potential construction damage. Once the plates are mounted, all SpectrAlert Advance devices utilize a plug-in design with a single captured screw to speed installation and virtually eliminate costly ground faults.

Outdoor devices ship with weatherproof plastic back boxes (metal back boxes are available separately) that accommodate in-and-out wiring for daisy chaining devices. Plastic back boxes feature removable side flanges and improved resistance to saltwater corrosion. Knock-outs located on the back eliminate the need to drill holes for screw-in mounting. Plastic and metal weatherproof back boxes come with ¾-inch top and bottom conduit entries and ¾-inch knock-outs at the back. A screw-in NPT plug with an O-ring gasket for a watertight seal is included with each back box.

SpectrAlert Advance Outdoor Horn, Strobe, and Horn Strobe Specifications

Architect/Engineer Specifications

General

SpectrAlert Advance outdoor horns, strobes, and horn strobes shall mount to a weatherproof back box. A universal mounting plate shall be used for mounting ceiling and wall products. The notification appliance circuit wiring shall terminate at the universal mounting plate. Also, SpectrAlert Advance products, when used with the Sync•Circuit™ Module accessory, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts. When used with the Sync•Circuit Module, 12-volt-rated notification appliance circuit outputs shall operate between 9 and 17.5 volts; 24-volt-rated notification appliance circuit outputs shall operate between 17 and 33 volts. Outdoor SpectrAlert Advance products shall operate between –40 and 151 degrees Fahrenheit from a regulated DC or full-wave rectified unfiltered power supply. Strobes and horn strobes shall have field-selectable candela settings including 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, and 185.

Strobe

The strobe shall be a System Sensor SpectrAlert Advance Model _____ listed to UL 1971 and shall be approved for fire protective service. The strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The strobe must be installed with its weatherproof back box in order to remain outdoor approved per UL. The strobe shall be suitable for use in wet environments.

Horn Strobe Combination

The horn strobe shall be a System Sensor SpectrAlert Advance Model _____ listed to UL 1971 and UL 464 and shall be approved for fire protective service. The horn strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The horn shall have three audibility options and an option to switch between a temporal three pattern and a non-temporal (continuous) pattern. These options shall be set by a multiple position switch. On four-wire products, the strobe shall be powered independently of the sounder. The horn or horn strobe models shall operate on a coded or non-coded power supply. The horn strobe must be installed with its weatherproof back box in order to remain outdoor approved per UL. The horn strobe shall be suitable for use in wet environments.

Physical/Electrical Specifications

Operating Temperature	–40°F to 151°F (–40°C to 66°C)
Strobe Flash Rate	1 flash per second
Nominal Voltage	Regulated 12 DC/FWR or regulated 24 DC/FWR[1]
Operating Voltage Range[2]	8 to 17.5 V (12 V nominal) or 16 to 33 V (24 V nominal)
Input Terminal Wire Gauge	12 to 18 AWG
Wall-Mount Dimensions (including lens)	5.6″L × 4.7″W × 2.5″D (142 mm L × 119 mm W × 64 mm D)
Horn Dimensions	5.6″L × 4.7″W × 1.3″D (142 mm L × 119 mm W × 33 mm D)
Wall-Mount Weatherproof Back Box Dimensions (SA-WBB)	5.7″L × 5.1″W × 2.0″D (145 mm L × 130 mm W × 51 mm D)

Notes:

1. Full Wave Rectified (FWR) voltage is a non-regulated, time-varying power source that is used on some power supply and panel outputs.
2. P, S, PC, and SC products will operate at 12 V nominal only for 15 and 15/75 cd.

UL Current Draw Data

UL Max. Strobe Current Draw (mA RMS)

		8–17.5 Volts		16–33 Volts	
	Candela	DC	FWR	DC	FWR
Standard Candela Range	15	123	128	66	71
	15/75	142	148	77	81
	30	NA	NA	94	96
	75	NA	NA	158	153
	95	NA	NA	181	176
	110	NA	NA	202	195
	115	NA	NA	210	205
High Candela Range	135	NA	NA	228	207
	150	NA	NA	246	220
	177	NA	NA	281	251
	185	NA	NA	286	258

UL Max. Horn Current Draw (mA RMS)

		8–17.5 Volts		16–33 Volts	
Sound Pattern	dB	DC	FWR	DC	FWR
Temporal	High	57	55	69	75
Temporal	Medium	44	49	58	69
Temporal	Low	38	44	44	48
Non-Temporal	High	57	56	69	75
Non-Temporal	Medium	42	50	60	69
Non-Temporal	Low	41	44	50	50
Coded	High	57	55	69	75
Coded	Medium	44	51	56	69
Coded	Low	40	46	52	50

UL Max. Current Draw (mA RMS), 2-Wire Horn Strobe, Standard Candela Range (15–115 cd)

	8–17.5 Volts		16–33 Volts						
DC Input	15	15/75	15	15/75	30	75	95	110	115
Temporal High	137	147	79	90	107	176	194	212	218
Temporal Medium	132	144	69	80	97	157	182	201	210
Temporal Low	132	143	66	77	93	154	179	198	207
Non-Temporal High	141	152	91	100	116	176	201	221	229
Non-Temporal Medium	133	145	75	85	102	163	187	207	216
Non-Temporal Low	131	144	68	79	96	156	182	201	210
FWR Input									
Temporal High	136	155	88	97	112	168	190	210	218
Temporal Medium	129	152	78	88	103	160	184	202	206
Temporal Low	129	151	76	86	101	160	184	194	201
Non-Temporal High	142	161	103	112	126	181	203	221	229
Non-Temporal Medium	134	155	85	95	110	166	189	208	216
Non-Temporal Low	132	154	80	90	105	161	184	202	211

UL Max. Current Draw (mA RMS), 2-Wire Horn Strobe, High Candela Range (135–185 cd)

	16–33 Volts					16–33 Volts			
DC Input	135	150	177	185	FWR Input	135	150	177	185
Temporal High	245	259	290	297	Temporal High	215	231	258	265
Temporal Medium	235	253	288	297	Temporal Medium	209	224	250	258
Temporal Low	232	251	282	292	Temporal Low	207	221	248	256
Non-Temporal High	255	270	303	309	Non-Temporal High	233	248	275	281
Non-Temporal Medium	242	259	293	299	Non-Temporal Medium	219	232	262	267
Non-Temporal Low	238	254	291	295	Non-Temporal Low	214	229	256	262

Candela Derating

For K series products used at low temperatures, listed candela ratings must be reduced in accordance with this table.

Strobe Output (cd)	
Listed Candela	Candela rating at –40°F
15	Do not use below 32°F
15/75	
30	
75	44
95	70
110	110
115	115
135	135
150	150
177	177
185	185

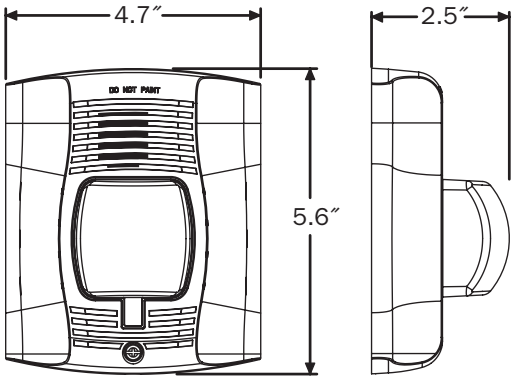
Horn Tones and Sound Output Data

Horn and Horn Strobe Output (dBA)

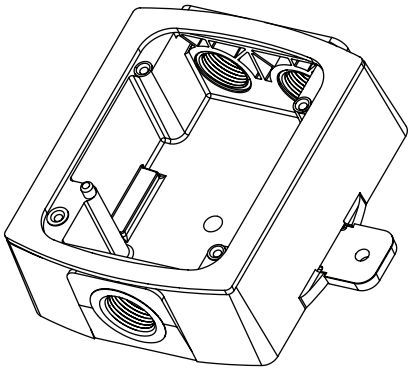
			8–17.5 Volts		16–33 Volts		24-Volt Nominal			
							Reverberant		Anechoic	
Switch Position	Sound Pattern	dB	DC	FWR	DC	FWR	DC	FWR	DC	FWR
1	Temporal	High	78	78	84	84	88	88	99	98
2	Temporal	Medium	74	74	80	80	86	86	96	96
3	Temporal	Low	71	73	76	76	83	80	94	89
4	Non-Temporal	High	82	82	88	88	93	92	100	100
5	Non-Temporal	Medium	78	78	85	85	90	90	98	98
6	Non-Temporal	Low	75	75	81	81	88	84	96	92
7†	Coded	High	82	82	88	88	93	92	101	101
8†	Coded	Medium	78	78	85	85	90	90	97	98
9†	Coded	Low	75	75	81	81	88	85	96	92

†Settings 7, 8, and 9 are not available on 2-wire horn strobe.

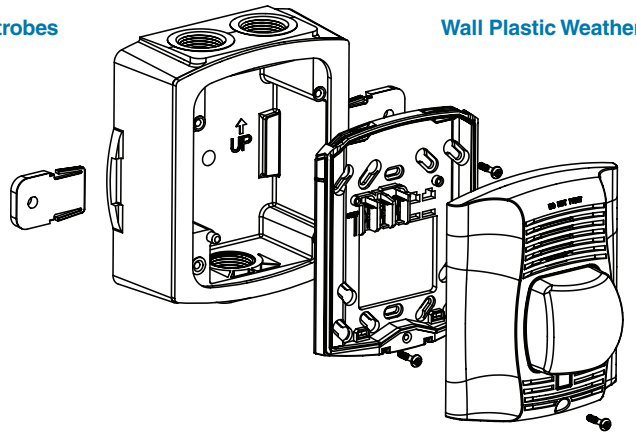
SpectrAlert Advance Diagrams



Wall-Mount Horn Strobes



Wall Plastic Weatherproof Back Box



Wall-Mount Horn Strobe with Plastic Weatherproof Back Box

SpectrAlert Advance Ordering Information

Model	Description
Wall Horn Strobes	
P2RK*†	2-Wire Horn Strobe, Standard cd, Red, Outdoor (includes plastic weatherproof back box)
P2RHK*†	2-Wire Horn Strobe, High cd, Red, Outdoor (includes plastic weatherproof back box)
P2WK*†	2-Wire Horn Strobe, Standard cd, White, Outdoor (includes plastic weatherproof back box)
P2WHK*†	2-Wire Horn Strobe, High cd, White, Outdoor (includes plastic weatherproof back box)
P4RK†	4-Wire Horn Strobe, Standard cd, Red, Outdoor (includes plastic weatherproof back box)
P4WK	4-Wire Horn Strobe, Standard cd, White, Outdoor (includes plastic weatherproof back box)
P2RHK-120	2-Wire Horn Strobe, High cd, Red, Outdoor, 120 V (includes plastic weatherproof back box)
Wall Strobes	
SRK*†	Strobe, Standard cd, Red, Outdoor (includes plastic weatherproof back box)
SRHK*†	Strobe, High cd, Red, Outdoor (includes plastic weatherproof back box)
SWK*†	Strobe, Standard cd, White, Outdoor (includes plastic weatherproof back box)
SWHK*†	Strobe, High cd, White, Outdoor (includes plastic weatherproof back box)
Horns	
HRK†	Horn, Red, Outdoor (includes plastic weatherproof back box)
Accessories	
SA-WBB	Red, Metal Weatherproof Back Box
SA-WBBW	White, Metal Weatherproof Back Box

Notes:

* Add "-P" to model number for plain housing (no "FIRE" marking on cover), e.g., P2RK-P.

† Add "-R" to model number for weatherproof replacement device (no back box included), only for use with weatherproof outdoor flush mounting plate, WTP and WTPW. "Standard cd" refers to strobes that include 15, 15/75, 30, 75, 95, 110, and 115 candela settings. "High cd" refers to strobes that include 135, 150, 177, and 185 candela settings. **When replacing standard outdoor units both the device and back box must be replaced.**

SYSTEM SENSOR®

3825 Ohio Avenue • St. Charles, IL 60174
Phone: 800-SENSOR2 • Fax: 630-377-6495

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Product specifications subject to change without notice. Visit systemsensor.com for current product information, including the latest version of this data sheet.
AVDS01201 • 3/12

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7300-1653:0187
CATEGORY:	7300 - FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES
LISTEE:	System Sensor, Unincorporated Div of Honeywell Int'l Inc. 3825 Ohio Ave, St. Charles, IL, 60174 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Models SWK, SWHK, SCWK, SCWHK, SRK, SRHK, SCRK and SCRHK strobe lights intended for indoor or outdoor use and may be mounted on the wall or the ceiling. These strobe lights are suitable for outdoor use at an operating temperature range of -40°F to 150°F (-40°C to 66°C)* rating and are NEMA 4X rated when used with the Listed models SA-WBB (wall), SA-WBBW (Wall) or the model SA-WBBC (ceiling), SA-WBBCW (Ceiling) weatherproof back boxes. May be followed by suffix -P for plain housing with no lettering. Refer to listee's data sheet for additional detailed product description and operational considerations.
RATING:	8-17.5 or 16-33 VDC/FWR
INSTALLATION:	In accordance with listee's printed installation instruction, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model number, electrical rating and UL label.
APPROVAL:	Listed as strobe lights for general signaling. For indoor or outdoor use. Refer to listee's Installation Instruction Manual for details.
NOTES:	Not approved for public mode and not to be used as an evacuation signal for the hearing impaired.

*Corrected 07-22-10 fm

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: 04/24/2023

Listing Expires: 06/30/2024

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

Indoor Selectable-Output Speaker Strobes and Dual Voltage Evacuation Speakers for Wall Applications

System Sensor L-Series selectable output speaker strobes and dual-voltage evacuation speakers can reduce ground faults and enable faster installation with lower current draw and modern aesthetics.



Features

- Plug-in design and protective cover reduce ground faults
- Universal mounting plate with an onboard shorting spring tests wiring continuity before installation
- No extension ring required
- Field selectable candela settings on wall units: 15, 30, 75, 95, 110, 135, 185
- Automatic selection of 12- or 24-volt operation at 15 and 30 candela
- Rotary switch simplifies field selection of speaker voltage (25 and 70.7 Vrms) and power settings (¼, ½, 1 and 2 watts)
- Seakers offer high fidelity and high volume sound output
- Compatible with System Sensor synchronization protocol
- Electrical compatibility with existing SpectrAlert and SpectrAlert Advance products
- Tamper-resistant construction
- Updated modern aesthetics

Agency Listings

SIGNALING UL LISTED
S4048

FM APPROVED
FM approved except for ALERT models
3057493

7320-1653:0505

The System Sensor L-Series of speakers and speaker strobes reduce costly ground faults using a plug-in design and universal mounting plate that allow the installer to pre-wire mounting plates, dress the wires, and confirm wiring continuity before plugging in the speakers. In addition, a protective plastic cover prevents nicked wires by covering exposed speaker components.

These devices also enable faster installations by providing instant feedback to ensure that wiring is properly connected, rotary switches to select voltage and power settings, and 7 field-selectable candela settings for wall speaker strobes.

The low total harmonic distortion of the speaker offers high fidelity sound output while still offering high volume sound output for use in high ambient noise applications.

System Sensor L-Series makes installation easy

- Attach a universal mounting plate to a 4 × 4 × 21⁄8 inch back box. Flush-mount applications do not require an extension ring.
- Connect the notification appliance circuit or speaker wiring to the terminals on the mounting plate.
- Attach the speaker or speaker strobe to the mounting plate by inserting the product tabs into the mounting plate grooves. Hinge the device into position to lock the product pins into the mounting plate terminals. The device will temporarily hold in place with a catch until it is secured with a captured mounting screw.

L-Series Speaker and Speaker Strobe Specifications

Architectural/Engineering Specifications

General

L-Series speaker and speaker strobes shall mount to a 4 × 4 × 21⁄8-inch back box. A universal mounting plate shall be used for mounting ceiling and wall products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate. Also, L-Series speaker strobes, when used with the Sync•Circuit™ Module accessory, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts. When used with the Sync•Circuit Module, 12-volt rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt rated notification appliance circuit outputs shall operate between 16.5 and 33 volts. Indoor L-Series products shall operate between 32°F and 120°F from a regulated DC, or full-wave rectified, unfiltered power supply. Wall-mount speaker strobes shall have field-selectable candela settings including 15, 30, 75, 95, 110, 135, 185.

Speaker

The speaker shall be a System Sensor L-Series model _____ dual-voltage transformer speaker capable of operating at 25.0 or 70.7 nominal Vrms. It should be listed to UL 1480 and shall be approved for fire protective service. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. The speaker shall have power taps and voltage that are selected by rotary switches.

Speaker Strobe combination

The speaker strobe shall be a System Sensor L-Series model _____ listed to UL1480 and UL 1971 and be approved for fire protective signaling systems. The speaker shall be capable of operating at 25.0 or 70.7 nominal Vrms selected via rotary switch, and shall have a frequency range of 400 to 4,000 Hz. The speaker shall have power taps that are selected by rotary switch. The strobe shall comply with the NFPA 72 requirements for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system.

Synchronization Module

The module shall be a System Sensor Sync•Circuit model MDL3 listed to UL 464 and shall be approved for fire protective service. The module shall synchronize SpectrAlert strobes at 1 Hz. The module shall mount to a 411⁄16 × 411⁄16 × 21⁄8-inch back box. The module shall also control two Style Y (class B) circuits or one Style Z (class A) circuit. The module shall synchronize multiple zones. Daisy chaining two or more synchronization modules together will synchronize all the zones they control. The module shall not operate on a coded power supply.

Physical Specifications			
Operating Temperature	32°F to 120°F (0°C to 49°C)		
Humidity Range	10 to 93% non-condensing		
Dimensions, Wall-Mount	**Length**	**Width**	**Depth**
SPL Speaker	6.5 in, 165 mm	5 in, 127 mm	.97 in,23 mm
With Surface Mount Back Box	6.6 in, 168 mm	5.1 in, 130 mm	3.2 in, 82 mm
SPSL Speaker/Strobe (including lens and speaker)	6.5 in, 165 mm	5.0 in, 127 mm	2.3 in, 58 mm
With Surface Mount Back Box	6.6 in, 168 mm	5.1 in, 130 mm	4.5 in, 116 mm
Electrical/Operating Specifications			
Nominal Voltage (speakers)	25 Volts or 70.7 Volts(nominal)		
Maximum Supervisory Voltage (speakers)	50 VDC		
Strobe Flash Rate	1 flash per second		
Nominal Voltage (strobes)	Regulated 12 VDC or regulated 24 DC/FWR[1,2]		
Operating Voltage Range (includes fire alarm panels with built in sync)	8 to 17.5 V (12 V nominal) or 16 to 33V (24 V nominal)		
Operating Voltage with MDL3 Sync Module	8.5 to 17.5 V (12 V nominal) or 16.5 to 33V (24 V nominal)		
Frequency Range	400 to 4000 Hz		
Power	¼, ½, 1, 2 watts		

1. Full Wave Rectified (FWR) voltage is a non-regulated, time-varying power source that is used on some power supply and panel outputs.
2. Strobe products will operate at 12 V nominal only for 15 and 30 cd

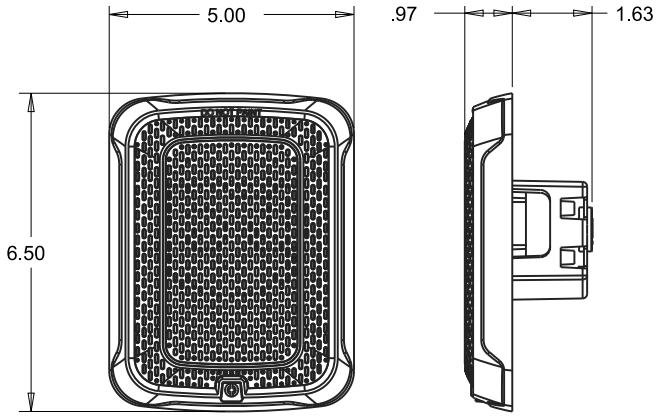
UL Current Draw Data

UL Max Strobe Current Draw (mA RMS)			
	8 to 17.5 Volts	16 to 33 Volts	
Candela	DC	DC	FWR
15	88	43	60
30	143	63	83
75	N/A	107	136
95	N/A	121	155
110	N/A	148	179
135	N/A	172	209
185	N/A	222	257

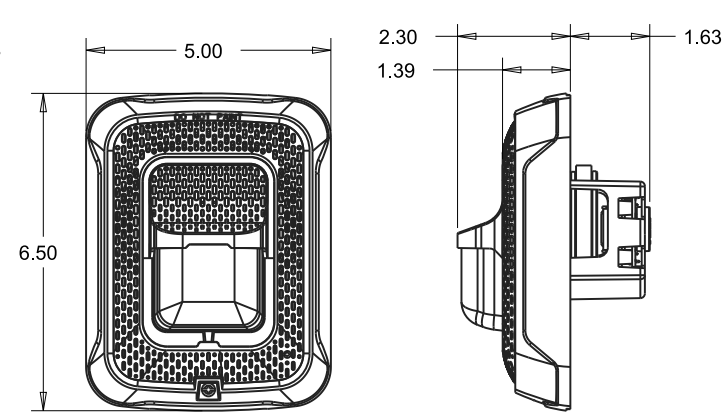
Sound Output Speaker Strobe				
	¼ W	½ W	1 W	2 W
UL Reverberant (dBA @10 ft)	77	80	83	86
UL Anechoic (dBA @10 ft)	77	80	83	86

Sound Output Speaker				
	¼ W	½ W	1 W	2 W
UL Reverberant (dBA @10 ft)	79	82	85	88
UL Anechoic (dBA @10 ft)	79	82	85	88

L-Series Dimensions

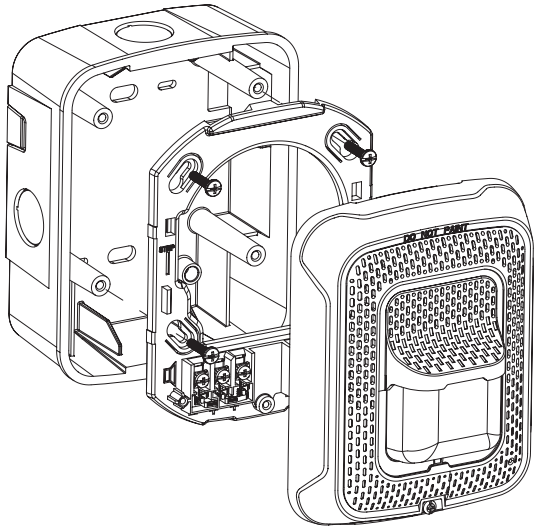


Wall-Mount Speaker



Wall-Mount Speaker Strobe

Surface Mounting



Wall-Mount Speaker Strobe with SBBSPL Surface Mount Back Box

L-Series Ordering Information

Wall Mount		
White	**Red**	**Description**
SPWL	SPRL	Speaker only
SPSWL	SPSRL	Speaker Strobe
SPSWL-P	SPSRL-P	Plain Speaker Strobe
SPSWL-ALERT	—	Speaker Strobe, Amber Lens
SPSWL-CLR-ALERT	—	Speaker Strobe Clear Lens
—	SPSRL-SP	Speaker Strobe, Fuego
Accessories		
White	**Red**	**Description**
RFPW	RFP	7 in × 9.5 in Retrofit Plate
SBBSPWL	SBBSPRL	Surface Mount Back Box for Speakers and Speaker Strobes
TR-2W	TR-2	Wall Mount Trim Ring

Notes:
All -P models have a plain housing (no “FIRE” marking on the cover)

SYSTEM SENSOR®
3825 Ohio Avenue • St. Charles, IL 60174
Phone: 800-SENSOR2 • Fax: 630-377-6495
www.systemsensor.com

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Product specifications subject to change without notice. Visit systemsensor.com for current product information, including the latest version of this data sheet.
AVDS86701 • 03/17

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7320-1653:0505
CATEGORY:	7320 - SPEAKERS
LISTEE:	System Sensor, Unincorporated Div of Honeywell Int'l Inc. 3825 Ohio Ave, St. Charles, IL, 60174 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	System Sensor Indoor Models: SPRL and SPWL Wall Speakers; SPCRL and SPCWL Ceiling Speakers; SPSRL, SPSWL, SPSRL-P, SPSRL-SP, SPSWL-P, SPSWL-ALERT and SPSWL-CLR-ALERT Wall Speaker Stobes; SPSCRL, SPSCWL, SPSCWL-P, SPSCWL-SP and SPSCWL-CLR-ALERT Ceiling Speaker Strobes. Wall Bezel Parts: BZSPR-P, BZSPR-AL, BZSPR-EV, BZSPR-AG, BZSPR-PG, BZSPR-F and BZSPR-SP, BZSPW-P, BZSPW-AL, BZSPW-EV, BZSPW-AG, BZSPW-PG, BZSPW-F and BZSPW-SP, Ceiling Bezel Parts: BZSPRC-P, BZSPRC-AL, BZSPRC-EV, BZSPRC-AG, BZSPRC-PG, BZSPRC-F and BZSPRC-SP, BZSPWC-P, BZSPWC-AL, BZSPWC-EV, BZSPWC-AG, BZSPWC-PG, BZSPWC-F and BZSPWC-SP, WallTrim Rings for Speaker Strobes: TR2 and TR2W CeilingTrim Rings for Speaker Strobes:

	TRC2 and TRC2W. Wall Surface Mounted Back Boxes: SBBSPRL and SBBSPWL, Ceiling Surface Mounted Back Boxes: SBBCRL and SBBCWL Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	25 or 70.7 VAC, 1/4, 1/2, 1, 2 Watt outputs. Regulated 12 VDC and 24 VDC/FWR is for 2-wire strobe portion.
INSTALLATION:	In accordance with listee's printed installation instructions, NFPA 72, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model number, electrical rating, and UL label.
APPROVAL:	Listed as speakers and speaker-strobes when used with separately listed compatible fire alarm control units. Suitable for indoor use, dry and damp environments. *Listed with software code, S05-0048-001 for low temperature compensation. Authority having jurisdiction should be consulted prior to installation. Refer to listee's Installation Instruction Manual for details.
NOTES:	

02-27-17 gt

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

Date Issued: **04/24/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

Indoor Selectable-Output Speaker Strobes and Dual Voltage Evacuation Speakers for Ceiling Applications

System Sensor L-Series selectable-output speaker strobes and dual-voltage evacuation speakers can reduce ground faults and enable faster installation with lower current draw and modern aesthetics.



Features

- Plug-in design and protective cover reduce ground faults
- Universal mounting plate with an onboard shorting spring tests wiring continuity before installation
- No extension ring required
- Field selectable candela settings on ceiling units: 15, 30, 75, 95, 115, 150, and 177
- Automatic selection of 12- or 24-volt operation at 15 and 30 candela
- Rotary switch simplifies field selection of speaker voltage (25 and 70.7 Vrms) and power settings (¼, ½, 1 and 2 watts)
- Speakers offer high fidelity and high volume sound output
- 520 Hz capable with compatible FACP
- Compatible with System Sensor synchronization protocol
- Electrical compatibility with existing SpectrAlert and SpectrAlert Advance products
- Tamper-resistant construction
- Updated modern aesthetics

Agency Listings

SIGNALING UL LISTED
S4048

FM APPROVED
FM approved except for ALERT models
3057493

7320-1653:0505

System Sensor L-Series of speakers and speaker strobes reduce costly ground faults using a plug-in design and universal mounting plate that allow the installer to pre-wire mounting plates, dress the wires, and confirm wiring continuity before plugging in the speakers. In addition, a protective plastic cover prevents nicked wires by covering exposed speaker components.

These devices also enable faster installations by providing instant feedback to ensure that wiring is properly connected, rotary switches to select voltage and power settings, and 7 field-selectable candela settings for both wall and ceiling speaker strobes.

The low total harmonic distortion of the SP speaker offers high fidelity sound output while still offering high volume sound output for use in high ambient noise applications.

L-Series makes installation easy

- Attach a universal mounting plate to a 4 × 4 × 21⁄8 inch back box . Flush-mount applications do not require an extension ring.
- Connect the notification appliance circuit or speaker wiring to the terminals on the mounting plate.
- Attach the speaker or speaker strobe to the mounting plate by inserting the product tabs into the mounting plate grooves. Hinge the device into position to lock the product pins into the mounting plate terminals. The device will temporarily hold in place with a catch until it is secured with a captured mounting screw.

L-Series Speaker and Speaker Strobe Specifications

Architectural/Engineering Specifications

General

L-Series speaker and speaker strobes shall mount to a 4 × 4 × 21⁄8-inch back box. A universal mounting plate shall be used for mounting ceiling and wall products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate. Also, L-Series speaker strobes, when used with the Sync•Circuit™ Module accessory, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts. When used with the Sync•Circuit Module, 12-volt rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt rated notification appliance circuit outputs shall operate between 16.5 and 33 volts. Indoor L-Series products shall operate between 32°F and 120°F from a regulated DC, or full-wave rectified, unfiltered power supply. Speaker strobes shall have field-selectable candela settings including 15, 30, 75, 95, 115, 150, 177.

Speaker

The speaker shall be a System Sensor L-Series model _____ dual-voltage transformer speaker capable of operating at 25.0 or 70.7 nominal Vrms. It should be listed to UL 1480 and shall be approved for fire protective service. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. The speaker shall have power taps and voltage that are selected by rotary switches.

Speaker Strobe combination

The speaker strobe shall be a System Sensor L-Series model _____ listed to UL1480 and UL 1971 and be approved for fire protective signaling systems. The speaker shall be capable of operating at 25.0 or 70.7 nominal Vrms selected via rotary switch, and shall have a frequency range of 400 to 4,000 Hz. The speaker shall have power taps that are selected by rotary switch. The strobe shall comply with the NFPA 72 requirements for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system.

Synchronization Module

The module shall be a System Sensor Sync•Circuit model MDL3 listed to UL 464 and shall be approved for fire protective service. The module shall synchronize SpectrAlert strobes at 1 Hz. The module shall mount to a 411⁄16 × 411⁄16 × 21⁄8-inch back box. The module shall also control two Style Y (class B) circuits or one Style Z (class A) circuit. The module shall synchronize multiple zones. Daisy chaining two or more synchronization modules together will synchronize all the zones they control. The module shall not operate on a coded power supply.

Physical Specifications		
Operating Temperature	32°F to 120°F (0°C to 49°C)	
Humidity Range	10 to 93% non-condensing	
Dimensions, Ceiling-Mount	**Diameter**	**Depth**
SPC Speaker	6.8 in, 173 mm	1.0 in, 25 mm
With Surface Mount Back Box	6.9 in, 176 mm	3.5 in, 89 mm
SPSC Speaker Strobe	6.8 in, 173 mm	2.8 in, 73 mm
With Surface Mount Back Box	6.9 in, 176 mm	5.37 in, 136 mm
Electrical/Operating Specifications		
Nominal Voltage (speakers)	25 Volts or 70.7 Volts (nominal)	
Maximum Supervisory Voltage (speakers)	50 VDC	
Strobe Flash Rate	1 flash per second	
Nominal Voltage (strobes)	Regulated 12 VDC or regulated 24 VDC/FWR [1,2]	
Operating Voltage Range (includes fire alarm panels with built in sync)	8 to 17.5 V (12 V nominal) or 16 to 33 V (24 V nominal)	
Operating Voltage with MDL3 Sync Module	8.5 to 17.5 V (12 V nominal) or 16.5 to 33 V (24 V nominal)	
Frequency Range	400 to 4,000 Hz[3]	
Power	¼, ½, 1, 2 watts	

1. Full Wave Rectified (FWR) voltage is a non-regulated, time-varying power source that is used on some power supply and panel outputs.
2. Strobe products will operate at 12 V nominal only for 15 and 30 cd.
3. 520Hz capable with compatible FACP.

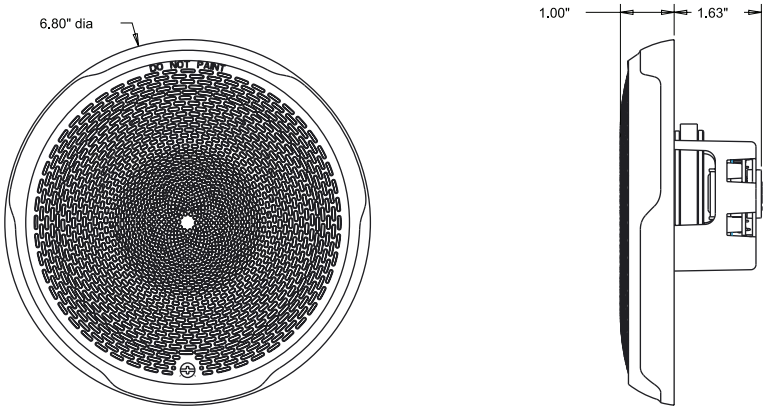
UL Current Draw Data

UL Max. Strobe Current Draw (mA RMS)			
	8 to 17.5 Volts	16 to 33 Volts	
Candela	DC	DC	FWR
15	87	41	60
30	153	63	86
75	NA	111	142
95	NA	134	164
115	NA	158	191
150	NA	189	228
177	NA	226	264

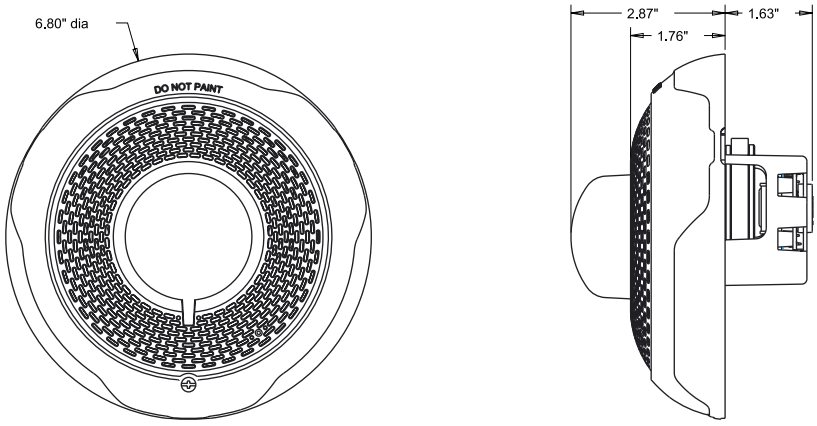
Ceiling-Mount Speaker Sound Output		
Setting	UL Reverberant (dBA @10 ft)	UL Anechoic (dBA @10 ft)
1/4 W	79	79
1/2 W	82	82
1 W	85	85
2 W	88	88

Ceiling-Mount Speaker Strobe Sound Output		
Setting	UL Reverberant (dBA @10 ft)	UL Anechoic (dBA @10 ft)
1/4 W	77	77
1/2 W	80	80
1 W	83	83
2 W	86	86

L-Series Dimensions

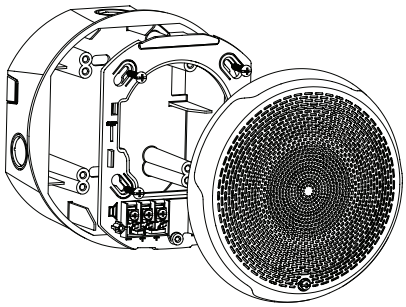


Ceiling Speaker

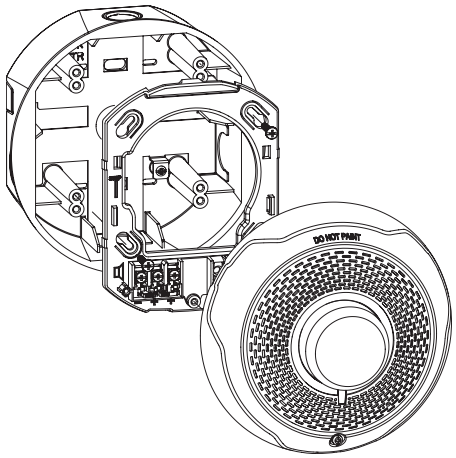


Ceiling Speaker Strobe

Surface Mounting



Ceiling Speaker with Surface Mount Back Box



Ceiling Speaker Strobe with Surface Mount Back Box

L-Series Ordering Information

Ceiling Mount		
White	**Red**	**Description**
SPCWL	SPCRL	Speaker only
SPSCWL	SPSCRL	Speaker Strobe
SPSCWL-P	—	Plain, Speaker Strobe
SPSCWL-SP	—	Fuego, Speaker Strobe
SPSCWL-CLR-ALERT	—	Alert, Speaker Strobe, Clear Lens
Accessories		
White	**Red**	**Description**
SBBCWL	SBBCRL	Universal Ceiling Surface Mount Back Box
TRC-2W	TRC-2	Universal Ceiling Trim Ring

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Product specifications subject to change without notice. Visit systemsensor.com for current product information, including the latest version of this data sheet.
AVDS86601 • 03/17

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7320-1653:0505
CATEGORY:	7320 - SPEAKERS
LISTEE:	System Sensor, Unincorporated Div of Honeywell Int'l Inc. 3825 Ohio Ave, St. Charles, IL, 60174 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	System Sensor Indoor Models: SPRL and SPWL Wall Speakers; SPCRL and SPCWL Ceiling Speakers; SPSRL, SPSWL, SPSRL-P, SPSRL-SP, SPSWL-P, SPSWL-ALERT and SPSWL-CLR-ALERT Wall Speaker Stobes; SPSCRL, SPSCWL, SPSCWL-P, SPSCWL-SP and SPSCWL-CLR-ALERT Ceiling Speaker Strobes. Wall Bezel Parts: BZSPR-P, BZSPR-AL, BZSPR-EV, BZSPR-AG, BZSPR-PG, BZSPR-F and BZSPR-SP, BZSPW-P, BZSPW-AL, BZSPW-EV, BZSPW-AG, BZSPW-PG, BZSPW-F and BZSPW-SP, Ceiling Bezel Parts: BZSPRC-P, BZSPRC-AL, BZSPRC-EV, BZSPRC-AG, BZSPRC-PG, BZSPRC-F and BZSPRC-SP, BZSPWC-P, BZSPWC-AL, BZSPWC-EV, BZSPWC-AG, BZSPWC-PG, BZSPWC-F and BZSPWC-SP, WallTrim Rings for Speaker Strobes: TR2 and TR2W CeilingTrim Rings for Speaker Strobes:

	TRC2 and TRC2W. Wall Surface Mounted Back Boxes: SBBSPRL and SBBSPWL, Ceiling Surface Mounted Back Boxes: SBBCRL and SBBCWL Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	25 or 70.7 VAC, 1/4, 1/2, 1, 2 Watt outputs. Regulated 12 VDC and 24 VDC/FWR is for 2-wire strobe portion.
INSTALLATION:	In accordance with listee's printed installation instructions, NFPA 72, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model number, electrical rating, and UL label.
APPROVAL:	Listed as speakers and speaker-strobes when used with separately listed compatible fire alarm control units. Suitable for indoor use, dry and damp environments. *Listed with software code, S05-0048-001 for low temperature compensation. Authority having jurisdiction should be consulted prior to installation. Refer to listee's Installation Instruction Manual for details.
NOTES:	

02-27-17 gt

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

Date Issued: **04/24/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

COOPER Notification

Weatherproof Appliances - Series AH Audibles, AS Audible Strobes, MT Multitone Strobes, RSS Strobes and ET70 Speaker Strobes and Weatherproof Mounting Accessories



*

Description:

Designed for life safety, performance and reliability, Cooper Notification's Wheelock cost effective weatherpoof notification appliances include:

Weatherproof Appliances	Series
Strobes	RSSWP
Horn Strobes	ASWP
Horns	AH-24WP, AH-12WP
Multitone Horn Strobes	MTWP
Multitone Horns	MT
Speaker Strobes	ET70WP
Speakers	ET-1010

All strobe models are UL dual listed - meeting both UL1638 and UL1971 requirements. As dual listed appliances, these weatherproof strobes, horn strobes and speaker strobes are listed for outdoor applications under UL 1638 as well as under UL 1971, the Standard for Safety Signaling Devices for Hearing Impaired. With an extended temperature range of –31°F to 150°F (-35°C to 66°C), Wheelock weatherproof appliances meet or exceed UL outdoor test requirements for rain, humidity and corrosion resistance while providing multiple strobe intensity options, including the highest strobe ratings available for area coverage per NFPA 72 strobe spacing tables (up to 185 candela for wall mounting and 177 candela for ceiling mounting).

To enable weatherproof mounting, Cooper Notification provides the industry's widest choice of mounting options for surface or unique semi-flush installation. Models are available for surface mounting to Wheelock weatherproof backboxes on walls or ceilings. The optional WP-KIT allows the weatherproof backboxes (IOB, WPBB or WPSBB) to be mounted to a recessed electrical box for concealed conduit installation. For semi-flush installation, the WPA* and WFPA* kits allow a customer to mount the weatherproof appliances to a recessed electrical box without the need for an external weatherproof backbox. See the Backboxes, Plates and Gaskets Table on page three of this document for a summarization of these mounting options and the required accessories.

All models may be synchronized using the Wheelock DSM Sync Modules, Wheelock Power Supplies or other manufacturers panels incorporating the Wheelock Patented Sync Protocol. The horn output of horn strobes can be independently controlled on 2-wire circuits using the Wheelock patented sync protocol. MTWP horn strobe models are 4-wire appliances; the strobes can be synchronized while the audible can be connected to a coded fire alarm system or can be set to produce any of eight selectable tones.

Features:

- Approvals include: UL Standards 1971, 1638, 464 and 1480 California State Fire Marshal (CSFM), New York City (MEA), Factory Mutual (FM), Chicago (BFP) and ULC . See agency approvals by model number on page two of this document
- Compliance with the following requirements: NFPA, UFC, ANSI 117.1, OSHA Part 29, 1910.165, ADA
- Weatherproof with extended temperature range of –40°F to 150°F (-40°C to 66°C)*
- Dual Listed strobe models (UL 1638 and UL 1971)
- Industry's highest strobe candela options
- Synchronize using the Wheelock Sync Modules or panels with built-in Wheelock Patented Sync Protocol
- Models with field selectable tone, dBA and candela settings
- Wall or ceiling mounting options
- Surface of semi-flush mounting
- IN/OUT wiring termination accepting two #12-18 AWG wires at each terminal

The series RSSWP, ASWP, AH-24WP, MTWP-2475W, and MT-12/24 have UL / ULC approval down to -40°F. The ET-1010 and ET70WP have UL approval down to -40°F. The AH-12WP has UL approval down to -31°F.

E5946
S5391
S2652

151-92-E

7125-0785:131 (ASWP)
7125-0785:146 (ET70WP)
7125-0785:156 (MTWP)
7300-0785:154 (RSSWP)

ARCHITECTS AND ENGINEERS SPECIFICATIONS

General
Weatherproof notification appliances shall be UL listed for outdoor use. Weatherproof Strobe appliances shall be listed under UL Standard 1638 (Standard for Visual Signaling Appliances) for Indoor/Outdoor use and UL Standard 1971 (Standard for Safety Signaling Devices for Hearing Impaired). The appliances shall be available for optional wall mounting or ceiling mounting to weatherproof backboxes using either exposed conduit or concealed conduit, or semi-flush mounting to a recessed electrical box in walls or ceilings using Wheelock mounting accessories.

Weatherproof Strobes
Weatherproof Strobe appliances shall produce a minimum flash rate of 60 flashes per minute over the UL Regulated Voltage Range of 16 to 33 VDC and shall incorporate a Xenon flashtube. The weatherproof strobes shall be available with UL 1971 candela ratings up to 185 cd for wall mounting and 177 cd for ceiling mounting. UL 1638 candela ratings up to 180 cd at 77°F shall be available. The strobes shall operate over an extended temperature range of –40°F to 150°F (-40°C to 66°C) and be listed for maximum humidity of 95% RH. Strobe inputs shall be polarized for compatibility with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP).

Weatherproof Audibles and Audible/Strobe Combinations Weatherproof horns and multitone audibles shall be listed for Indoor/Outdoor use under UL Standard 464. The horns shall be able to produce a continuous output or a temporal code-3 output that can be synchronized. The horns shall have at least 3 sound level settings. Horn/Strobe combinations shall be able to be synchronized on a single NAC.

Multitone audibles shall be able to produce 8 distinct tones selectable by dip switch and shall have at least 2 sound level settings. Multitone Audible/Strobe combinations shall have independent inputs for the audible and strobe. The strobes shall be able to be synchronized. The audibles shall be able to be coded when operated on a separate NAC.

Weatherproof Speakers and Speaker/Strobes
Weatherproof speakers and speaker/strobes shall be listed for Indoor/Outdoor use under UL Standard 1480. All speakers shall provide field selectable taps for 1/8W to 8W operation for either 25 VRMS or 70 VRMS audio systems and shall incorporate a sealed back construction for extra protection and improved audibility. Speakers without strobes shall be Wheelock Series ET-1010. They shall be listed to produce up to 94 dBA and shall incorporate a vandal resistant grille design. Speaker with strobes shall be Wheelock Series ET70WP. They shall be available for surface or semi-flush mounting to walls or ceilings and shall be listed to produce up to 93 dBA.

Synchronization Modules
When synchronization of strobes or temporal code-3 audibles is required, the appliances shall be compatible with the Wheelock Series DSM Sync Modules, Wheelock Power Supplies or other manufacturers panels with built-in Wheelock Patented Sync Protocol. The strobes and audibles shall not drift out of synchronization at any time during operation.

Series ASWP audibles and strobes shall be able to be synchronized on a 2-wire circuit with the ability to silence the audible if required. The strobes on Series MT multitone audible/strobe appliances shall be able to be synchronized and shall be able to be operated on a separate circuit from the audibles while the audible circuit is connected to a coded or continuous NAC.

Weatherproof Mounting Accessories
Weatherproof mounting options shall include surface mounting or semi-flush mounting to walls or ceilings. Surface mounted appliances shall mount to Wheelock IOB, WBB, WPBB or WPSBB weatherproof backboxes using either exposed conduit or concealed conduit. For concealed conduit the weatherproof backbox shall be mounted to a recessed electrical box with Wheelock's WP-KIT to provide a weatherproof seal for the electrical box. Semi-flush mounted appliances shall mount to a recessed electrical box using Wheelock WFP or WFPA flush plates to provide a weatherproof seal between the electrical box and the appliance.

NEMA Member

WE ENCOURAGE AND SUPPORT NICET CERTIFICATION
3 YEAR WARRANTY

S9004 WP 11/12

NJ Location
273 Branchport Ave.
Long Branch, NJ 07740
P: 800-631-2148
F: 732-222-8707
www.coopernotification.com

Cooper Notification is Wheelock® MEDC SAFEPATH WAVES Roam Secure

COOPER Notification

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7320-0785:0105
CATEGORY:	7320 - SPEAKERS
LISTEE:	Cooper Wheelock Inc. 7246 16th St. E., Ste. 105, Sarasota, FL, 34243 Contact: Newsome, Leon 941-487-2331 Email: LeaonJNewsome@Eaton.com
DESIGN:	Models ET-1010, ET-1011, ET-1070, ET-1071, ET-1080, ET-1081, ET-1090 and ET-109[illegible] series speaker or speaker/strobe. Refer to listee's data sheet for product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instructions, NFPA 72, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model number, electrical rating and UL label.
APPROVAL:	Listed as a speaker for use with separately listed compatible fire alarm control units. If this appliance is required to produce a distinctive three-pulse Temporal Pattern Fire Alarm Evacuation Signal (for total evacuation) in accordance with NFPA 72, 2002 Edition, the appliance must be used with a fire alarm control unit that can generate the temporal pattern signal. Refer to manufacturer's Installation Manual for details.
NOTES:	

*Rev. 06-13-2006

This listing is based upon technical data submitted by the applicant. OSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: 05/01/2023

Listing Expires: 06/30/2024

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

The WP-KIT allows for surface mounting of a weatherproof back box to a recessed electrical box.

WFPA and WFP plates allow for flush mounting of weatherproof products without an external back box.

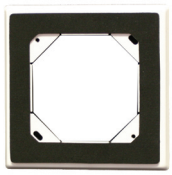
Available features and options:

Mounting: Flush or surface

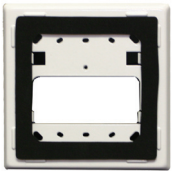
Color: Red or white

Mounting Screws Supplied

Mounting Accessories



WFP



WFPA



IOB



WPSBB



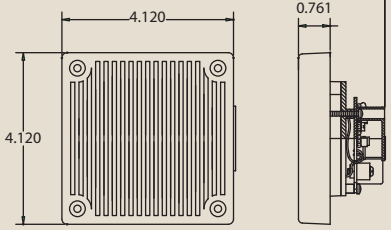
WPBB

Gasket Kit		Order Code
WP-KIT		4486
Flush Plates		
WFPA-R	Red	4698
WFPA-W	White	4701
WFP-R	Red	4696
WFP-W	White	4697
Backboxes		
IOB-R	Red	5046
IOB-W	White	5047
WPSBB-R	Red	9751
WPSBB-W	White	3033
WPBB-R	Red	9014
WPBB-W	White	4692
WBB-R	Red	2959
WBB-W	White	2960

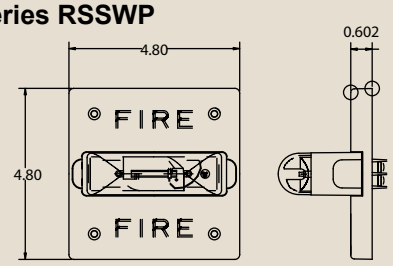


WBB

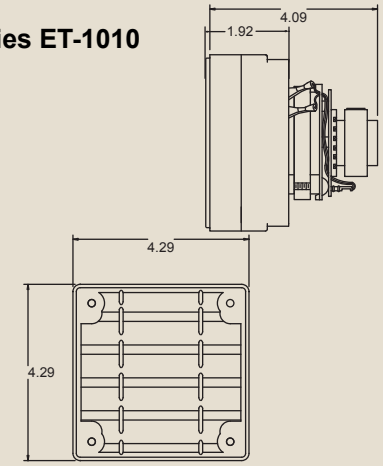
Series AHWP



Series RSSWP



Series ET-1010



Mounting Options:

	Backboxes, Plates, Gasket Kits		
	Surface Mount		Flush Mount
	Exposed Conduit	Concealed Conduit	
RSSWP Strobes	WPSBB	WPSBB + WP-KIT	WFP
ET70WP Speaker Strobes	IOB	IOB + WP-KIT	WFP
ASWP Horn Strobes	WPBB	WPBB + WP-KIT	WFPA
AHWP Horns	WBB	-	WFP
ET-1010 Speakers	WBB	-	WFP
MTWP Multitone Strobes	IOB	IOB + WP-KIT	WFP
Multitone	IOB	IOB + WP-KIT	WFP

Shown:
ASWP-2475C-FW with WFPA plate for flush mounting.



CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7300-0785:0177
CATEGORY:	7300 - FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES
LISTEE:	Cooper Wheelock Inc. 7246 16th St. E., Ste. 105, Sarasota, FL, 34243 Contact: Newsome, Leon 941-487-2331 Email: LeaonJNewsome@Eaton.com
DESIGN:	Models IOB, IOB-KIT, WBB, FBB, BB, DFB, FSB1, DBB, SB, SBB, SHBB, SBL, SFP, AP, UFP, FP, RP, ISP, ISP2, NATP, SP, TP, SHMP, WFP, WFPA, WPBB, WPSBB, WP-KIT, and SER, ZBB, SSB-4, ESB, ESBC (may be followed by letter or number indicating product color), LSBB and ESB-KIT. Refer to listee's data sheet for additional detailed product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model number and UL label.
APPROVAL:	Listed as speaker, audible and visual appliance accessories. Refer to listee's Installation Instruction Manual for details.
NOTES:	

03-13-14 gt

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Date Issued: 05/01/2023

Listing Expires: 06/30/2024

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

Gamewell FCI FIRE CONTROL INSTRUMENTS

by Honeywell

Velociti® Series

AMM-2F

Addressable Monitor Module

Description

The Gamewell-FCI Velociti® Series, addressable monitor module AMM-2F is a single Style B, Class B initiating device circuit (IDC) with a 47KW end-of-line resistor. This module provides an address for any device or group of devices connected to this circuit on the signaling line circuit (SLC) of the Gamewell-FCI addressable series fire alarm control panel. Any initiating device with normally open (N.O.) dry contacts may be made addressable when connected to the AMM-2F module.

The Velociti® Series use a communication protocol that substantially increases the speed of communication between the sensors and certain Gamewell-FCI analog addressable fire alarm controls. These devices operate in a grouped fashion. If one of the devices in the group has a status change, the panel's microprocessor stops the group poll and concentrates on the single device. The net effect is response speed up to five times greater than earlier designs.

The AMM-2F module can be programmed to provide a wide variety of input functions to the Gamewell-FCI addressable series fire alarm control panels. It can be identified as a manual station, heat detector, plenum detector, waterflow switch, tamper switch, N.O. contact, smoke detector, projected beam smoke detector, sub loop, remote zone, etc. It can also serve as a remote system silence, system reset, system acknowledge or drill switch. It is even possible to customize its device type to meet specific job requirements.

The initiating device circuit of the AMM-2F can support a maximum line resistance of up to 40 ohms allowing the use of linear heat detection devices. The compact size facilitates the installation of the module inside manual stations, or mounting boxes of various types of alarm initiating devices.

Velociti® is a registered trademark of Honeywell International Inc.
UL® is a registered trademark of Underwriters Laboratories Inc.



AMM-2F

Features

- Compact size allows easy installation
- Class B, Style B, initiating circuit
- 40 Ohm line resistance for each initiating device circuit
- Connects to any normally open dry contact device

Specifications

Supervisory Current:	.000375 amps
Alarm Current:	.00060 amps
Operating Temperature:	32° to 120° F (0° to 49° C)
Relative Humidity:	10 to 93% (non-condensing)
End-of-Line Resistance:	47K ohms
Dimensions:	1.3" L x 2.5" W x 0.5" D (3.3 x 6.4 x 1.3 cm)

Ordering Information

Part Number	Description
AMM-2F	Addressable monitor module, single circuit, Style B, Class B

SIGNALING UL LISTED S1949 FM APPROVED 3023594 MEA Approved 227-03-E VOL IV 7300-1703:0102

ISO 9001 CERTIFIED ENGINEERING & MANUFACTURING QUALITY SYSTEMS

GAMEWELL-FCI
12 Clintonville Road, Northford, CT 06472-1610 USA • Tel: (203) 484-7161 • Fax: (203) 484-7118

Specifications are for information only, are not intended for installation purposes, and are subject to change without notice. No responsibility is assumed by Gamewell-FCI for their use.
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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7300-1703:0102
PARENT LISTING No.:	7300-1653:0103
CATEGORY:	7300 - FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES
LISTEE:	GAMEWELL-FCI 12 Clintonville Road, Northford, CT, 06472 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Models AMM-4, *AMM-4F, AMM-2 and *AMM-2F monitor modules and Models AOM, AOM-2, AOM-2R, *AOM-2RF, AOM-2S and *AOM-2SF control modules. Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model designation, electrical rating and UL label.
APPROVAL:	Listed as accessories for use with separately listed compatible control units. System Sensor Model SMB500 surface mount box (CSFM Listing No. 7300-1653:103) may be used as an enclosure for these modules
NOTES:	FORMERLY: 7300-0694:178

12-4-07

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Date Issued: 05/05/2023

Listing Expires: 06/30/2024

Authorized By: **David Castillo** , Program Coordinator
Fire Engineering & Investigations Division

Addressable Devices

Velociti® Series AOM-2SF

Addressable Output Relay Supervised Control Module

General

The Gamewell-FCI Velociti® Series addressable output supervised control module (AOM-2SF) allows a Gamewell-FCI analog addressable fire alarm control panel to switch an external power supply, such as a DC supply or audio amplifier (up to 80 V_{RMS}) to notification appliances. The AOM-2SF notification appliance circuit can be wired either Class A (Style Z) or Class B (Style Y). It also supervises the wiring to the connected loads and reports their status to the panel as NORMAL, OPEN or SHORT CIRCUIT. The module contains a panel controlled LED.

The Velociti® Series use a communication protocol that substantially increases the speed of communication between the SLC devices and certain Gamewell-FCI analog addressable fire alarm control panels. These devices operate in a grouped fashion. If one of the devices in the group has a status change, the panel's microprocessor stops the group poll and concentrates on the single device. The net result is a superior response speed up to five times greater than the earlier designs.

The AOM-2SF module is designed for installation in the signaling line circuit of any Gamewell-FCI analog addressable fire alarm control panel. The signaling line circuits of Gamewell-FCI analog addressable fire alarm control panels are designed to accommodate up to 159 modules per circuit. The AOM-2SF is designed to mount in a 4" (10.16 cm) square junction box 2 1/8" (5.5 cm) deep.



AOM-2SF

Table 1 lists the relay contact ratings.

Current Rating	Maximum Voltage	Load Description	Application
3A	30 VDC	Resistive	Non-Coded
2A	30 VDC	Resistive	Coded
0.9A	110 VDC	Resistive	Non-Coded
0.5A	125 VAC	Resistive	Non-Coded
0.5A	30 VDC	Inductive (L/R=5ms)	Coded
1A	30 VDC	Inductive (L/R=2ms)	Coded
0.5A	125 VAC	Inductive (PF=.35)	Non-Coded
0.7A	75 VAC	Inductive	Non-Coded

Table 1: Relay Contact Ratings

Ordering Information

AOM-2SF: Addressable output supervised control module

FEATURES & BENEFITS

- Listed under UL® Standard 864 and UL2572 for Mass Notification
- Designed as a compact size to allow easy installation
- Includes Class A, Style Z, or Class B, Style Y notification appliance circuit
- Accommodates audio amplifiers up to 80 V_{RMS}
- FM Listed as suitable for a releasing device service
- Includes a bi-color LED that flashes green whenever the module is addressed, and lights steady red upon activation*

*Note 1: Only the red LED is operative in panels that do not operate in Velociti® mode
*Note 2: The bi-color LED functionality is not available on the GWF-7075 panel.

Velociti® Series AOM-2SF Technical Specifications

SYSTEM

Supervisory Current: 0.00375 amps
Alarm Current: .0065 amps
Operating Temperature: 32° to 120° F (0° to 49° C)
Relative Humidity: 10 to 93% relative humidity (non-condensing)
Dimensions: 4 1/2" H x 4" W x 1 1/4" D
(11.4 H x 10.2 W x 3.2 D cm)

TEMPERATURE AND HUMIDITY RANGES

This system meets NFPA requirements for operation at 0 – 49°C/32 – 120°F and at a relative humidity 93% ± 2% RH (noncondensing) at 32°C ± 2°C (90°F ± 3°F). However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and its peripherals be installed in an environment with a normal room temperature of 15 – 27°C/60 – 80°F.

STANDARDS

The Velociti Series AOM-2SF are designed to comply with the following standard:

UL Standards: UL 864 9th Edition

AGENCY LISTINGS AND APPROVALS

These listings and approvals apply to the modules specified in this document. In some cases, certain modules or applications may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

UL: S1949
FM: 3023594
MEA FDNY: 227-03-E Vol. IV
CSFM: 7300-1703:0102
ISO 9001 Certification

For a complete listing of all compliance approvals and certifications, please visit: http://www.gamewell-fci.com/en-US/documentation/Pages/Listings.aspx

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This document is not intended to be used for installation purposes. We try to keep our product information up-to-date and accurate. We cannot cover all specific applications or anticipate all requirements. All specifications are subject to change without notice.

For more information
Learn more about Gamewell-FCI's Velociti® Series AOM-2SF and other products available by visiting www.Gamewell-FCI.com

Honeywell Gamewell-FCI
12 Clintonville Road
Northford, CT 06472-1610
203.484.7161
www.honeywell.com

9020-0627 | I | 08/18
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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7300-1703:0102
PARENT LISTING No.:	7300-1653:0103
CATEGORY:	7300 - FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES
LISTEE:	GAMEWELL-FCI 12 Clintonville Road, Northford, CT, 06472 Contact: Brant, Lisa (203) 484-6105 Email: lisa.brant@honeywell.com
DESIGN:	Models AMM-4, *AMM-4F, AMM-2 and *AMM-2F monitor modules and Models AOM, AOM-2, AOM-2R, *AOM-2RF, AOM-2S and *AOM-2SF control modules. Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, model designation, electrical rating and UL label.
APPROVAL:	Listed as accessories for use with separately listed compatible control units. System Sensor Model SMB500 surface mount box (CSFM Listing No. 7300-1653:103) may be used as an enclosure for these modules
NOTES:	FORMERLY: 7300-0694:178

12-4-07

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Date Issued: 05/05/2023

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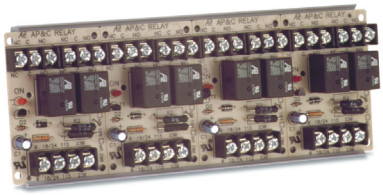
Authorized By: **David Castillo** , Program Coordinator
Fire Engineering & Investigations Division

AIR PRODUCTS AND CONTROLS

You in Control

MR-100, 200 SERIES

MULTI-VOLTAGE CONTROL RELAYS

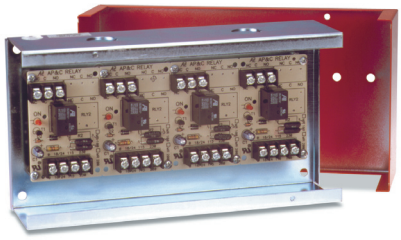


PRODUCT DESCRIPTION

The MR Series Multivoltage Control Relays offer SPDT or DPDT 10 Amp resistive contacts which may be operated by one of four input control voltages. A single relay may be energized from a voltage source of 24VDC, 24VAC, 120VAC or 230VAC by wiring to appropriate input terminals.



Each relay position contains a red LED which indicates the relay coil is energized. Relays may be "snapped apart" from a standard 4 module assembly and used independently. These Devices are Ideal for applications where local contacts are required for system status, remote contacts for control of electrical loads and general purpose switching. They are suitable for use with HVAC, Temperature Control, Fire Alarm, Security, Energy Management and Lighting Control Systems.



FEATURES

- Relays may be energized from a voltage source of 18 to 35VDC or VAC, 120VAC or 230VAC
- Each relay position contains a red LED, which illuminates when the coil is energized. This provides a time saving device when checking an installed system – no metering is required
- Single, dual or triple relay modules may be "snapped apart" from standard 4-position master
- DC control inputs are polarized
- For continuous duty use at 24VAC, 24VDC or 120VAC (NOTE: Not intended for continuous duty use @ 230VAC)
- Available in dust resistant enclosures with LED viewing port(s)
- /C versions mounted in enclosures
- /C/R versions with red covers for NYC and other uses
- /T versions come complete with track mounting hardware which facilitates installation in standard cabinets
- UL recognized relays rated at 10,000,000 mechanical operations
- UL listed as Control Unit Accessory

c UL us LISTED

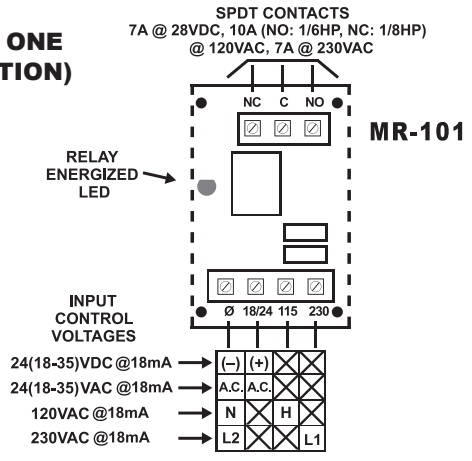
CSFM LISTED

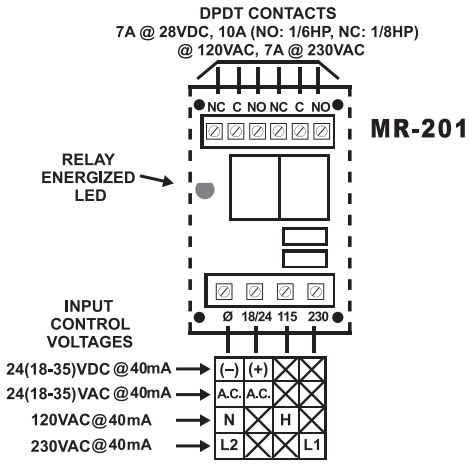
MEA ACCEPTED

RECOGNIZED COMPONENT

WIRING

(TYPICAL FOR ONE MODULE POSITION)





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A HALMA GROUP COMPANY

Distributed By:

PRODUCT SPECIFICATIONS

MODEL NUMBER:	MODULE POSITIONS	CONTACT CONFIGURATION PER POSITION	TRACK MOUNTED H X W X D	ENCLOSURE MOUNTED H X W X D	COVER MATERIAL	UL* FILE S3403	MEA FILE 73-92-E	CSFM FILE 7300-1004
MR-101/T	1	SPDT	3.25" (82mm) 2.125" (54mm) 1.50" (38mm)			UOXX2		:106
MR-101/C	1	SPDT		5.125" (130mm) 3.125" (79mm) 2.50" (63mm)	Grey ABS-94VO Plastic	UOXX UOXX2 UOXX7	Vol. 14	:101
MR-101/C/R	1	SPDT			Red ABS-94VO Plastic		Vol. 22	
MR-104/T	4	SPDT	3.25" (82mm) 8.50" (215mm) 1.50" (38mm)			UOXX2		:106
MR-104/C	4	SPDT		5.125" (130mm) 9.50" (241mm) 2.50" (63mm)	Plated 18ga CRS	UOXX UOXX2 UOXX7	Vol. 14	:101
MR-104/C/R	4	SPDT			Red 18ga CRS			
MR-201/T	1	DPDT	3.25" (82mm) 2.125" (54mm) 1.50" (38mm)			UOXX2		:106
MR-201/C	1	DPDT		5.125" (130mm) 3.125" (79mm) 2.50" (63mm)	Grey ABS-94VO Plastic	UOXX UOXX2 UOXX7	Vol. 16	:101
MR-201/C/R	1	DPDT			Red ABS-94VO Plastic		Vol. 22	
MR-204/T	4	DPDT	3.25" (82mm) 8.5" (215mm) 1.50" (38mm)			UOXX2		:106
MR-204/C	4	DPDT		5.125" (130mm) 9.50" (241mm) 2.50" (63mm)	Plated 18ga CRS	UOXX UOXX2 UOXX7	Vol. 16	:101
MR-204/C/R	4	DPDT			Red 18ga CRS			

COIL VOLTAGE:	MR-100: 24(18-35)VDC, 24(18-35)VAC, 120VAC, 230VAC MR-200: 24(18-35)VDC, 24VAC, 120VAC, 230VAC (Pull in voltage: 75% of nominal max. @ 25°C; Drop out voltage: 25% of nominal min. @ 25°C)
POLARIZED:	DC input only
ENERGIZED LED INDICATOR:	One per module position
CURRENT REQUIREMENT:	Per module position: MR-100 Series = 18mA / MR-200 Series = 40mA
CONTACT RATINGS:	7A @ 28VDC / 10A (NO:1/6HP, NC:1/8HP) @ 120VAC / 7A @ 230VAC
CONTACT CONSTRUCTION:	Dry Form "C"
ENVIRONMENTAL:	32°F to 120°F (0°C to 49°C) @ 85% RH (@ 32°F), Non-condensing, Non-freezing
WIRING:	Solid or stranded; #14 to #22 AWG terminals
/T VERSIONS:	3.5" wide, low profile plastic snap track provided with mounting screws
/C VERSIONS:	Backbox: 18ga CRS, plated with 1/2" conduit knockouts top and bottom

*UOXX=Control Unit Accessories, System; 2=Component; 7=Certified for Canada

NOTICE: The information contained in this document is intended only as a summary and is subject to change without notice. The products described have specific instructional/installation documentation, which covers various technical, approval, code, limitation and liability information. Copies of this documentation along with any general product warning and limitation documents, which also contain important information, are provided with the product and are also available from Air Products and Controls Inc. The information contained in all of these documents should be considered before specifying or using the products. Any example applications shown are subject to the most current enforced local/national codes, standards, approvals, certifications, and/or the authority having jurisdiction. All of these resources, as well as the specific manufacturer of any shown or mentioned related equipment, should be consulted prior to any implementation. For further information or assistance concerning the products, contact Air Products and Controls Inc. Air Products and Controls Inc. reserves the right to change any and all documentation without notice.

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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7300-1004:0101
CATEGORY:	7300 - FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES
LISTEE:	Apollo America Inc. 30 Corporate Drive, Auburn Hills, MI, 48326 Contact: Howells,Dale (248) 563-8405 (248) 332-8807 Email: dale.howells@apollo-fire.com
DESIGN:	Models MR-101/C, *MR-101/C/R, *MR-101-SSE/C, *MR-101-SSE/C/R, MR-104/C, *MR_104/C/R, *MR-104-SSE/C, *MR-104-SSE/C/R, MR-201/C, MR-201/C/*R, *MR-201-SSE/C, *MR-201-SSE/C/R, MR-204/C, MR-204/C/*R, *MR-204-SSE/C, *MR-204-SSE/C/R, PAM-1, PAM-2, PAM-3, PAM-4, PAM-SD, RIC-1, RIC-2, RIC-3, RIC-4, MR-RIC-301/*C, *MR-RIC-301/C/R, MR-RIC-305*/C, * MR-RIC-305/C/R, MR-RIC-401*/C, *MR-RIC-401/C/R, MR-RIC-405*/C and *MR-RIC-405/C/R relay modules. *Models MR-ITM/C and MR-ITM/C/R relay modules (with test mode). Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instruction, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, electrical rating and UL label.
APPROVAL:	Listed as relay modules for use with separately listed compatible fire alarm control units. Refer to manufacturer's Installation Manual for details.
NOTES:	1. Formerly Air Products and Controls, Inc.

*Rev. 04-03-14 gt

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Date Issued: **04/13/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING - BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No. 7300-1004:0101

CATEGORY: 7300 -- FIRE ALARM CONTROL UNIT ACCESSORIES/MISC. DEVICES

LISTEE: Apollo America Inc.30 Corporate Drive, Auburn Hills, MI 48326
Contact: Dale Howells (248) 332-3900 Fax (248) 332-8807
Email: dale.howells@apollo-fire.com

DESIGN: Models MR-101/C, *MR-101/C/R, *MR-101-SSE/C, *MR-101-SSE/C/R, MR-104/C, *MR_104/C/R, *MR-104-SSE/C, *MR-104-SSE/C/R, MR-201/C, MR-201/C/*R, *MR-201-SSE/C, *MR-201-SSE/C/R, MR-204/C, MR-204/C/*R, *MR-204-SSE/C, *MR-204-SSE/C/R, PAM-1, PAM-2, PAM-3, PAM-4, PAM-SD, RIC-1, RIC-2, RIC-3, RIC-4, MR-RIC-301/*C, *MR-RIC-301/C/R, MR-RIC-305*/C, * MR-RIC-305/C/R, MR-RIC-401*/C, *MR-RIC-401/C/R, MR-RIC-405*/C and *MR-RIC-405/C/R relay modules. *Models MR-ITM/C and MR-ITM/C/R relay modules (with test mode). Refer to listee's data sheet for detailed product description and operational considerations.

INSTALLATION: In accordance with listee's printed installation instruction, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction.

MARKING: Listee's name, electrical rating and UL label.

APPROVAL: Listed as relay modules for use with separately listed compatible fire alarm control units. Refer to manufacturer's Installation Manual for details.

NOTE: 1. Formerly Air Products and Controls, Inc.

*Rev. 04-03-14 gt

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Date Issued: **July 01, 2022** *Listing Expires* **June 30, 2023**

Authorized By: ***VICTOR WONG**, Program Coordinator*

Fire Engineering Division

Technical Data Sheet
Fire Alarm Cables- Addressable



2833 West Chestnut Street
Washington, PA 15301
Toll Free: (800) 245-4964
Fax: (724) 222-6420
www.westpenn-wpw.com

PART NUMBER: **D990**

DESCRIPTION: 16/2 Solid bare copper conductors, unshielded with an overall jacket.

NEC RATING: FPLR, NEC Article 760

APPROVALS: (UL) Listed

APPLICATION: Indoor data fire alarm cable for (Data Circuits, Initiating Circuits, Notification Circuits, Addressable Systems)

Construction Parameters:

Conductor	16 AWG Bare Copper
Stranding	Solid
Insulation Material	Copolene
Insulation Thickness	0.015" Nom.
Number of Conductors	2
Shield	None
Drain	None
Jacket Material	PVC
Jacket Thickness	0.030" Nom.
Overall Cable Diameter	0.223" Nom.
Approximate Cable Weight	29 Lbs/1M' Nom.
Flame Rating	UL 1666 Riser Flame Test

Electrical & Environmental Properties:

Temperature Rating	-20deg C to 60deg C
Operating Voltage	300 V RMS
Max.Capacitance Between Conductors @ 1 KHz	18 pf/ft Nom.
DC Resistance per Conductor @ 20deg C	4.2 Ohms/1M' Nom.
Velocity of Propagation	71% Nom.
Insulation Colors	Black, Red
Jacket Color	Red
RoHS Compliant	--

Mechanical Properties:

Max. Recommended Pull Tension	62.4 lbs.
Min. Bend Radius (Install)	2.25”

Specification Issue Date: 7/06

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Standard Lengths are 1000ft.
The Jacket is sequentially footmarked.
The information presented here is, to the best of our knowledge, is true and accurate. However, since conditions of use are beyond our control, all recommendations or suggestions are presented without guarantee or responsibility on our part. We disclaim all liability in connection with the use of information contained herein or otherwise.

Technical Data Sheet
Fire Alarm Cables



2833 West Chestnut Street
Washington, PA 15301
Toll Free: (800) 245-4964
Fax: (724) 222-6420
www.westpenn-wpw.com

PART NUMBER: **D991**

DESCRIPTION: 16/2 Solid bare copper conductors, shielded with an overall jacket.

NEC RATING: FPLR, NEC Article 760

APPROVALS: (UL) Listed

APPLICATION: Indoor data fire alarm cable for (Data Circuits, Initiating Circuits, Notification Circuits, Addressable Systems)

Construction Parameters:

Conductor	16 AWG Bare Copper
Stranding	Solid
Insulation Material	Polyolefin
Insulation Thickness	0.015" Nom.
Number of Conductors	2
Shield	100% Aluminum Polyester Foil
Drain	Stranded Tinned Copper
Jacket Material	PVC
Jacket Thickness	0.030" Nom.
Overall Cable Diameter	0.226" Nom.
Approximate Cable Weight	33 Lbs/1M' Nom.
Flame Rating	UL 1666 Riser Flame Test

Electrical & Environmental Properties:

Temperature Rating	-20deg C to 60deg C
Operating Voltage	300 V RMS
Max.Capacitance Between Conductors @ 1 KHz	30 pf/ft Nom.
Capacitance Between Conductors to Shield @ 1 KHz	54 pf/ft Nom.
DC Resistance per Conductor @ 20deg C	4.1 Ohms/1M' Nom.
Velocity of Propagation	71% Nom.
Insulation Colors	Black, Red
Jacket Color	Red
RoHS Compliant	--

Mechanical Properties:

Max. Recommended Pull Tension	76.4 lbs.
Min. Bend Radius (Install)	2.25”

Specification Issue Date: 7/06

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Technical Data Sheet
Aquaseal® Communication Cables



WEST PENN WIRE

2833 West Chestnut Street
Washington, PA 15301
Toll Free: (800) 245-4964
Fax: (724) 222-6420
www.westpenn-wpw.com

PART NUMBER: **AQC225**

DESCRIPTION: 16/2 Stranded bare copper conductors, unshielded with an Aquaseal tape and overall jacket.

NEC RATING: CM / CL3 / FPL, NEC Article 800, 725, and 760

APPROVALS: (UL) Listed

APPLICATION: Materials suitable for outdoor use, and indoor trays, allows a variety of uses for (Intercom, Security, Sound, Audio, Background music, and Fire Alarm Circuits)

Construction Parameters:

Conductor	16 AWG Bare Copper
Stranding	19x29
Insulation Material	PVC
Insulation Thickness	0.010" Nom.
Number of Conductors	2
Shield	None
Drain	None
Water-Blocking Tape	2 ply water swellable tape
Jacket Material	Sunlight/Moisture Resistance PVC
Jacket Thickness	0.025" Nom.
Overall Cable Diameter	0.242" Nom.
Approximate Cable Weight	52 Lbs/1M' Nom.
Flame Rating	UL 1685 Vertical Tray

Electrical & Environmental Properties:

Temperature Rating	-20deg C to 60deg C
Operating Voltage	300 V RMS
Max.Capacitance Between Conductors @ 1 KHz	35 pf/ft Nom.
DC Resistance per Conductor @ 20deg C	4.2 Ohms/1M' Nom.
Insulation Colors	Black, Red
Jacket Color	Gray
RoHS Compliant	--
TIA455-82B Water Infiltration Test Compliant	Yes
UL 444 & 13 Compliant	Yes

Mechanical Properties:

Max. Recommended Pull Tension	54 lbs.
Min. Bend Radius (Install)	2.4”

Specification Issue Date: 4/12

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Technical Data Sheet
Aquaseal® Audio and Alarm



WEST PENN WIRE

2833 West Chestnut Street
Washington, PA 15301
Toll Free: (800) 245-4964
Fax: (724) 222-6420
www.westpenn-wpw.com

PART NUMBER:	**AQC294**
DESCRIPTION:	16/2 Stranded bare copper conductors, shielded with an Aquaseal tape and overall jacket.
NEC RATING:	CM / CL3 / FPL, NEC Article 800, 725, and 760
APPROVALS:	(UL) Listed
APPLICATION:	Materials suitable for outdoor use, and indoor trays, allows a variety of uses for (Intercom, Security, Sound, Audio, Background music, and Fire Alarm Circuits)

Construction Parameters:

Conductor	16 AWG Bare Copper
Stranding	19x29
Insulation Material	PVC
Insulation Thickness	0.010" Nom.
Number of Conductors	2 (1 Pair)
Shield	100% Aluminum Polyester Foil
Drain	24AWG Stranded Tinned Copper
Water-Blocking Tape	2 ply water swellable tape
Jacket Material	Sunlight/Moisture Resistance PVC
Jacket Thickness	0.025" Nom.
Overall Cable Diameter	0.281" Nom.
Approximate Cable Weight	55 Lbs/1M' Nom.
Flame Rating	UL 1685 Vertical Tray

Electrical & Environmental Properties:

Temperature Rating	-20deg C to 60deg C
Operating Voltage	300 V RMS
Max.Capacitance Between Conductors @ 1 KHz	46 pf/ft Nom.
Capacitance Between Conductors to Shield @ 1 KHz	83 pf/ft Nom.
DC Resistance per Conductor @ 20deg C	4.2 Ohms/1M' Nom.
Insulation Colors	Black, Red
Jacket Color	Gray
RoHS Compliant	--
TIA455-82B Water Infiltration Test Compliant	Yes
UL 444 & 13 Compliant	Yes

Mechanical Properties:

Max. Recommended Pull Tension	67 lbs.
Min. Bend Radius (Install)	2.8”

Specification Issue Date: 4/12

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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7161-0859:0101
CATEGORY:	7161 - CABLES-FIRE PROTECTIVE SIGNALING
LISTEE:	West Penn Wire 2200 U.S. Highway 27 South, Richmond, IN, 47374 Contact: Dorna, Gerald (765) 994-9963 Email: gerald.dorna@belden.com
DESIGN:	Types FPL and FPLP power limited fire protective signaling cable. Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instructions, NEC Article 760, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, type, NEC rating and UL label.
APPROVAL:	Listed as power-limited fire protective signaling cable.
NOTES:	

Rev. 12-15-23 bh

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Date Issued: 12/15/2023

Listing Expires: 06/30/2024

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7160-0859:0102
CATEGORY:	7160 - CABLES-OTHERS
LISTEE:	West Penn Wire 2200 U.S. Highway 27 South, Richmond, IN, 47374 Contact: Dorna, Gerald (765) 994-9963 Email: gerald.dorna@belden.com
DESIGN:	Type NPLF conductor cable. Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Listee's name, type, NEC rating and UL label.
APPROVAL:	Listed as non-power limited conductor cable.
NOTES:	

Rev. 12-15-2023
bh

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Date Issued: **12/15/2023**

Listing Expires: **06/30/2024**

Authorized By: **David Castillo**, Program Coordinator
Fire Engineering & Investigations Division

CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL
FIRE ENGINEERING & INVESTIGATIONS DIVISION
BUILDING MATERIALS LISTING PROGRAM

LISTING SERVICE

LISTING No.:	7160-0859:0103
CATEGORY:	7160 - CABLES-OTHERS
LISTEE:	West Penn Wire 2200 U.S. Highway 27 South, Richmond, IN, 47374 Contact: Dorna, Gerald (765) 994-9963 Email: gerald.dorna@belden.com
DESIGN:	Type NPLFP plenum cable. Refer to listee's data sheet for detailed product description and operational considerations.
RATING:	
INSTALLATION:	In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction.
MARKING:	Type and UL label.
APPROVAL:	Listed as non power-limited plenum cable.
NOTES:	

Rev. 12-15-2023
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Date Issued: **12/15/2023**

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