

City of Portland, Maine



Portland Fire Department Fireboat Crew Quarters Renovation

October 28, 2012

Bid #3913

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**CITY OF PORTLAND, MAINE
Notice to Contractors**

FIREBOAT CREW QUARTERS RENOVATION

Sealed bids will be received at the Purchasing Office, Room 103, City Hall, 389 Congress Street, Portland, Maine 04101, until 3:00 P.M., Tuesday, November 27, 2012, at which time they will be publicly opened, for:

Project Name: Fireboat Crew Quarters Renovation
Bid #3913

Location: 54 Commercial Street
Portland, Maine

Outline of Work: Briefly and without force and effect upon the contract documents, the work of the contract can be summarized as follows: furnishing all the labor, materials, equipment, and incidentals necessary to complete selective demolition of interior partitions, finishes, fixtures and building systems within the existing fireboat quarters and install new partitions, insulation, finishes, fixtures and systems as described in the drawings. Work also includes construction of a small new addition of masonry construction to house a new sprinkler service. This will entail excavation, foundation work and utility work to tie new sprinkler service into water main.

MANDATORY PRE-BID CONFERENCE

There will be a **mandatory pre-bid meeting on Tuesday, November 13, 2012 at 10:00am** at the fireboat crew quarters. All prospective qualified bidders must attend. Interested parties shall meet and register at the Casco Bay Parking Garage entrance. Only firms represented at this meeting may submit a bid.

Copies of the above documents will be available at the Purchasing Office, Room 103, City Hall, 389 Congress Street, Portland, ME 04101, upon payment in advance of \$50.00 for each set of plans and specifications, or \$75.00 for each set of plans and specifications to be mailed. Each prospective bidder will be required to obtain from the City each copy of the proposal form and each set of plans; e-mail jrl@portlandmaine.gov, or phone (207) 874-8654, fax (207) 874-8652.

CITY OF PORTLAND, MAINE

CITY OF PORTLAND, MAINE

FIREBOAT CREW QUARTERS RENOVATION

Notice to Bidders

Sealed bids for the above project, addressed to Purchasing office, City Hall, Room 103, 389 Congress Street, Portland, Maine 04101, and clearly marked on the outside of the envelope with the name of the bidder, project title and bid number, will be received **until 3:00 PM on Tuesday, November 27, 2012**, at which time they will be publicly opened.

MANDATORY PRE-BID MEETING

There will be a **mandatory pre-bid meeting on Tuesday, November 13, 2012 at 10:00am** at the fireboat crew quarters. Interested parties shall meet and register at the Casco Bay Parking Garage entrance. Only firms represented at this meeting may submit a bid.

All questions shall be directed in writing ONLY to the Purchasing Office at the above address and be received no later than 12 noon, Tuesday, November 20, 2012. (FAX 207-874-8652, or email krc@portlandmaine.gov). Responses from the City that substantially alter this bid will be issued in the form of a written addendum to all bid holders registered in the Purchasing Office. Oral explanations or interpretations given before the award of the contract will not be binding.

Bids from vendors not registered with the Purchasing Office may be rejected; receipt of this document directly from the City of Portland indicates registration. Should a vendor receive this Invitation from a source other than the City, please contact 207-874-8654 to ensure that your firm is listed as a vendor for this project. All bids shall be submitted on the attached form and are to remain open for sixty (60) days after their opening. Late, faxed or bids submitted electronically will be rejected.

This bid will be awarded to the bidder that submits the lowest base bid amount.

The successful bidder shall agree to defend, indemnify and save the City harmless from all losses, costs or damages caused by its acts or those of its agents, and, before signing the contract, will produce evidence satisfactory to the City's Corporation Counsel of coverage for General Public and Automobile Liability insurance in amounts not less than \$400,000 per person, for bodily injury, death and property damage, protecting the contractor and the City, and naming the City as an additional insured from such claims, and shall also procure Workers' Compensation insurance.

The City disclaims any and all responsibility for injury to contractors, their agents or others while examining the job or at any other time.

The successful bidder shall supply the City with a Performance Bond and Labor and Material Payment Bond, each in the amount of the contract price, guaranteeing one hundred percent (100%) performance of the contract, including the guarantee period and free and clear of any and all liens, attachments and encumbrances. All bonds shall comply with the requirements of Maine state law.

Materials and equipment purchased for permanent installation in this project are exempt from the State of Maine Sales and Use tax and from all Federal Excise taxes. Each bidder shall take this exception into account in calculating his bid price for the work.

The contractor shall furnish all labor, materials, fixtures, supplies, equipment and transportation necessary to do the work as specified. The contractor affirms that the equipment, or work, shall be in full compliance with any and all applicable O.S.H.A., D.O.T., ANSI, Federal, State and/or municipal regulations. **Contractors will be responsible for acquiring all necessary permits, licenses and pay all associated fees (including dump disposal fees and disposal taxes, if applicable and transportation costs), unless otherwise specified herein.**

The contractor shall erect and maintain, at all times, any and all safeguards necessary for the protection of life and property of all pedestrian and vehicular traffic. Note that this project will require care by the contractor to limit the disruption with students arriving and departing to school by vehicle or on foot. The contractor is responsible to submit a traffic control plan with this in mind. No additional payment or costs will be made to the contractor for this work.

It is the custom of the City of Portland, Maine to pay its bills 30 days following delivery of items, their acceptance, and receipt of invoices for, all items covered by the Purchase Order(s). In submitting bids under these specifications bidders should take into account all discounts, both trade and time allowed in accordance with this payment policy and quote a net price. The City is exempt from the State's Sales and Use Tax and from all Federal Excise tax.

Equal Employment Opportunities. Vendor shall comply fully with the Nondiscrimination and Equal Opportunity Provisions of the Workforce Investment Act of 1998, as amended (WIA, 29 CFR part 37); the Nontraditional Employment for Women Act of 1991; title VI of the Civil Rights Act of 1964, as amended; section 504 of the Rehabilitation Act of 1973, as amended; the Age Discrimination Act of 1975, as amended; title IX of the Education Amendments of 1972, as amended; and with all applicable requirements imposed by or pursuant to regulations implementing those laws, including but not limited to 29 CFR part 37.

The City reserves the right to waive any informalities in bids, to accept any bid or portions thereof (bidders are advised to note this and quote accordingly) and to reject any or all bids should it be deemed for the best interest of the City to do so. The City reserves the right to substantiate the bidder's qualifications, capability to perform, availability, past performance record and to verify that the bidder is current in its obligations to the City, as follows:

Pursuant to City procurement policy and ordinance, the City is unable to contract with businesses or individuals who are delinquent in their financial obligations to the City. These obligations may include but are not limited to real estate and personal property taxes and sewer user fees. Bidders who are delinquent in their financial obligations to the City must do one of the following: bring the obligation current, negotiate a payment plan with the City's Treasury office, or agree to an offset which shall be established by the contract which shall be issued to the successful bidder.

October 28, 2012

Karen C. Marston
Assistant Purchasing Manager

PROPOSAL

Proposal of

Name

Address

The name and address shown on the above lines shall be the official name and address of the person, partnership or corporation submitting this bid and shall agree with the "Signature of Bidder" in the case of an individual; the "Name of Firm or Partnership" in the case of a firm or partnership; the "Name of Bidder" in case of a corporation.

TO: Karen C. Marston, Assistant Purchasing Manager
City Hall, Room 103
389 Congress Street
Portland, ME 04101

The undersigned having carefully examined the site of the work; the Plans; Standard Specifications, including all current amendments or revisions there of; the Supplemental Specification, Special Provisions; Contract Agreement and Contract Bonds, where applicable, contained herein for the **Fireboat Crew Quarters Renovation** on which proposals will be received until the time specified in this bid document; and in case of award, do(es) hereby propose and offer to enter into a contract to supply all the materials, tools, equipment and labor required to perform and construct the whole of the work in strict accordance with the terms and conditions of this contract at lump sum price stated in the following Price Proposal Page submitted by the undersigned.

This Proposal may be accepted by the City of Portland at any time within sixty (60) calendar days after opening of the bids.

**PRICE
PROPOSAL**

The undersigned having examined the attached document do(es) hereby propose and offer to enter into a contract to supply all the materials, tools, equipment and labor required to perform and construct the whole of the work in strict accordance with the terms and conditions of this contract at the price stated in the following Proposal:

BASE BID

LUMP SUM PRICE: \$ _____
(Award Basis)

TIME FOR COMPLETION FROM START OF WORK: _____

WARRANTY OF LABOR: _____

WARRANTY OF MATERIALS: _____

ALTERNATE BID: _____

(Alternate #1 - Delete VCT flooring and add heat welded sheet vinyl flooring with integral coved base.)

The undersigned also agrees as follows:

FIRST: To do any extra work which may be ordered, and to accept as full compensation therefore such prices as may be agreed upon in writing by the Engineer and the Contractor; or in case no agreement is made, to accept as full compensation the amount determined upon a "force account" basis as provided in the M.D.O.T. Standard Specifications, Revision of December, 2002.

SECOND: To begin work on the date specified in the Engineer's "Notice to Commence Work" as mutually agreed and to prosecute said work in such a manner as to complete it in the time stated on this proposal.

THIRD: That this offer is to continue open to acceptance until the formal contract is executed by the successful bidder of this work, and the City may at any time without notice accept this proposal whether any other proposal has previously been accepted or not. Provided, however, that the City will accept, in writing, one of the proposals made, or reject all proposals made, within sixty (60) calendar days after the date of opening of the proposals.

The undersigned as Bidder, declares that the only persons or parties interested in this Proposal are those named herein; that the bidder is not financially interested in, or otherwise affiliated in a business way with any other bidder on this contract; and that this Proposal is made without collusion with any other person, firm or corporation.

The undersigned declares that any person(s) employed by the City of Portland, Maine, who has direct or indirect personal or financial interest in this proposal or in any portion of the profits which may be derived therefrom, has been identified and the interest disclosed by separate attachment. (Please include in your disclosure any interest which you know of. An example of a direct interest would be a City employee who would be paid to perform services under this proposal. An example of an indirect interest would be a City employee who is related to any officers, employees, principal or shareholders of your firm or you.) If in doubt as to status or interest, please disclose to the extent known.

Respectfully submitted this _____ day of _____, 20 _____

IF AN INDIVIDUAL, SIGN HERE

Signature of Bidder _____

Address _____

Telephone Number _____ Fax Number _____

Social Security Number: _____

(Signatures for a Firm, Partnership or Corporation on next page.)

PROPOSAL (continued)

IF A FIRM OR PARTNERSHIP, SIGN HERE

Signature of Bidder _____

Name of Firm or Partnership _____

Business Address _____

Telephone Number _____ Fax Number _____

Social Security or Tax ID Number _____

Names and Addresses of Members of Firm or Partnership:

IF A CORPORATION, SIGN HERE

Name of Bidder _____

Authorized Signature _____
(name) (title)

Business Address _____

Telephone Number _____ Fax Number _____

Tax ID Number _____

Incorporated under the Laws of the State of _____

Names and Addresses of Officers of the Corporation:

President _____

Secretary _____

Treasurer _____

_____ ss

Before me, personally appeared _____ and acknowledged that the signature to the preceding bid is his/her signature in his/her official capacity.

Date: _____

Notary Public - Signature and Seal

**ALL CORPORATIONS MUST SIGN THIS FORM
AND SUBMIT WITH THE BID PROPOSAL**

(Insert copy of that part of the records of the corporation wherein authority is given to the officer of that corporation to sign this bid on behalf of the corporation.)

(date)

The above is a true copy of the records of the _____
Corporation, which records are in my legal custody.

Officer having custody of the records

_____SS

Before me appeared, _____,

_____ of the _____ Corporation, and
made

oath that the above statement is true.

Notary Public - Signature and Seal

NOTICE

(This Must Be Filled Out)

The full names and residences of all persons interested in this bid as principals are as follows: (In case of Corporation, include and identify President, Treasurer, Manager)

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**ALL CONTRACTORS SHALL FILL IN THE FOLLOWING INFORMATION
BEFORE SUBMITTING BID**

	Name and Address of Supplier	Products to be Supplied
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____

	Name and Address of Contractor	Service or Trades to be Supplied	Anticipated \$ Amount
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____
4	_____	_____	_____
5	_____	_____	_____
6	_____	_____	_____

AGREEMENT BETWEEN THE
CITY OF PORTLAND
AND

(CONTRACTOR)

AGREEMENT entered into this _____ day of _____, 2012 by and between the CITY OF PORTLAND, a body politic and corporate, (hereinafter the "CITY"), and _____, located at _____ (hereinafter the "CONTRACTOR").

WITNESSETH

WHEREAS, the CITY did advertise by Bid #3913, entitled Fireboat Crew Quarters Renovation, and

WHEREAS, the CONTRACTOR did, under date of November 27, 2012, submit a Bid for such work; and

WHEREAS, after due consideration of all the Proposals, the CITY did award the Bid to the CONTRACTOR;

NOW THEREFORE, in consideration of the mutual promises made by each party to the other, the parties covenant and agree as follows:

1. The CONTRACTOR shall furnish all labor, materials, fixtures, supplies, equipment and transportation and shall perform all work required for the construction and completion of the Fireboat Crew Quarters Renovation project in accordance with the specifications contained in the contract documents entitled Fireboat Crew Quarters Renovation, Bid #3913, dated October 28, 2012 (hereinafter referred to as "Contract Documents") of which this Agreement is a part. All work shall be performed in strict conformance with the provisions of this Agreement, the Invitation for Bids, the CONTRACTOR's Proposal, and any and all General and Detailed Provisions and Plans.
2. It is agreed that the amount(s) given on the Proposal Page in the CONTRACTOR's Proposal Section of the Contract Documents will be used as the basis for determining the amount due under this Contract Agreement and for establishing the amount of the required Contract Performance Surety Bond and Contract Payment Surety Bond, and that the amount due under this Agreement so determined is _____ (\$ _____) (hereinafter referred to as the "Contract Price"). The CITY will have the right to increase or decrease the amount and extent of the work by giving reasonable notice in writing to the CONTRACTOR.

3. **CONTRACTOR** covenants and agrees that all work performed and materials used shall be free from all defects, and that all work be performed as specified.
4. The **CITY** reserves the right to require Waivers of Lien from subcontractors and/or suppliers prior to each progress payment made to **CONTRACTOR** pursuant to the terms of this Agreement.
5. Prior to the execution of this Agreement, **CONTRACTOR** shall procure and maintain Public Liability Insurance coverage and Automobile Insurance coverage in amounts of not less than Four Hundred Thousand Dollars (\$400,000.00) combined single limit and aggregate for bodily injury, death, and property damage, naming the **CITY** as an additional insured thereon, and shall also procure Workers' Compensation Insurance coverage. **CONTRACTOR** shall furnish and thereafter maintain certificates evidencing such coverage, which certificates shall guarantee thirty (30) days' notice of termination of insurance from insurance company or agent.
6. Prior to the execution of this agreement, **CONTRACTOR** shall supply the City with a Performance Bond and Labor and Material Payment Bond, each in the amount of the contract price, guaranteeing one hundred percent (100%) performance of the contract, including the guarantee period and free and clear of any and all liens, attachments and encumbrances. All bonds shall comply with the requirements of Maine state law.
7. To the fullest extent permitted by law, the **CONTRACTOR** shall defend, indemnify and hold harmless the **CITY**, its officers and employees, from and against all claims, damages, losses, and expenses, just or unjust, including but not limited to the costs of defense and attorneys' fees arising out of or resulting from the performance of the Agreement, provided that any such claims, damage, loss or expense (1) is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property, including the loss of use therefrom, and (2) is caused in whole or in part by any negligent act or omission of the **CONTRACTOR**, anyone directly or indirectly employed by it, or anyone for whose act it may be liable.
8. Upon receipt of executed contracts and insurance as required, the **CITY** will promptly send an executed **CITY** contract and a "Notice to Commence Work" to the **CONTRACTOR**. The **CONTRACTOR** agrees to perform no work under this Agreement until it receives said Notice and to complete the work in the time specified by the contractor on the Proposal Page; that date/time is:_____. The time set for such completion may be extended only by written consent of the Director of Public Buildings for City of Portland (hereinafter referred to as the "**DIRECTOR**").
9. The **CONTRACTOR** shall perform the work to the satisfaction of the responsible **CITY** official who will have the right of inspection at all times, and whose approval and acceptance of the work will be a condition precedent to payments by the **CITY** under this Contract. **CITY** inspectors will have the authority to stop work in progress if such work is being done contrary to the plans, specifications, or engineering practice.
10. In the event that any dispute as to the amount, nature or scope of the work required under this Contract, the decision and judgment of the responsible **CITY** official will be final and binding.
11. The **CONTRACTOR** shall guarantee the work for a period of one (1) year for the faithful remedy of any defects due to faulty materials or workmanship and payment for any damage resulting therefrom.

- 12. **CONTRACTOR** shall keep accurate records of all services performed under this Agreement and shall submit such information to the **CITY** on a monthly basis. Payment for such services shall be made to **CONTRACTOR** not more than thirty (30) days after receipt of said forms and acceptance of the work by the **DIRECTOR**.
- 13. The **CITY** may terminate this Agreement for cause by written Notice to the **CONTRACTOR**. In the event of such termination, **CONTRACTOR** shall not be entitled to any further payment under this Agreement from the date of receipt of said Notice.
- 14. The **CITY** will have the right to terminate this Agreement at any time for its convenience on prior written Notice to **CONTRACTOR**. If Agreement is terminated by the **CITY** for convenience, the **CITY** will pay the **CONTRACTOR** for all work performed and all materials purchased pursuant to this Agreement prior to receipt of said Notice.

IN WITNESS WHEREOF, the said **CITY OF PORTLAND** has caused this Agreement to be signed and sealed by Mark H. Rees, its City Manager, thereunto duly authorized, and _____ has caused this Agreement to be signed and sealed by _____, its _____, thereunto duly authorized, the day and year first above written.

WITNESS

CITY OF PORTLAND

BY: _____

Mark H. Rees
It's City Manager

CONTRACTOR

By: _____

(Print or type name)

Its _____

Approved as to Form:

Approved as to funds:

Corporation Counsel's Office

Budget Office

**Fireboat Crew Quarters Renovation
October 28, 2012**

Project Dates

1. Contract time for the Work scheduled at the Fireboat Crew Quarters Renovation may commence in December 2012.
2. Contract time for the Work scheduled at City of Portland owned facilities will be subject to Owner's review and approval of Contractor's submitted schedule.
3. Bid due date for the Work will be 3:00 EST, Tuesday, November 27, 2012.
4. Technical questions concerning the bid must be submitted in writing no later than 12:00 noon, Tuesday, November 20, 2012.

Additional Requirements

1. Contractor is responsible for complying with all OSHA regulations.
2. Contractor shall provide a Site Specific Safety and Health Plan (SSHP) prior to project construction.
3. All installation work shall comply with the current state and local codes and regulations.
4. After construction is complete, a total of three (3) copies of all documentation, and warranties shall be provided.
5. Three (3) complete copies of maintenance manuals shall be provided

Summary of Work

PART 2 – GENERAL REQUIREMENTS

1.1 DESCRIPTION

Briefly and without force and effect upon the contract documents, the work of the contract can be summarized as follows: furnishing all the labor, materials, equipment, and incidentals necessary to complete selective demolition of interior partitions, finishes, fixtures and building systems within the existing fireboat quarters and install new partitions, insulation, finishes, fixtures and systems as described in the drawings. Work also includes construction of a small new addition of masonry construction to house a new sprinkler service. This will entail excavation, foundation work and utility work to tie new sprinkler service into water main.

1.2 SCOPE OF WORK

The scope of work includes providing all labor, material, tools, equipment, and supervision necessary to complete the following:

- A. Demolish existing interior partitions, fixtures, and finishes.
- B. Reconstruct new bathroom, shower room, bedrooms, living room, kitchen, office, and work room with new partitions. Insulate exterior walls and precast concrete deck above. Install new HVAC equipment and ductwork, sprinkler system, plumbing, electrical and data systems.
- C. Construct new masonry enclosed addition to house new sprinkler service. Excavation, foundation work and utility work will be required for the addition and tying in the sprinkler service to the existing water main.
- D. As a bid Alternate, delete VCT flooring. Add therefore heat welded sheet vinyl flooring with integral coved base.

1.3 CONSTRUCTION DOCUMENTS SUBMITTALS

- A. Prior to starting the work, the Contractor must submit all required shop drawings showing layout, details of construction and identification of materials. Reference attached technical specifications for details and additional requirements.
- B. Submittal Schedule: Within (2) weeks of authorization to proceed, submittal a submittal schedule to the design team indicating all action submittals required for the project; submittal schedule shall accommodate review durations indicated below or in the technical specifications, whichever is more lengthy.

- C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineers receipt of submittal.
- D. Review: Allow 14 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals.
- E. Incomplete submittals will not be reviewed.
- F. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with.
- G. Hardcopy Submittals: Submit three prints. Prints will be reviewed by the Engineer, and then the Architect when required. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.
- H. Electronic Submittals:
 - a. Contractor shall include in the submittal schedule an indication of submittals that are intended to be submitted electronically. Upon receipt of the submittal schedule, the Engineer reserves the right to indicate submittals that will not be accepted electronically. Paper copies of such submittals shall be furnished as referenced in this specification.
 - b. The Engineer reserves the right to require paper copies of submittals that are received electronically. Provide Engineer one (1) paper copies in addition to the electronic submittal. Paper copy will be retained and electronic copy will be returned. Review cycle for such submittals shall not commence until such time that the paper copies are received.
 - c. Electronic Submittals shall be submitted in Protected Document Format (PDF) compatible with Adobe Acrobat Professional version 7.0 or later. Electronic files shall not be broken into smaller individual files. File sizes too large to process email or within a file transfer protocol (FTP) site shall be provided on a CD.

- d. The submission of submittals electronically does not relieve the contractor of their responsibility to review the submittal prior to transmission to the Engineer. Electronic Submittals shall include contractor comments, and a statement and/or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with. Electronic submittals without the Contractor's approval will be rejected and returned.
- e. The Engineer assumes no responsibility for the printed reproduction of submittals reviewed electronically, transmission errors or returned electronic submittals that become corrupted or are otherwise not accessible by the Contractor's or Subcontractor's computer hardware and/or software.
- I. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- J. Copies: Unless otherwise noted, submit (3) three copies of Action submittals for review by the Engineer. One copy will be returned. Provide Owner with a duplication of the returned copy.
- K. Upon completion of the installed work, submit copies of the manufacturer's final inspection to the Owner prior to issuance of the manufacturer's warranty.

1.4 ALTERNATES: Schedule of Alternates:

- A. Alternate Number 1: As a bid Alternate, delete VCT flooring. Add therefore heat welded sheet vinyl flooring with integral coved base.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Limited storage area will be provided by Owner, where available. Supply temporary storage required for storage of equipment and materials for duration of Project. Utilize only areas designated by Owner's Representative for storage.
- B. Deliver materials to the job site in the manufacturer's original, unopened containers or wrappings with the manufacturer's name, brand name and installation instructions intact and legible. Deliver in sufficient quantity to permit work to continue without interruption.
- C. Comply with the manufacturer's written instructions for proper materials storage.
 - 1. Store materials within temperature ranges complying with manufacturer's recommendations, in dry areas protected from water and direct sunlight. If exposed to temperatures lower or higher than this the installer must restore to

this range before using.

2. Store materials containing solvents or cements in dry, well ventilated spaces with proper fire and safety precautions. Keep lids on tight. Use all products before expiration of their shelf life.
- D. All materials must be stored on pallets, off the ground and tightly covered with waterproof materials.
- E. Any materials which are found to be damaged shall be removed and replaced at the installer's expense.
- F. Substitutions:
1. Substitution Requests: Within 2 weeks of notice to proceed, submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 2. Engineers/Owners Action: If necessary, Engineer and/or Owner will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within 10 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

1.6 BUILDING OCCUPANCY AND USE OF PREMISE

- A. Owner will occupy premises during periods of construction for the conduct of his normal operations. Cooperate with Owner to minimize conflict and to facilitate Owner's operations. Interior school spaces and facilities may not be utilized unless Owner's permission is requested and granted.
- B. Predetermine and obtain approval, in advance from Owner, for vertical and horizontal transportation of labor and construction materials onto and out of the building.
- C. Before beginning work Contractor must secure approval from the Owner for the following.
1. Access to the site.
 2. Areas permitted for storage of materials and debris.
 3. Areas permitted for the location of cranes, hoists and chutes for loading and unloading materials to and from the roof.

- D. Contractor parking will not be provided by the Owner.
- E. Interior stairs or elevators may not be used for removing debris or delivering materials, except as authorized by the Owner.

1.7 CONTRACTOR USE OF PREMISES

- A. Contractor will limit use of premises to allow for continuous, uninterrupted Owner occupancy and use. Dumpsters, scaffolds, ladders, staging or any other equipment will be only as permitted by the Owner's Representative.
- B. Coordinate use of premises under direction of Owner's Representative.
- C. Assume full responsibility for protection and safekeeping of products stored on-site under this Contract.
- D. Obtain and pay for use of secured additional storage or work areas needed for operations under this Contract.
- E. Obtain and pay for use of portable toilet facilities for use by Contractor's work force. Contractor's work force will not be allowed regular access to interior toilet facilities. Special situations, in which access to interior toilet facilities is requested, will be at Owner's discretion.
- F. Maintain all exits from the building as fire exits. Should it be necessary, the Contractor will stop work during facility functions and allow use of all egresses from the building.
- G. Keep all drive lanes open at all times.

1.8 TEMPORARY UTILITIES, FACILITIES AND CONTROLS

- A. Temporary Utilities:
 - 1. Water and power for construction purposes will be made available at the site and will be made available to the Contractor. No lighting for construction purposes will be made available to the Contractor.
 - 2. Contractor must provide all hoses, valves and connections for water from the source designated by the Owner when made available.
 - 3. When available electrical power should be extended as required from the source designated by the Owner. Contractor must provide all trailers, connections and fused disconnects.
- B. Temporary Sanitary Facilities:

1. Sanitary facilities will not be made available at the job site. The Contractor shall be responsible for the provision and maintenance of portable toilets or their equal.

C. Building Site:

1. The Contractor shall use reasonable care and responsibility to protect the building and site against damages. The Contractor shall be responsible for the correction of any damage incurred as a result of the performance of the contract.
2. The Contractor shall remove all debris from the job site in a timely and legally acceptable manner so as to not detract from the aesthetics or functions of the building.

D. Security:

1. Obey the Owner's requirements for personnel identification, inspection and other security measures.

1.9 JOB SITE PROTECTION

- A. The Contractor shall adequately protect building, paved areas, service drives, lawns, shrubs, trees, etc. from damage while performing the required work. Provide canvas, boards and sheet metals (properly secured) as necessary for protection and remove protection materials as work is completed. The Contractor shall repair or be responsible for costs to repair all property damaged during the work.
- B. During the Contractor's performance of the work, the building Owner will continue to occupy the existing building (parking garage). The Fire Boat crew will NOT be occupying the space during construction. The Contractor shall take all precautions to prevent the spread of dust and debris, particularly where such material may sift into the building. The Contractor shall provide labor and materials to construct, maintain and remove necessary, temporary enclosures to prevent dust or debris in the construction areas from entering the remainder of the building.
- C. Do not overload any portion of the building, by either use of or placement of equipment, storage of debris, or storage of materials.
- D. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.
- E. Take precautions to prevent drains from clogging during the work. Remove debris

at the completion of each day's work and clean drains, if required. At completion, test drains to ensure the system is free running and drains are watertight. Remove strainers and plug drains in areas where work is in progress. Install flags or telltales on plugs. Remove plugs each night and screen drain.

- F. Store moisture susceptible materials above ground and protect with waterproof coverings.
- G. Remove all traces of piled bulk material and return the job site to its original condition upon completion of the work.

1.10 WORKING HOURS AND SCHEDULE

- A. Construct work in stages to accommodate Owner's use of premises during construction. Coordinate progress schedule and coordinate with Owner's Representative occupancy during construction. Contractor's daily work areas must be coordinated with and approved by the Owner's Representative, prior to any work commencing in that area. Submit work schedule to Owner's Representative. Normal working hours shall be between the hours of 7:00 a.m. and 7:00 p.m., seven days a week, except holidays.
- B. Construct work in stages to provide for continuous public usage. Do not close off public access to facility.
- C. Obtain approval from Owner prior to altering Work schedule.

1.11 CONSTRUCTION SCHEDULE

- A. The Contractor's Construction Schedule shall clearly identify the on-site crew foreman and the size of the crew to be utilized for each site. The crew size shall remain consistent and work shall be continuous throughout the project, from start-up to completion.
- B. The Owner's Representative shall review the Contractor's Construction Schedule prior to the start of any work. After defining the location(s) of the work progress, the Owner's Representative shall arrange to control occupancy in the facilities to the greatest extent possible. It shall be the responsibility of the Contractor to supply the Owner's Representative with written notice, 24 hours in advance, if his work location(s) for a workday is different from the schedule. The Contractor shall update his Construction Schedule weekly and submit a copy to the Owner's Representative for review.
- C. Schedule shall be updated on a bi-weekly basis; present the updated schedule at a biweekly project meeting with the project Owner.

1.12 PRE-JOB DAMAGE SURVEY OF FACILITY

- A. Perform a thorough survey of property and all affected areas of the building with Owner's Representative prior to starting the work in each area to document existing damage and operational status of existing equipment. Items identified on this list will not be the responsibility of Contractor unless further damaged by Contractor during execution of Work.

1.13 CORRECTION OF DAMAGE TO PROPERTY

- A. Consider any damage to building or property not identified in the pre-job damage survey as having resulted from execution of this Contract and correct at no additional expense to Owner.

1.14 SAFETY

- A. The Contractor shall be responsible for all means and methods as they relate to safety and shall comply with all applicable local, state and federal requirements that are safety related. Safety shall be the responsibility of the Contractor. All related personnel shall be instructed daily to be mindful of the full time requirement to maintain a safe environment for the facility's occupants including staff, visitors, students, customers and the occurrence of the general public on or near the site.

1.15 WORKMANSHIP

- A. The Contractors installing new systems and related work shall be factory trained and approved by the manufacturer they are representing.
- B. All work shall be of the highest quality and in strict accordance with the manufacturer's published specifications and to the building Owner's satisfaction.
- C. There shall be a supervisor on the job site at all times while work is in progress.

1.16 QUALITY ASSURANCE

- A. Unless otherwise noted in this specification, the Contractor must strictly comply with the manufacturer's current specifications and details.
- B. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and an experienced superintendent on the job at all times work is in progress.
- C. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the Owner. Any deviation from the manufacturer's installation procedures must be supported by written certification

on manufacturer's letterhead and presented for the Owner's consideration.

- D. Owner may implement a quality assurance program including material testing and/or inspection by the Engineer; work found not in compliance with the project documents, submittals and specifications shall be corrected at no cost to the Owner.

1.17 PROJECT CONDITIONS

- A. The facilities will be occupied (parking garage) and in use during construction. Take any necessary precaution to create as little disturbance or disruption to the facilities and their occupants as possible during the work.
- B. Supply, install and maintain barriers, protection, warning lines, lighting and personnel required to segregate the work area(s) from pedestrian or vehicular traffic, as well as to prevent damage to the facilities, their occupants, and the surrounding landscaped and paved areas. All applicable O.S.H.A., City of Portland, State of Maine and Federal requirements shall be observed by the Contractor. In all instances the more stringent requirements will apply.
- C. Schedule and execute work without exposing the facilities interiors to the effects of inclement weather. Protect the facilities and their occupants against such risks, and repair/replace work-related damage to the Owner's satisfaction.
- D. Proceed with work only when weather conditions are in compliance with the manufacturer's recommendation limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirement and recommendations.
- E. Phased or temporary construction will not be permitted. Schedule, execute and coordinate work on a daily basis so that components are installed completely and permanently as specified.
- F. Supply shoring, supports and other items or materials necessary to brace existing work to remain or as required to install new work including arches and other assemblies. Support the structure, fixtures and facilities affected by the work.
- G. All work shall be performed in accordance with applicable Federal, State and local code requirements. In all instances the more stringent requirements will apply.
- H. All workmanship and materials shall be of the best construction practice. Specification requirements, which exceed the minimum requirements of the manufacturer, shall be complied with by the Contractor. In all instances the more stringent requirements will apply.

- I. Coordinate the work in this Section, including preparatory work, building protection, daily clean up and protection of building occupants.
- J. Supply labor, vacuums, tools and appliances necessary to keep the interior and exterior facilities and site areas below and around the area of work clean, with as little accumulation of dust and debris as possible on a daily basis.

1.18 EMERGENCY RESPONSE

- A. The Contractor shall provide the Owner with after-hours (24 hour), emergency cell phone numbers of the Contractor's Superintendent and Foreman.
- B. The Contractor must respond to emergency situations or calls within two (2) hours.

1.19 SCHEDULE OF VALUES

- A. Provide a line item breakdown of construction labor and materials costs.

1.20 PROGRESS MEETINGS

- A. Progress meetings may be scheduled as determined by the Owner and/or Owner's Representative not more than once weekly.

1.21 DIMENSIONS AND QUANTITIES

- A. Verify dimensions and quantities in the field prior to bid submission. The scope has been compiled from various sources and may not reflect the actual field conditions, sizes and/or quantities at the time of construction.
- B. The Contractor is solely responsible for means and methods of construction. Make necessary investigations (including sampling) and take necessary precautions to properly supply, fabricate, and install work.
- C. Unfamiliarity with existing project conditions will not be considered as a basis for additional compensation.
- D. In case of inconsistency between this document and product Manufacturers Specifications or within either document, the better quality and/or greater quantity of work shall be provided, as determined by the Owner's Representative.

1.22 MATERIAL SAFETY DATA SHEETS

- A. Material safety data sheets (MSDS) shall be submitted in complete sets for all products to be used prior to any work being performed.

1.23 WARRANTY

- A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

SECTION 01 30 00

ALTERATIONS, GENERAL

1. GENERAL

1.01 GENERAL CONDITIONS: The General Conditions, Supplementary General Conditions and all Sections of Division 1 shall apply to each and every contract and contractor, person or persons supplying material, labor or entering into the work directly or indirectly.

1.02 DESCRIPTION:

- A. The work covered by all sections of specifications shall conform to the conditions of this Section.
- B. The phrase “match existing” shall mean the following: Where Contract Documents call for exact matching, match existing work exactly in quality and appearance. When Contract Documents do not call for exact matching, match existing work as nearly as possible, using normally available materials and workmanship. If normally available materials and workmanship do not approximate existing work notify Architect. If in the Architect’s judgment it is impossible to approximate existing work with normally available materials and workmanship, the Architect may issue suitable Change Orders. Changes imposing extra costs to the Contractor will not be ordered without the Contractor’s approval. Existing structures and materials are indicated “existing”.
- C. In general, structures and materials which are not indicated existing are included in the work.

2. PRODUCTS

2.01 GENERAL

- A. Materials used to replace, patch or repair existing exposed work shall match or be compatible with existing adjacent finished surfaces.
- B. Materials used for such replacement, patching and repairing shall be as specified in the applicable section of this specification and/or as indicated on the drawings, or as approved by the Architect.

3. EXECUTION

3.01 TEMPORARY PARTITIONS Construct necessary temporary dust proof partitions to isolate construction work from adjacent areas and remove partitions when work in area is completed.

3.02 CUTTING AND PATCHING

- A. Contractor shall do all demolition, cutting, altering, removing, replacing and patching as necessary for the performance of the contract. Unless otherwise provided by the drawings or specifications, no structural members shall be cut or altered without authorization of the Architect.
 - B. Where any alteration or new work is indicated it will be required that the contractor perform all necessary cutting, patching, altering and rebuilding necessary to produce a complete, finished and operational element.
 - C. Work remaining in place which is damaged or defaced by reason of work done under this contract shall be restored equal to its condition at the time of the award of the contract.
 - D. Where existing work is removed, exposed surfaces shall be finished to match adjacent surfaces.
 - E. All disturbed plaster areas and all holes, cracks and loose plaster shall be patched to provide a smooth uniform and sound wall, matching existing surfaces. Plaster around ne openings in existing walls shall be cut back to firm bond and patched to match surrounding area. Materials for patching shall be similar to adjacent materials. Bonding agents shall be used as required to produce positive bond.
 - F. Contractor shall provide all necessary shoring and temporary supports required for proper support of existing and new work during execution of the contract and shall remove same when support is no longer required.
- 3.03 COOPERATION: The Owner shall have the right, at any time during the construction of the structure, to enter the same for the purpose of installing any necessary work, or for any other purpose in connection with the installation of facilities, it being mutually understood and agreed, however, that the Contractor and the Owner will labor to mutual advantage where their several works in the above mentioned or unforeseen instances touch upon or interfere with each other.
- 3.04 SALVAGE All materials which are removed will become the property of the Contractor and shall be removed from the premises, unless indicated otherwise on the drawings or in these specifications.

END OF SECTION

SECTION 01 73 10

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Division 1 Section "Selective Demolition" for demolition of selected portions of the building for alterations.
 - 2. Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.
 - 3. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - a. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.

4. Dates: Indicate when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 1. Primary operational systems and equipment.
 2. Air or smoke barriers.
 3. Fire-protection systems.
 4. Control systems.
 5. Communication systems.
 6. Conveying systems.
 7. Electrical wiring systems.
 8. Operating systems of special construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Exterior curtain-wall construction.
 4. Equipment supports.
 5. Piping, ductwork, vessels, and equipment.
 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
 - a. Processed concrete finishes.

- b. Stonework and stone masonry.
 - c. Ornamental metal.
 - d. Matched-veneer woodwork.
 - e. Preformed metal panels.
 - f. Roofing.
 - g. Firestopping.
 - h. Window wall system.
 - i. Stucco and ornamental plaster.
 - j. Terrazzo.
 - k. Finished wood flooring.
 - l. Fluid-applied flooring.
 - m. Aggregate wall coating.
 - n. Wall covering.
 - o. HVAC enclosures, cabinets, or covers.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties 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.
- F. Prevent movement or settlement of adjacent elements of construction. Provide and place bracing or shoring and be responsible for safety and support of structure. Be liable for any such movement or settlement and any damage or injury caused.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
- 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as

possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cease operations and notify the Architect immediately, if safety of structure appears to be endangered. Take all precautions to properly support structure. Do not resume operations until permission is granted by the Architect and authorities having jurisdiction.

END OF SECTION 01731

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

- 1. Demolition and removal of selected portions of a building or structure.
- 2. Demolition and removal of selected site elements.
- 3. Repair procedures for selective demolition operations.

- B. Related Sections include the following:

- 1. Division 1 Section "Summary" for use of the premises and phasing requirements.
- 2. Division 1 Section "Work Restrictions" for restrictions on use of the premises due to Owner or tenant occupancy.
- 3. Division 1 Section "Construction Progress Documentation" for preconstruction photographs taken before selective demolition.
- 4. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
- 5. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.
- 6. Division 1 Section "Dust Control Measures" for dust control measures in adjacent owner occupied areas.
- 7. Division 2 Section "Building Demolition" for demolition of entire buildings, structures, and site improvements.
- 8. Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.
- 9. Division 15 Sections for demolishing, cutting, patching, or relocating mechanical items.
- 10. Division 16 Sections for demolishing, cutting, patching, or relocating electrical items.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

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- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.
- B. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.
 - 1. Coordinate with Owner, who will establish special procedures for removal and salvage.

1.5 SUBMITTALS

- A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Locations of temporary partitions and means of egress, including for other departments affected by selective demolition operations.
 - 6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- D. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.
- E. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.
- F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

CITY OF PORTLAND FIREBOAT CREW QUARTERS RENOVATIONS

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Professional Engineer Qualifications: Comply with Division 1 Section "Quality Requirements."
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 5 days notice to Owner of activities that will affect Owner's operations.
- B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
 - 1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- C. Owner assumes no responsibility for condition of areas to be selectively demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 2. Before selective demolition, Owner will remove the following items:
 - a. Exit Control System.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site will not be permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

CITY OF PORTLAND FIREBOAT CREW QUARTERS RENOVATIONS

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.
 - 1. If possible, retain original Installer or fabricator to patch the exposed Work listed below that is damaged during selective demolition. If it is impossible to engage original Installer or fabricator, engage another recognized experienced and specialized firm.
 - a. Brick masonry.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
 - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

- B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
 - 1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.
- C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.
 - 3. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
 - 4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
- C. Utility Requirements: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

- A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, walkways, 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.
 - 2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - 3. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 4. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
- C. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

4. Cover and protect furniture, furnishings, and equipment that have not been removed.

D. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

E. Temporary Partitions: Erect and maintain dust proof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

G. Temporary Shoring: Provide and maintain interior and/or exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

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

3.4 POLLUTION CONTROLS

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

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. Disposal: 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 in a controlled descent.

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

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.

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Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly.
 10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.
- C. Removed and Salvaged Items: Comply with the following:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area on-site.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items: Comply with the following:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- F. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

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- G. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- H. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- I. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- J. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
 - 1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.
- K. Roofing: Remove no more existing roofing than can be covered in one day by new roofing. Refer to applicable Division 7 Section for new roofing requirements.
- L. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 PATCHING AND REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Patching: Comply with Division 1 Section "Cutting and Patching."
- C. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
 - 1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.
- D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- E. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - 2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
 - 3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.
- D. The Owner has right of first refusal for all salvageable items removed from the project, including but not limited to light fixtures, plumbing fixtures, doors, windows, equipment, artifacts, copper and other metals and the like.

3.8 SELECTIVE DEMOLITION SCHEDULE

- A. Existing Items to Be Removed shall be as shown on the drawings
- B. Existing Items to Be Removed and Salvaged shall be as shown on the drawings.

END OF SECTION 024119

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

1. GENERAL

1.01 GENERAL CONDITIONS: The General Conditions, Supplementary General Conditions and all Sections of Division 1 are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. Work included: Provide labor, materials, and equipment necessary to complete the work of this Section and without limiting the generality thereof, furnish and include the following:

1. The extent of cast-in-place concrete work is shown on drawings and includes (but not by way of limitation) formwork, reinforcing, cast-in-place concrete, accessories, and casting in of items specified under other Sections of the Specification or furnished by Owner that are required to be built-in with the concrete.

1.03 RELATED WORK:

A. Miscellaneous Metal Section 05500

1. Expansion Anchors Section 05500
2. Embedded Items Section 05500

B. Anchor Bolts Section 05120

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following except where more stringent requirements are shown or specified.

1. ACI 211.1-77 “Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete”.
2. ACI 212.2 R-81 “Guide for Use of Admixtures in Concrete”.
3. ACI 301-72 R-81 “Specifications for Structural Concrete for Buildings”.
4. ACI 302.1 R-80 “Guide for Concrete Floor and Slab Construction”.
5. ACI 304-73 “Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete”.
6. ACI 304-2 R-71 “Placing Concrete by Pumping Methods”.
7. ACI 306 R-78 “Cold Weather Concreting”.
8. ACI 308-81 “Standard Practice for Curing Concrete”.

9. ACI 309-72 “Recommended Practice for Consolidation of Concrete”.
 10. ACI 315-80 “Details and Detailing of Concrete Reinforcement”.
 11. ACI 318-89 “Building Code Requirements for Reinforced Concrete”.
 12. ACI 347-78 “Recommended Practice for Concrete Formwork”.
 13. Concrete Reinforcing Steel Institute, “Placing Reinforcing Bars”, 1976.
- B. Materials and installed work may require testing and retesting, as directed by the Architect, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests not specifically indicated to be done at Owner’s expense, including retesting of rejected materials and installed work, shall be done at Contractor’s expense.

1.05 SUBMITTALS:

- A. Product Data: Submit manufacturer’s product data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, patching compounds, non-shrink grout and others as requested by Architect.
- B. Shop Drawings:
 1. Reinforcement: Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures” showing bar schedules, diagrams of bent bars and arrangement of concrete reinforcement.
- C. Samples: Submit samples of materials as requested by Architect, including names, sources and descriptions.
- D. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design test, if trial batch method is used for proportioning concrete mixes.
- E. Strength Tests: Provide required records of strength tests, if field experience method is used for proportioning concrete mixes.

2. PRODUCTS

2.01 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise indicated, Construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
 1. Use plywood complying with US Product Standard PS-1 “B-B (Concrete Form) Plywood”, Class I, Exterior Grade or better, mill oiled and edge sealed, with piece bearing legible inspection trademark.

- B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.
- C. Form Coatings: Provide commercial formulation form coating compounds that will not bond with, stain nor adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.02 REINFORCING MATERIALS:

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric. Provide welded wire fabric in flat sheets.
- C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendation, unless otherwise specified. Wood, brick and other devices are not acceptable.
 - 1. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs (when welded wire fabric is used).

2.03 CONCRETE MATERIALS:

- A. Portland Cement: ASTM C 150, Type I or Type II, unless otherwise acceptable to Architect. Use one brand of cement throughout project, unless otherwise acceptable to Architect.
- B. Normal Weight Aggregates: ASTM C 33. Provide from a single source for exposed concrete. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, or ochre which can cause stains on exposed concrete surfaces.
- C. Water: Potable.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Accelerating Admixture: ASTM C494, Type C or E.
- F. Calcium Chloride shall not be permitted.

2.04 RELATED MATERIALS:

- A. Non-Shrink Cement Based Grout: Provide grout consisting of premeasured, prepackaged materials supplied by the manufacturer requiring only the addition of water. Manufacturer's instructions must be printed on the outside of each bag.
 - 1. Non-shrink: No shrinkage (0.0%) and a maximum 4.0% expansion when tested in accordance with ASTM C-827. No shrinkage (0.0%) and a maximum of 0.2% expansion in the hardened state when tested in accordance with CRD-C-621.
 - 2. Compressive strength: A minimum 28 day compressive strength of 5000

3. Setting time: A minimum initial set time of 60 minutes when tested in accordance with ASTM C-191.
 4. Composition: Shall not contain metallic particles or expansive cement.
- B. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M12, Class 2.
- C. Moisture Retaining Cover: One of the following complying with ANSI/ASTM C 171.
1. Waterproof paper
 2. Polyethylene film
 3. Polyethylene coated burlap
- D. Preformed Expansion Joint Formers:
1. Bituminous Fiber Type, ASTM D 1751.
 2. Felt Void, Polystyrene Cap with removable top as manufactured by SUPERIOR.

2.05 PROPORTIONING AND DESIGN OF MIXES:

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. Use material, including all admixtures, proposed for use on the project. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.
- B. Submit written reports to Architect of each proposed mix for each class of concrete at least 14 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.
- C. Proportion design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:
1. 3000 psi 28 day compressive strength for footings, walls and slabs on grade. W/C ratio shall not exceed 0.58.
 2. Slump at point of placement shall be not less than 1" nor more than 4".
 3. Use air-entraining admixture in concrete that will experience freeze/thaw cycles (e.i. exposed slabs, frost walls, etc.) unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content within following limits: 4% - 8% for maximum 3/4" aggregate.
- D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor, when characteristics of materials, for conditions, weather, test results or other circumstances warrant, at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

1. Water may be added at the project only if the maximum specified slump and design mix maximum water/cement ration is not exceeded.
2. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.

2.06 CONCRETE MIXING:

- A. Job-Site Mixing: Will not be permitted.
- B. Ready Mix Concrete: Must comply with the requirements of ASTM C94, and as herein specified. Provide batch ticket for each batch discharged and used in work, indicating project name, mix type, mix time and quantity.
 1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required by Engineer.
 2. When the air temperature is between 85°F and 90°F, reduce the mixing and delivery time from 1 1/2 hours to 75 minutes, and when the air temperature is above 90°F, reduce the mixing and delivery time to 60 minutes.

3. **EXECUTION**

3.01 FORMS:

- A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Design, construct, erect, maintain and remove forms for cast-in-place concrete work in compliance with ACI 347, "Recommended Practice for Concrete Formwork".
- C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- D. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like to prevent swelling and for easy removal.
- F. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

- G. Chamfer exposed corners/edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- H. Form Ties: Factory fabricated, adjustable length, removable or snapoff metal form ties, designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
 - 1. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is 1" inside concrete and will not leave holes larger than 1" diameter in concrete surface.
- I. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
- J. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT:

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as herein specified.
 - 1. Clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.
 - 2. Accurately position, support and secure reinforcement against displacement by formwork, construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers as required.
 - 3. Place reinforcement to obtain specified coverages for concrete protection within tolerances of ACI-318. Arrange, space and securely tie bars and bar support to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
 - 4. Install welded wire fabric in flat sheets in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.03 JOINTS:

- A. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Architect.
 - 1. Provide keyways at least 1-1/2" deep in construction joints in walls and slabs; accepted bulkheads designed for this purpose may be used for slabs.\

2. Roughened surfaces shall be used between walls and footings unless shown otherwise on the drawings. The footing surface shall be roughened to at least an amplitude of 1/4" for the width of the wall before placing the wall concrete.
3. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.
4. Joints in slabs on grade shall be located and detailed as indicated on the drawings. If saw cut joints are required or permitted, cutting shall be timed properly with the set of the concrete: cutting shall be started as soon as the concrete has been hardened sufficiently to prevent aggregate being dislodged by the saw, and shall be completed before shrinkage stresses become sufficient to produce cracking.

3.04 INSTALLATION OF EMBEDDED ITEMS:

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto. Notify other trades to permit installation of their work.
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface.

3.05 INSTALLATION OF GROUT

- A. Place grout for base plates in accordance with manufacturer recommendations.
- B. Grout below setting plates as soon as practicable to facilitate erection of steel and prior to removal of temporary bracing and guys. If leveling bolts or shims are used for erection, grout shall be installed prior to addition of any column load.
- C. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials and allow to cure. For proprietary grout materials comply with manufacturer instructions.

3.06 PREPARATION OF FORM SURFACES

- A. Coat contact surfaces of forms with a form coating compound before reinforcement is placed.
- B. Thin form coating compounds only with thinning agent of type, and in amount, and under conditions of form coating material manufacturer's directions. Do not allow excess form coating to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.07 CONCRETE PLACEMENT:

- A. Preplacement Review: Footing bottoms, reinforcement and all work shall be subject to review by Architect. Verify that reinforcing, ducts, anchors, seats, plates and other items to be cast into concrete are placed and securely held. Notify Architect 48 hours prior to scheduled placement and obtain approval or waiver of review prior to placement.

Moisten wood forms immediately before placing concrete where form coatings are not used. Be sure that all debris and other foreign matter is removed from forms.

- B. General: Comply with ACI 304, and as herein specified.
1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.
 2. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.
 3. Conveying equipment shall be approved and shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Conveying equipment and operations shall conform to the following additional requirements:
 - a. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An arrangement shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.
 - b. Chutes shall be metal or metal lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 ft. long, and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.
 - c. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete.
 - d. The loss of slump in pumping or pneumatic conveying equipment shall not exceed 2". Concrete shall not be conveyed through pipe made of aluminum alloy. Standby equipment shall be provided on the site.
 - e. Tyned rakes are prohibited as a means of conveying fiber reinforced concrete.
 4. Do not use reinforcement as bases for runways for concrete conveying equipment or other construction loads.
- C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18" and in a manner to avoid inclined construction joints. Where placement consist of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

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1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
 2. Use vibrators designed to operate with vibratory equipment submerged in concrete, maintaining a speed of not less than 8000 impulses per minute and of sufficient amplitude to consolidate the concrete effectively. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine, generally at points 18" maximum apart. Place vibrators to rapidly penetrate placed layer and at least 6" into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion maintain the duration of vibration for the time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix, generally from 5 to 15 seconds. A spare vibrator shall be kept on the job site during all concrete placing operations.
- D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
1. Consolidate concrete using internal vibrators during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Do not sprinkle water on plastic surface.
 3. Maintain reinforcing in proper position during concrete placement operations.
- E. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
1. When air temperature has fallen to or is expected to fall below 40°F(4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C), and not more than 80°F (27°C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators.
 4. All temporary heat, form insulation, insulated blankets, coverings, hay or other equipment and materials necessary to protect the concrete work from physical damage caused by frost, freezing action, or low temperature shall be provided prior to start of placing operations.

5. When the air temperature has fallen to or is expected to fall below 40°F, provide adequate means to maintain the temperature in the area where concrete is being placed between 50 and 70°F.
- F. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
 2. Cover reinforcing steel with water soaked burlap if it becomes too hot, so temperature immediately before embedment in concrete.
 3. Wet forms thoroughly before placing concrete.
 4. Do not use retarding admixtures without the written acceptance of the Architect.

3.08 FINISH OF FORMED SURFACES:

- A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or by other construction, unless otherwise indicated. This concrete surface shall have texture imparted by form facing material, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed to view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This as cast concrete surface shall be obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.
- C. Grout Cleaned Finish: Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment. Combine one part portland cement to 1-1/2 parts fine sand by volume and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- D. Related Unformed Surfaces: At tops of walls and grade beams, horizontal offset surfaces occurring adjacent to formed surfaces, strike off, smooth and finish with a texture matching adjacent unformed surfaces. Continue final surface treatment of formed surfaces, unless otherwise indicated.

3.09 MONOLITHIC SLAB FINISHES:

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds, and as otherwise indicated.

After placing slabs, plane surface to a tolerance not exceeding 1/2" in 10' when tested with a 10' straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms or rakes.

- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, and as otherwise indicated.

After screening, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or be hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/4" in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces indicated, including slab surfaces to be covered with carpet, resilient flooring, paint or other thin film finish coating system.

After floating, begin first trowel finish operation using a power driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/4" in 10' when tested with a 10' straightedge. Grind smooth any surface defects which would telegraph through applied floor covering system.

- D. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps and elsewhere as indicated.

Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 CONCRETE CURING AND PROTECTION:

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions or low temperatures, in compliance with the requirements of ACI 306 as herein specified.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
2. 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.
 - a. Curing shall be continued for at least 7 days in the case of all concrete except high early strength concrete for which the period shall be at least 3 days. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, moisture retention measures may be terminated when the average compressive strength has reached

70% of the specified strength, f'c. If one of the curing procedures below is used initially, it may be replaced by one of the other procedures any time after the concrete is 1 day old provided the concrete is not permitted to become surface dry during the transition.

3. When the mean daily temperature is less than 40°F, the temperature of the concrete shall be maintained between 50 and 70°F for the required curing period.
 - a. When necessary, arrangements for heating, covering, insulation, or housing the concrete work shall be adequate to maintain the required temperature without injury due to concentration of heat. Combustion heaters shall not be used during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.
 - b. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. Avoid rapid dry out of concrete due to overheating, avoid thermal shock due to sudden cooling or heating.
 - c. Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 5°F in any 1 hour or 50°F in any 24 hour period.
- B. Curing Methods: Perform curing of concrete by moist curing, by moisture retaining cover curing, by curing compound, and by combinations thereof, as herein specified.
1. Provide moisture curing by following methods:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water fog spray.
 - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
 2. Provide moisture cover curing as follows: Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Provide curing compound to slabs 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. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

- b. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener or with a covering material bonded to concrete such as concrete, waterproofing, dampproofing, membrane roofing, flooring, painting and other coatings and finish materials, unless otherwise acceptable to Architect.
 - c. Separating compound may be used as a curing medium if applied in accordance with manufacturer's specifications.
- C. Curing Formed Surfaces: 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. Protection From Mechanical Injury: During the curing period, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials, or methods, by application of curing procedures, and by rain or running water. Self supporting structures shall not be loaded in such a way as to overstress the concrete.

3.11 REMOVAL OF FORMS:

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns and similar parts of the work, may be removed after cumulatively curing at not less than 50°F (10°C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in place concrete by testing field cured specimens representative of concrete location or members.
- C. Form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and support.

3.12 REUSE OF FORMS:

- A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated or otherwise damaged from facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.13 MISCELLANEOUS CONCRETE ITEMS:

- A. Filling In: 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.

3.14 CONCRETE SURFACE REPAIRS:

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the Architect.
1. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1". 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.
- B. Repair of Formed Surfaces: 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.
1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
 2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 3. 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. Proprietary patching compounds may be used when acceptable to Architect.
 4. Repair defective areas, except random cracks and single holes not exceeding 1" in 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" clearance all around. 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 the same manner as adjacent concrete.
 5. Repair isolated random cracks and single holes not over 1" 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.

6. Use epoxy based mortar for structural repairs, where directed by the Architect.
7. Repair methods not specified above may be used, subject to acceptance of the Architect.

3.15 QUALITY CONTROL TESTING DURING CONSTRUCTION:

- A. The Contractor shall employ a testing laboratory to inspect, sample and test the materials and the production of concrete and to submit test reports. Concrete testing shall be performed by technicians certified by the Maine Concrete Technician Certification Board.
- B. Concrete shall be sampled and tested for quality control during placement of concrete shall include the following, unless otherwise directed by Architect.
- C. Sampling Fresh Concrete: ASTM C 172.
 1. Slump: ASTM C143; one test for each concrete load at point of discharge and one test for each set of compressive strength test specimens. A slump test must be run prior to the incorporation of the CFP fibers per recommendations of ACI 544.
 2. Air Content: ASTM C 231 pressure method for normal weight concrete; one for each set of compressive strength test specimens.
 3. Concrete Temperature: Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C) and above; and each time a set of compression test specimens are made.
 4. Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field cure test specimens are required.
 - a. Fiber reinforced concrete test specimens shall be vibrated externally per recommendations ACI 544.
 5. Compressive Strength Tests: ASTM C 39; one set for each 100 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 5,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, and 1 specimen retained in reserve for later testing if required.
 - a. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 used.
 - b. When total quantity of a given class of concrete is less than 50 cu. yds., strength test may be waived, if in the Architect's judgement, adequate evidence of satisfactory strength is provided.

- c. When strength of field cured cylinders is less than 85% of companion laboratory cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in place concrete.
 - d. Strength level of concrete will be considered satisfactory if averages of sets of 3 consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
 - e. Test results will be reported in writing to Architect and Contractor on the day after tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials compressive breaking strength, and type of break for both 7 day tests and 28 day tests.
- D. Additional Tests: The testing service will make additional tests of in place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods, as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

3.16 ENGINEER'S REVIEW

- A. The Engineer of Record will conduct periodic reviews of the construction for compliance with the provisions of the Specifications and Drawings during the construction period.
- B. Should additional visits be required which are necessitated by failure of the Contractor to perform his work in accordance with the Plans and Specifications or if additional design or drafting time is required for corrective measures caused by the failure of the Contractor to perform in accordance with Plans and Specifications, the Contractor shall reimburse the Engineer at the rate of 2.3 times direct personnel expense plus out of pocket expenses incurred.

END OF SECTION

SECTION 04 02 00

UNIT MASONRY

PART 1 - GENERAL

- 1.1 GENERAL CONDITIONS: The General Conditions, Supplementary General Conditions and all Sections of Division 1 shall apply to each and every contract and contractor, person or persons supplying material, labor or entering into the work directly or indirectly.
- 1.2 STANDARDS: All materials and workmanship shall conform to the recommendations of the following:
- A. The Brick Institute of America (BIA)
 - B. American Society of Testing and Materials (ASTM)
 - C. Portland Cement Association (PCA)
 - D. National Concrete Masonry Association (NCMA)
- 1.3 SCOPE:
- A. This Section includes all labor, materials, equipment and related services necessary for the fabrication, delivery and installation of the work shown on the drawings and/or specified herein, including but not limited to the following:
 - 1. Concrete Masonry Units as indicated
 - 2. Mortar and grout for masonry work, including grout fill of bond and lintel beams.
 - 3. Reinforcing, ties, anchors and other metal accessories for tying masonry work together and to other work, except as otherwise specified herein.
 - 4. Building in of door frames, window frames, steel lintels, louvers, grilles, sleeves, anchors and all other items required to be built into the masonry construction.
 - 5. Control joints, including fillers, occurring in masonry.
 - 6. Cutting and patching of new unit masonry work as required for the work of other Sections.
 - 7. Submission of samples as specified.
 - 8. Cleaning and pointing of masonry work of this Section exposed to view.
 - 9. Cavity wall insulation board.
 - a. Include board insulation within masonry cavity walls.
 - b. Include dampproofing exterior face of inner wythe of cavity walls, and against outer face of structural steel embedded in exterior masonry walls.
 - 10. Through-wall flashing in masonry construction.
 - a. Include flashing under precast items.
 - 11. Provide and maintain all staging required for work of this SECTION 042000, in accordance with the requirements set forth in SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS.
 - B. Items to be Furnished Only: Furnish and deliver following items for installation under designated Sections:
 - 1. Dovetail anchor slots, for installation in concrete: SECTION 033000 - CAST-IN-PLACE CONCRETE.

- C. Items To Be Installed Only: Install following items furnished under designated Sections:
1. Loose steel angle lintels for openings in masonry walls: DIVISION 5.
 2. Flue clean-out doors: SECTION 055000 – METAL FABRICATIONS.
 3. Access panels, sleeves for piping and conduit to be built into masonry as furnished under Mechanical and Electrical Sections.
 4. Built-in anchors, blocking, plates, anchor bolts, ties and all other items required to be built into masonry as furnished by other trade Sections. Cooperate with all other trades and notify them sufficiently in advance of the time when the material furnished by them is to be built into the masonry so that progress of the work will not be impeded. Every precaution shall be taken to minimize cutting and patching.
 5. Vents: DIVISION 230000 – HEATING, VENTILATING AND AIR CONDITIONING
- D. Related Work Specified Elsewhere:
1. Metal flashing, except as specified herein: SECTION 076200.
 - a. NOTE: Include close coordination of masonry and metal flashing work, particularly at chimney and other points where masonry abuts roof construction.
 2. Caulking and sealing of joints in masonry: SECTION 079200 - JOINT SEALANTS.
- E. Alternates: Refer to SECTION 012100 - ALLOWANCES, SECTION 012200 – UNIT PRICES, and SECTION 012300 - ALTERNATES, to determine extent, if any, work of this Section will be affected by Alternates, Unit Prices or Allowances.

1.4 QUALITY ASSURANCE

- A. General: Comply with requirements of SECTION 013300 - SUBMITTALS; SECTION 014000 - QUALITY REQUIREMENTS.
- B. Standards: Comply with applicable recommendations made by following producer associations:
1. Concrete Masonry Units: National Concrete Masonry Association (NCMA).
 2. Locate as approved by Architect. Arrange for open southeast exposure so that facing materials will be in sun during morning hours (not under a tree or otherwise covered location).
 3. Arrange for panel construction, including related work, to be started in presence of Architect; do not proceed further until beginning portion is approved.
 4. Arrange for adequate weather protective covering at top, and covering opposite side and ends with 6-mil clear polyethylene film protection.
 5. Upon completion and approval, panel shall remain on site as a standard of acceptance for the permanent exterior wall construction (including all related work).
 6. Remove panel when directed by Architect.
- C. Fire-Related Masonry: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction, comply with requirements for materials and installation by the American Insurance Association and governing authorities for the construction shown.

1.5 SUBMITTALS:

CITY OF PORTLAND FIREBOAT CREW QUARTERS RENOVATIONS

- A. General: Provide submittals in compliance with SECTION 013300 – SUBMITTALS.
- B. Manufacturer’s Data: For information only (except as indicated) submit 2 copies of manufacturer’s specifications and other data for each type of masonry unit and accessory required including certification that each type complies with the specified requirements. Include instruction for handling, storage, installation and protection of each.
- C. Samples: Submit samples of following:
 - 1. Standard CMU: Two sets of each type to be provided.
 - 2. Mortar: Two sets of cured mortar samples for all exposed mortar not to be painted or otherwise covered.
 - a. Include for each mortar color.
- D. Certificates of Compliance: Submit certificates of compliance for following materials (designate on certificates the applicable standards including all type, class and other designations as applicable):
 - 1. Concrete masonry units.
 - 2. Portland cement.
 - 3. Lime.
 - 4. Masonry aggregate.
 - 5. Insulation materials.
 - 6. Refractory mortar.
 - 7. Flue tile.
- E. Test Reports:
 - 1. Submit independent laboratory test reports for face brick and each type of masonry unit, mortar material and other component specified herein.
 - 2. Include in test reports:
 - a. Compressive strength.
 - b. 24-hour cold water absorption.
 - c. 5-hour boil absorption.
 - d. Saturation coefficient.
 - e. Initial rate of absorption (suction).
 - f. Latent salt content, ASTM C-67.
 - g. Water, if from sources other than local potable water supply.

1.6 TESTING AND INSPECTION; BY OWNER (OPTIONAL):

- A. Following acceptance of initial test reports by Contractor, all masonry work, including specifically but not limited to masonry and mortar materials, shall be subject to testing and inspection to be performed by a Testing Laboratory selected and paid for by Owner.
 - 1. Owner *will not* be required to engage such Testing Laboratory.
 - 2. Such testing, if Owner so elects, shall be in addition to and not in lieu of testing and test reports required by Contractor.
 - 3. Costs of additional testing required by failed samples shall be at expense of Contractor, including all related per diem costs.
- B. Use no masonry or mortar materials on the work without prior test and written approval of the Testing Engineer (if applicable) and Architect, unless Architect specifically approves otherwise. If applicable, materials shall be submitted to the Testing Laboratory at least three

weeks, and preferably five weeks, in advance of proposed first use in the structure for subsection to the prescribed basic acceptance test and determination of basic mixtures.

- C. At start of field operations, and periodically during the course of work, the Testing Laboratory may check tests of mortar materials and mortar to assure compatibility with these Specification and the originally approved samples. Number and frequency of tests shall be determined by the Architect.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. General: Protect masonry units and manufactured products of all types for wetting by rain or snow, and keep covered when not in use.
- B. Masonry Face Units: Handle all face materials carefully in transit and on the site so as to keep units whole, edges sharp and faces clean and undamaged. Do not dump masonry face units but deliver on pallets, handled individually or in suitable groups and properly stacked, with minimum protection as follows:
 - 1. Glazed CMU: As recommended by manufacturer.
 - 2. Other Concrete Masonry Units: Careful handling.
- C. Aggregates: Deliver, store and handle aggregate materials so as to prevent contamination with earth or other foreign materials.
- D. Manufactured Items: Deliver all manufactured products in their original containers, plainly marked with product identification and manufacturer's name.
 - 1. Store cement, lime and similar products under cover and from direct contact with earth or floor slabs.
 - 2. Store metal accessories and the like under cover and from direct contact with ground, and in manner to prevent rust.
- E. Damaged Material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages or packages containing water marks or other evidence of damage, unless Architect specifically authorizes correction and use on project.

1.8 JOB CONDITIONS, PROTECTION:

- A. Protection of Work: During erection, cover exposed tops of exterior facebrick or concrete masonry units with heavy waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - 2. Do not apply loading for at least 12 hours after building masonry walls or columns.
 - 3. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.
 - 4. Comply as a minimum requirement with recommendations of the referenced producer associations; comply with more stringent requirements for same where options are given; comply with more stringent requirements where specified herein.
 - a. NOTE: Requirements of referenced standards and as specified herein are minimal acceptable, and compliance shall not relieve Contractor of

responsibility for providing masonry in sound condition, undamaged by freezing or other action of the elements other than normal weathering following proper curing of mortar. Contractor shall take additional precautions and corrective measures as required.

5. Protect windows, other finished surfaces from mortar droppings.
 - a. Take particular care with window sills and other horizontal surfaces.
 - b. Remove mortar or grout immediately from finished surfaces, rinse and wipe clean.

- B. Staining: Prevent grout or mortar from staining the face of masonry to be left exposed or coated. Remove immediately grout or mortar in contact with such masonry.

- C. Cold Weather Protection:
 1. Definitions:
 - a. "Air Temperature" means the lower of (1) the current ambient air temperature at time the masonry work is being erected, or (2) the temperature forecast by the Weather Service within the next four hours.
 - b. "Mean Air Temperature" denotes the expected mean air temperature for the 24 hour period (or other period if applicable) following the completion of each segment of masonry work.
 - c. "Exterior Masonry" means any masonry exposed to the elements, including interior or enclosed masonry in unheated locations.
 2. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.
 3. Remove all masonry determined to be frozen or damaged by freezing conditions.
 4. Perform following construction procedures while any exterior masonry work is progressing:
 - a. When air temperature is from 40 deg. F to 32 deg. F, heat sand or mixing water to produce mortar temperatures between 50 deg F and 120 deg. F.
 - b. When air temperature is from 32 deg. F to 25 deg. F, heat sand or water to produce mortar temperature between 50 deg. F and 120 deg. F; maintain temperature of mortar on boards above freezing.
 - c. When air temperature is from 25 deg. F to 20 deg. F, heat sand and mixing water to produce mortar temperatures between 40 deg. F and 120 deg. F; maintain temperature of mortar on boards above freezing; use salamanders, infra-red lamps or other heat sources on both sides of walls under construction; use wind breaks when wind is in excess of 15 mph.
 - d. When air temperature is 20 deg. F and below, heat sand and mixing water to produce mortar temperatures between 50 deg. F and 120 deg. F; provide enclosures and auxiliary heat to maintain air temperature above 32 deg. F; do not lay units which have surface temperature lower than 32 deg. F.
 5. Provide following protections for completed exterior masonry or exterior masonry not being worked on:
 - a. When mean daily air temperature is from 40 deg. F to 32 deg. F, protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane; 48 hours for grouted masonry.
 - b. When the mean daily air temperature is between 20 deg. F and 32 deg. F, cover with weather-resistive insulating blankets or equivalent for at least 24 hours; 48 hours for grouted masonry.
 - c. When the mean daily air temperature is 20 deg. F and below, maintain masonry temperature above 32 deg. F for 24 hours (48 hours for grouted

- masonry) using enclosures and supplementary heat, electric heating blankets, infra-red lamps, or other acceptable methods.
6. Optional methods of BIA for increasing the mortar strength or use of Type III cement *will not* be allowable.
 7. Use of calcium chloride or other additives to accelerate curing of mortar, or use of anti-freeze additives in the mortar, will not be acceptable.

PART 2: PRODUCTS

2.1 MASONRY UNITS:

- A. Manufacturer: Obtain masonry units from one manufacturer, of uniform texture and color for each kind required, for each continuous area and visually related areas.
- B. Concrete Masonry Units (CMU) - Standard:
 1. Size: Manufacturer's standard units with nominal face dimensions of 16 in. long x nominal widths indicated (15-5/8 in. 7-5/8 in. actual face dimensions), unless otherwise shown.
 2. Special Shapes: Provide where shown and where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.
 3. Type: Hollow load bearing, ASTM C-90, Grade N, Type 1.
 - a. NOTE: Grade N required all locations, including interiors.
 - b. Provide solid block (maximum 25-percent voids) for interior CMU where indicated or required, complying with ASTM C-145.
 4. Weight: Provide only normal weight units, unless otherwise indicated.
 5. Exposed Face: To Match Adjacent Existing. Provide center scored split face at new exterior addition and provide standard block at infills.

2.2 MORTAR AND GROUT MATERIALS FOR CMU

- A. Portland Cement: ASTM C 150, Type I or II.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Aggregate for Mortar: ASTM C 144.
- D. Aggregate for Grout: ASTM C 404.
- E. Water: Potable.
- F. Masonry Cement: Not acceptable.
- G. Water: Obtain from public water system, clean and potable when used.
 1. NOTE: If obtained from new well or other below ground surfaces water must be tested by Contractor for calcium content.
- H. Integral Waterproofing: Non-chloride type (only), one of following; or approved equal:
 1. Euco Integral Waterpeller (powder), by The Euclid Chemical Co.
 2. Drycrete, C. G. Pardee Co., Inc.

3. Acryl 60, by Thoro Systems Products.
4. Laticrete 3701, by Laticrete International, Inc.

2.3 MASONRY ACCESSORIES:

- A. Ferrous Metal Materials and Finish: Except as otherwise specified provide ferrous metal materials complying with the following:
 1. Wire Products: ASTM A-82, finish as follows except as specified otherwise:
 - a. Exterior Walls: Hot-dipped galvanized, ASTM A-153, Class B-2, minimum 1.5 ounce coating.
 - b. Inner Wythes of Exterior Walls: Same as exterior walls.
 - c. Inner Walls: Regular mill galvanized, ASTM A-641, minimum 0.10 ounce coating; or as specified for exterior walls.
 2. Steel Plates and Bar Anchors: ASTM A-36.
 3. Sheet Steel: ASTM A-568
 - a. Exterior Walls Including Inner Wythes: Mill galvanized, ASTM A641, Class 1, minimum 0.40 ounce coating.
 - b. Interior Walls: Regular mill galvanized, ASTM A-641, minimum 0.10 ounce coating.
 4. Optional Finish: Fusion bonded epoxy in lieu of galvanized, except where stainless steel is specified.
- B. Veneer Anchors:
 1. General: Secure to metal studs only, through sheathing.
 2. Light Gauge Metal Framing: For securement to light gauge framing provide 14-gauge reinforced stainless steel (only) plate with 3/16 inch steel ties.
 - a. Product, Exterior Walls: Dur-O-Wal Dur-O-Wal D/A 213 System, stainless steel with SFS-SX3 self-drilling stainless steel fasteners (two per anchor); or approved equal.
 - b. Product, Interior Masonry: Same as exterior masonry; or mill galvanized or hot-dipped galvanized construction, with D/A 807 corrosion-resistant coated fasteners; or approved equal.
 3. For securement to structural steel, furnish standard weld on steel slots (hot-dipped galvanized) to structural steel fabricator, for welding on in ship, not lighter than 16 gauge. Provide one of the following:
 - a. Heckman No. 315 or 315-B with 316 ties.
 - b. AA Wire Products Co. AA401-G or B with AA400 Series Flex-O-Lok ties.
 - c. Dur-O-Wal D/A 709 with D/A 701-708 Series ties.
 - d. Approved equal.
 4. For securement to concrete provide dovetail anchor slots with matching dovetail insert and wire tie (each hot-dipped galvanized). Furnish dovetail anchor slots (hot-dipped galvanized) to concrete installer. Provide one of following:
 - a. Heckman No. 100 with 103 ties (107 for slot mounted vertically).
 - b. AA Wire Products Co. AA 100 with 200 ties (similar ties to suit horizontal installation if applicable).
 - c. Dur-O-Wal D/A 100 with D/A 720-723 ties (similar ties to suit horizontal installation if applicable).
 - d. Approved equal.

5. For brick facing at masonry backup cavity wall, provide adjustable pintle ties with 3/16 inch double leg rectangular pintle section and 3/16 inch diameter rectangular eye section, properly sized in compliance with manufacturer's recommendations for particular wythe thickness and cavity depth.
 - a. Product: Dur-O-Wal D/A 515; or approved equal.
 6. Other Anchoring Devices for Masonry: Provide anchors, straps, bars, bolts and rods fabricated from not less than 16 ga. sheet metal or 3/8 in. diameter rod stock, unless otherwise indicated.
- C. Anchors and Precast Concrete: Except as indicated otherwise on Drawings, comply with requirements specified for veneer anchors, and following additional requirements:
1. Unless otherwise indicated, provide all anchorage accessories not lighter than 12-gauge, stainless steel.
 2. For precast bands provide Dur-O-Wal D/A 901 Channel Slot and 911 Series Anchor, not lighter than 12 -gauge, stainless steel.
 3. For panels provide 3/8 inch diameter rods and dowels as indicated, stainless steel.
 4. Provide special shapes as indicated and as required for secure, positive anchorage.
 5. Coordinate anchorage accessories with cast-in devices, as specified under SECTION 03450.
 6. Comply with final shop drawings for precast concrete.
- D. Flashings for Masonry: Provide concealed flashing, shown to be built into masonry, as follows:
1. Product: Wasco/York 3 Ounce Copper Fabric; or approved equal.
 2. Elastomeric Flashing at Brick Shelf: Self adhering, elastomeric flashing material.
 - a. Locate where grade is less than 6 inches from finish floor slab, and as indicated.
 - b. Product: W. R. Grace Perm-A-Shield; or approved equal.
- E. Reinforcement for Bond/Lintel Beams, Vertically Reinforced Masonry: ASTM A-615, Grade 60.
1. Provide sizes as shown, or if not shown provide 2 No. 3 bars in bottom of lintel unit.
 2. Refer to Structural and Architectural Drawings for sizes and locations.
- F. Perforated Plates: Hot-dipped galvanized steel sheet, not lighter than 16 gauge, perforated with 1/8 in. holes at 3/8 in. on centers each way.
- G. Weeps and Vent Tubes: Clear plastic tube, 3/8 inch diameter by 3-1/2 inch long.
1. Product: Dur-O-Wal D/A 1005; or approved equal.

2.4 BOARD INSULATION FOR CAVITY WALLS:

- A. Polyurethane Board Insulation: Foil faced each side, Fed. Spec. HH-I-1972/1, Class 2.
1. R-Value: Aged R-Value at 75 deg. F. 7.0 minimum for 1-inch thick material.
 2. Provide "cyanurate" type board insulation, an industry recognized modification of normal urethane insulation.
- B. Product: Celotex Thermax 600 Series; or approved equal.

2.5 DAMPPROOFING MATERIAL:

- A. Provide emulsion product as approved in writing by the insulation manufacturer as compatible with its product.
- B. Product: Karnak 100; or approved equal.

PART 3 - EXECUTION

3.1 MORTAR PROPORTIONING AND MIXING:

- A. General: Provide mortar complying with the proportion requirements of ASTM C-270, except as otherwise specified or indicated on Drawings.
 - 1. Provide Type N mortar where not otherwise specified or indicated on Drawings.
 - a. Refer also to Structural Drawings.
 - 2. Provide Type M mortar for below grade conditions in contact with earth materials.
 - 3. Provide Type S mortar as indicated on Structural Drawings.
 - 4. For bond beams and vertically reinforced concrete, provide grout complying with ASTM C-476, similar to Type S mortar and following:
 - a. For fine grout provide mixture of 1-part portland cement, 0 to 0.10 parts lime, and 2-1/4 to 3 parts sand.
 - b. For coarse grout provide mixture of 1-part portland cement, 0 to 0.10 parts lime, 2-1/4 to 3 parts fine aggregate and 2-parts coarse aggregate (pea gravel).
 - c. Ordinary concrete (maximum aggregate size 3/4 inch) with compressive strength of 3,000 psi or greater may be used for bond beams where minimum interior dimension exceeds 4 inches.
 - d. Provide fine grout for vertically reinforced masonry where minimum horizontal core dimensions is under 3 inches, coarse grout where minimum core dimension is 3 inches or greater.
 - e. Ordinary concrete (maximum aggregate size 3/4 inch) with compressive strength of 3,000 psi or greater may be used for vertically reinforced concrete where minimum core dimension exceeds 6 inches.
- B. Waterproofing: Add integral waterproofing admixture to mortar used for exterior masonry, in quantity and manner recommended by manufacturer.
 - 1. Include for parging coats, mortar for laying inner wythe backup walls of exterior walls.
- C. Machine mix mortar only. Cement and hydrated lime may be batched by the bag. Batch aggregates by weight, except subject to approval of Architect certain small operations may be batched by volume in suitably calibrated containers, provided proper allowance is made for weight per cubic foot, contained moisture, bulking and consolidation.
 - 1. Shovel measurement will not be acceptable.
- D. Provide mortar with just sufficient water for proper workability under the trowel.
 - Provide water for tempering (only) on the scaffold at all times. Discard mortar which has begun to "set" or is not used within two hours after initial mixing. Mortar which has stiffened due to evaporation within the two hour period shall be re-tempered to restore its workability. Re-tempering the mortar at the mixer shall not be permitted.
 - 1. Do not re-temper colored mortar if it adversely affects color uniformity.

3.2 ALLOWABLE TOLERANCES FOR MASONRY WORK:

- A. Maximum Variation From Plumb:

1. In lines and surfaces of columns, walls and arrises:
 - a. 1/4 in. in 10 ft
 - b. 3/8 in. in any story or 20 ft maximum
 - c. 1/2 in. in 40 ft
 2. For external corners, control joints and other conspicuous lines:
 - a. 1/4 in. in any story or 20 ft maximum
- B. Maximum variation from level or grades for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
1. 1/4 in. in any bay or 20 ft
 2. 1/2 in. in 40 ft
- C. Maximum variation of linear building line from an established position in plan and related portions of columns, walls and partitions:
1. 1/2 in. in any bay or 20 ft maximum
 2. 3/4 in. in 40 ft (1:640)
- D. Maximum variation in cross-sectional dimensions of columns in thickness of walls: Not less than 1/4 in. smaller nor more than 1/2 in. larger than walls.

3.3 JOINTS AND BONDING PATTERNS:

- A. Joints: Unless otherwise indicated provide joints as follows:
1. Depth and Width: 3/8 inch for both horizontal and vertical.
 2. Facebrick: Strike joints flush when thumb print hard, thoroughly tool with 1/2 inch round tool, to produce a glassy-hard, polished concave joint free from drying cracks.
 3. CMU: Same as facebrick.
 4. Joints in Precast Concrete: As specified for facebrick.
 5. Joints to Receive Sealant: Rake out joints to receive caulking or sealant as specified.
 6. Concealed Masonry: Strike joints flush joints in masonry unit walls and partitions concealed from view, tooling not required.
- B. Masonry Bonds: Unless otherwise indicated provide bonding patterns as follows:
1. Exterior Facebrick: Running bond except as indicated.
 2. CMU: Running bond.
 3. All other masonry, including with joints concealed: Running bond.

3.4 MASONRY INSTALLATION, GENERAL:

- A. Lay all masonry work with skilled workmen under adequate supervision, true to lines and levels with joints of uniform thickness, all surfaces true, and corners straight and plumb.
- B. Lay up walls and partitions which are to remain exposed to view in place within 1/8 inch when measured with a ten foot long straightedge. Where walls are exposed two sides, obtain decision from Architect as to which is to be held to the 1/8 inch tolerance.
- C. Examine all Drawings as to requirements for the accommodation of work of other trades and Contractors and provide all required recesses, chases, slots, cutouts, and built-ins, settling of loose lintels, placement of anchors, bolts, sleeves and other items occurring in the masonry work. Take every precaution to minimize future cutting and patching.

- D. Except as specified otherwise, lay all masonry units dry. Masonry units shall be protected from rain prior to laying, and shall have a moisture absorption ratio less than 35 percent when laid. In hot weather, lightly moisten contact surfaces with water by use of a soft brush.
- E. Brick: Lay all brick with full shove joints in full beds of mortar; fill all vertical joints with mortar.
1. Determine suction properties of brick from manufacturer, wet brick prior to laying as recommended by manufacturer.
 2. Unless otherwise recommended by brick manufacturer, wet brick prior to laying where suction exceeds 30 gm/minute/30 sq in.
 3. If brick manufacturer does not have suction properties or does not recommend a different procedure, testing of suction may be determined by drawing a circle using a 25-cent piece as template with a wax pencil. With a medicine dropper place 20 drops of water within circle, and note time required for water to be absorbed. If time exceeds 1-1/2 minutes, wetting is not required.
 4. Wet brick, where required, by hosing down the day before or at least three hours before laying, so that interior is saturated but surfaces have a chance to become dry. Do not lay brick with wet surfaces.
- F. CMU: Lay all blocks with full bed on shells only, except set bottom course bearing on concrete with full face and webs also; fully butter vertical edges.
- G. Place masonry fitting into bucks and frames as not to distort alignment of such items and slush backs of such items full with mortar. Carefully point around all metal frames with mortar, except where joints are specified or noted to receive sealant, in which case rake out joints to a uniform depth of 3/4 inch and a width of 3/8 inch for proper installation of sealant material.
- H. Take special care in laying up masonry units that will be exposed to view in the finished work to insure a uniform appearance in texture and joint pattern.
- I. Perform all cutting of exposed masonry units with a motor-driven carborundum saw to insure straight, evenly cut edges.
- J. At locations where conduits and pipes are to be concealed by masonry units, install each unit so as to provide a finished appearance with adjacent surface. Wherever possible, cuts shall be hidden from view.
- K. Provide complete protection against breakage and weather damage to all masonry work. Provide substantial wood boxing around door jambs, over window sills and jambs, over the tops of partitions and wherever necessary to protect work at all stages of completion. Masonry, when not roofed over, shall be positively protected at all times when Masons are not working on the walls.
- L. NOTE: Openings other than shown on the Drawings shall not be allowed in masonry walls, without the expressed consent of the Architect.
- M. Wall Heights:
1. Where walls are indicated to extend full height, extend walls from top of structural floor to bottom surface of construction above, or to bottom of parallel steel where applicable. Install joint filler between masonry and bottom surface of floor construction.

2. Where walls are not required to extend full height, terminate a minimum of 8 inches above finished ceiling line. Where run of wall without intersecting masonry walls exceeds 12 feet provide rigid steel bracing from top of walls to structural system above at not over 12 feet on centers.

N. Control Joints: Form as indicated.

3.5 WALL TIES AND ANCHORS - INSTALLATION:

- A. Masonry Veneer Anchors: Anchor masonry veneer to metal studs through wall sheathing, and structural steel framing members, with metal ties.
 1. Provide minimum of one wall tie for each 2 square feet of wall area.
 2. Stagger ties in alternate courses.
 - a. Stagger ties with joint reinforcement where applicable.
 3. Maximum distance between adjacent ties:
 - a. Vertically: 16 inches on centers, not more than 8 inches from bottoms and tops of walls.
 - b. Horizontally: Match stud spacing but not more than 24 inches on centers, not more than 8 inches from ends of any masonry run including control joints.
 4. Embed ties in horizontal joints of masonry.
 5. Provide additional ties at openings:
 - a. Maximum spacing around perimeter: 24 inches
 - b. Install within 8 inches of opening.
 6. NOTE: Use channel slot corrugated anchors to secure masonry veneer to structural steel columns and beams.
- B. Anchor walls abutting concrete members with dovetail anchors inserted in slots built into concrete.
 1. Maximum anchor spacing:
 - a. Vertically: 16 inches
 - b. Horizontally: 24 inches
 2. Maintain space not less than 1/2 inch wide between masonry wall and concrete members.
 3. Keep space free of mortar or other rigid material to permit differential movement between concrete and masonry.
- C. For intersecting bearing or shear walls carried up separately provide rigid steel anchors spaced not more than 2 feet apart vertically.
- D. Anchor non-bearing partitions abutting or intersecting other walls or partitions with wall ties at vertical intervals of not more than 16 inches.

3.6 INSTALLATION OF HORIZONTAL WALL REINFORCEMENT:

- A. Unless otherwise shown on the Drawings, install continuous wall reinforcing in following locations, spaced 16 inches on centers commencing at second or third block courses, and terminating within second or third courses from top of wall.
 1. Exterior CMU veneer (inner wythe backup walls).
 2. Interior CMU walls and partitions.

3. NOTE: Terminate continuous wall reinforcing on each side of control joints. Avoid placement of reinforcement in same joint in which thru-wall flashing, anchors or ties occur.
- B. Where openings occur in masonry walls, install reinforcing in bed joints so as to be placed not more than 8 inches on centers for first 16 inches horizontally and vertically below openings, and extending 2 feet beyond the jambs. All other reinforcing shall be continuous. Lap side rods at least 6 in. at splices. Place reinforcing as to assure a 1/2 in. mortar cover on the faces of walls.
- C. Use prefabricated or job fabricated corners and tee sections to form continuous reinforcement around corners, and for anchoring abutting walls and partitions. Material in corner and tee sections shall correspond to type and design of reinforcing used.
- D. Coordinate installation at exterior walls so that reinforcement does not occur in same joint as masonry veneer wall ties.

3.8 EXTERIOR CURTAIN WALL VENEER WALLS:

- A. Construct exterior brick veneer walls as indicated. Take care to keep cavity free of mortar.
 1. Use of mortar board or other approved method is required.
- B. Back-up portion of exterior walls, including light-gauge metal framing and sheathing, shall be constructed first. Fasten ties as previously specified. Interior face of masonry veneer shall have flush joints with no mortar projecting.
- C. Lay-up face wythe, filling all joints and incorporating metal ties into joints of exterior veneer walls.
- D. Drain base of cavity as specified under Paragraph DRAINING/VENTING OF CAVITY WALLS.

3.9 MASONRY BACK-UP CAVITY-WALL REQUIREMENTS:

- A. Apply dampproofing to entire exterior surface of inner wythe, complying with manufacturer's recommendations and to achieve a uniform application at rate of 25 to 35 sq. ft. per gallon.
 1. Apply also to all surfaces of structural steel flush with or extending beyond the exterior face of the inner wythe.
- B. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
- C. Install small pads of mortar or mastic spaced 1 ft-0 in. o.c. both ways on inside face, as recommended by manufacturer.
- D. Keep air space free of mortar by use of cavity boards, lifted regularly and excess mortar removed.
- E. Drain base of cavity as specified under Paragraph DRAINING/VENTING OF CAVITY WALLS.

- F. Set brick ties as specified and indicated. Coordinate work so that ties do not occur in same joint as reinforcing in CMU backup.

3.10 FLASHING:

- A. Provide concealed through-wall flashing for masonry. Construct masonry to accommodate other flashing. Prepare masonry surfaces smooth and free from projections which might puncture flashing. Place through-wall flashing on bed of mortar and cover with mortar. Seal flashing penetrations with mastic before covering with mortar. Terminate flashing 1/2 in. from face of wall, unless otherwise shown. Extend flashings beyond edge of lintels and sills at least 4 in. and turn up edge on sides to form pan to direct moisture to exterior.
- B. Install flashings in accordance with manufacturer's instructions.
- C. Install nailers for flashing and other related work where shown to be built into masonry work.
- D. NOTE: Coordinate flashing with other related work, in particular with installation of sheathing as specified under SECTION 061000 - ROUGH CARPENTRY, and metal roofing, flashing and siding as specified under SECTION 076200. Note that flashing is to extend up outer face of sheathing minimum of 10 inches, then through horizontal joint in sheathing and up inner face of sheathing a minimum of 4 inches.

3.11 DRAINING/VENTING OF CAVITY WALLS:

- A. Place pea gravel into bottom of cavity, to a depth of 4 in., directly over previously installed membrane flashing.
- B. Drain base of cavity by placing weeps in bottom course of exterior wythe, at approximately 24 in. on centers unless otherwise indicated.
 - 1. Provide also at lintels, other locations where cavity is terminated.

3.12 CONTROL JOINTS:

- A. Build in control joints in masonry as shown and required herein. Generally, control joints shall be placed in all walls with an unbroken length over 30 ft., one (1) vertical joint in walls 40 to 60 ft. long, spaced as directed.
 - 1. Location of control joints not indicated on Drawings must be approved in advance by Architect.
- B. Control joint fillers as specified shall be installed in joints with a set back dimension of 3/4 in. for reception of back-up rod and sealant.

3.13 CLEANING AND REPOINTING OF MASONRY WORK:

- A. Not later than at end of each day's work fill all holes in joints of masonry surfaces to be exposed (except weep holes) with mortar and suitably tooled. Dry brush masonry walls at the end of each day's work after final pointing, leave clean and free from mortar spots and droppings. Repair any cracks in masonry. Cut out and repoint defective joints.

- B. Leave new exposed to view masonry that is not to be painted or coated in clean, satisfactory condition, free of stains, efflorescence or other defacement. Before applying any cleaning agent to the entire wall, apply it to a sample wall area of approximately 20 sq. ft. in an approved location. Do not proceed further with cleaning work until the sample area has been approved, after which time use the same cleaning materials and method on the remaining wall area. If stiff brushes and water do not suffice, thoroughly clean wet surface of masonry with clear water and then scrub with a solution, i.e. Sure-Klean, or equal, followed immediately by a thorough rinsing with clear water. Thoroughly protect all sash and other corrodible elements during cleaning operations.
1. For mortar stains, use Sure-Klean No. 600, 101 or Vanitrol; or approved equal; as recommended by manufacturer or particular brick type and as determined by prior test samples.
 2. Perform washing and cleaning only during warm weather, from April to November and only when the temperature is above 40 deg. F and rising.
 3. Remove efflorescence, if in evidence, in accordance with brick manufacturer's recommendations. Repeat cleaning as often as required to remove efflorescence to satisfaction of Architect.
 - a. NOTE: Include repeat cleaning during the one year Building Warranty period if necessary.

END OF SECTION

SECTION 04 41 00

STONE COUNTERTOPS

1. GENERAL
 - 1.01 GENERAL CONDITIONS The General Conditions, Supplementary General Conditions and all Sections of Division 1 shall apply to each and every contract and contractor, person or persons supplying material, labor or entering into the work directly or indirectly.
 - 1.02 STANDARDS: All materials and work shall conform with the recommendations of the National Building Granite Quarry Association. All granite shall be obtained from quarries having adequate capacity and facility to meet the specified requirements. Cutting and finishing shall be done by a firm equipped to process the material promptly on order and in accordance with specifications.
 - 1.03 SUBMITTALS
 - A. One ozalid transparency and two prints of erection and shop fabrication drawings.
 - B. Shop drawings shall show all bedding, bonding, jointing and anchoring details and the dimension and setting number of each piece of granite. No final sizing or finishing shall be done until shop drawings for that part of the work has been approved.
 1. Show location of inserts of equipment which are to be built into counters.
 2. Show large scale details of base units with dimensional coordination of tops and surrounding building construction.
 - 1.04 SAMPLES: Submit to the Architect, one sample for approval of color, texture and surface finish. Sample shall be at least 12" x 12" in size and representative of the proposed finished product.
 - 1.05 QUALITY ASSURANCE:
 - A. Upon receipt at the site, the granite shall be stacked on timber or platforms at least 4" above the ground and extreme care shall be taken to prevent staining during storage. If storage is to be for a prolonged period, polyethylene shall be placed between any wood and finished surfaces and shall be used also as an overall protective coating. Lewis holes shall be plugged during freezing weather to prevent the accumulation of water. Salt shall not be used for melting of ice formed in Lewis holes or on pieces or for any purpose involving its contact with the granite.
 - B. If any unit is damaged during handling or erection, it shall be inspected by the Architect to determine whether the unit can be repaired or rejected.
 - C. Reference Standards: Comply with National Building Granite Quarries Association, Inc. (NBGQA).
 1. Granite: National Building Granite Quarries Association, Inc. (NBGQA).
 - D. Fabricator: Sub-subcontract fabrication of stone to a firm which has successfully fabricated stone similar to the quality specified for a period of not less than 5 years and is equipped to provide the quantity shown.

- 1.06 SCOPE: The Section includes all labor, materials, equipment and related services necessary for the fabrication, delivery and installation of the work shown on the drawings and/or specified herein, including but not limited to the following:
- A. Fabrication, delivery and erection of all granite countertops and splashes as shown on the drawings.
 - B. Mortars and sealants.
 - C. Anchors, cramps, dowels and other anchoring devices.
 - D. Incidental cutting and drilling.
 - E. Pointing of joints.
 - F. Cleaning and protecting the finished work.
- 1.07 RELATED WORK IN OTHER SECTIONS:
- A. Division 12 Section "Kitchen Casework"
- 1.08 INSTALL ONLY Install following items, to be furnished under other Sections:
- A. Anchors, inserts and other items furnished by other trades required to be built in with stone counters.
- 1.09 PRODUCT DELIVERY, STORAGE AND HANDLING:
- A. Protect stone during storage and construction against moisture, soiling, staining and physical damage.
 - B. Handle stone to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of stone with wood or other rigid materials. Lift with wide belt type slings wherever possible; do not use wire rope or ropes containing tar or other substances which might cause staining. If required, use wood rollers and provide cushion at end of wood slides.
 - C. Store stone on wood skids or pallets, covered with non-staining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones. Protect stored stone from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around stones.
 - D. Protect mortar materials and stonework accessories from weather, moisture and contamination with earth and other foreign materials.
 - E. Upon receipt at the building site or storage yard, the granite shall be stacked on timber or platforms at least 3" above the ground, and extreme care shall be taken to prevent staining during storage. If storage is to be for a prolonged period, polyethylene or other suitable plastic film shall be placed between any wood and finished surfaces, and shall be used also as an overall protective covering. Lewis holes shall be plugged during freezing weather to prevent the accumulation of water. Salt shall not be used for melting of ice formed in Lewis holes or on pieces, or for any purpose involving its contact with the granite.

1.10 DEFECTIVE WORK: Any piece of granite showing flaws or imperfections upon receipt at the storage yard or building site shall be referred to the Design Professional for determination as to responsibility and decision as to whether it shall be rejected, patched or redressed for use.

1.11 ALLOWABLE PATCHING: Chips at the edges or corners may be patched providing the structural integrity of the stone is not affected and providing the patch matches the color and finish of the natural stone so that the patch does not detract from the appearance.

2. MATERIAL

2.01 GRANITE

A. All granite shall be of standard grade, free of cracks, seams or starts which may impair its structural integrity or function. Inherent variation characteristic of the quarry from which it is obtained is acceptable. Color or other visual characteristics indigenous to the particular material and adequately demonstrated in the sampling or mock-up phases will be accepted provided they do not compromise the structural or durability capabilities of the material. Texture and finish shall be within the range of samples approved by the Design Professional.

B. Granite must conform to ASTM C97, C170 and C99.

C Granite shall be provided as follows:

Material: G623 Gray Granite or similar

Finish: Polished

D. Finishes listed in the above schedule shall be defined by the National Building Granite Quarries Association, Inc.

2.02 DIMENSIONAL TOLERANCE:

Panel Thickness 3/4" to 1 5/8" (20 to 41 mm): $\pm 1/8"$ (± 3 mm)

Panel Face Dimension: $\pm 1/16"$ (± 1.5 mm)

Face variation from rectangular: $\pm 1/16"$ (± 1.5 mm)

(Maximum out of Square) (non-Cumulative)

Heads / Calibrated Edge: $\pm 1/16"$ (± 1.5 mm)

Anchor Holes - from face to C/L Of Slot: $\pm 1/16"$ (± 1.5 mm)

Anchor Holes - Lateral Placement: $\pm 1/8"$ (± 3 mm)

Anchor Holes - Diameter: $\pm 1/16"$ (± 1.5 mm)

Anchor Holes - Depth: $\pm 1/8"$ (± 3 mm)

Anchor Sinkages - Depth: -0, +1/8"(-0, +3 mm)

Continuous Kerfs - from face to C/L of Kerf: $\pm 1/16"$ (± 1.5 mm)

Continuous Kerfs - Maximum Bow in 4'-0" (1.2m): $1/16"$ (± 1.5 mm)

Continuous Kerfs - Width: $\pm 1/16"$ (± 1.5 mm)

Continuous Kerfs - Depth: $-1/16"$; $+1/8"$ (-1.5 mm, $+3$ mm)

2.03 FLATNESS TOLERANCE:

Variation from true plane, or flat surfaces, shall be determined by a 4' dimension in any direction on the surface.

Such variations on polish, hone, and fine rubbed surfaces shall not exceed tolerances listed below or 1/3 of the specified joint width, whichever is greater. On surfaces having other finishes, the maximum variation from true plane shall not exceed the tolerance listed below or 1/2 of the specified joint width, whichever is greater.

Polished, honed or fine rubbed finishes..... $1/16"$

2.04 MORTAR AND GROUT MATERIALS:

A. Grout: Unsanded latex modified portland cement grout, color as selected by Architect.

2.05 FABRICATION:

- A. General: Fabricate as shown and as detailed on final shop drawings and in compliance with recommendations of applicable stone association. Provide holes and sinkages cut or drilled for anchors, fasteners, supports and lifting devices, as shown and as necessary to secure stonework in place. Cut and back check as required for proper fit and clearance. Shape beds to fit supports.
- B. Contiguous Work: Provide chases, reveals, reglets, openings and similar spaces and features as required for contiguous work. Coordinate with drawings and final shop drawings showing contiguous work.
- C. Workmanship: Cut accurately to shape and dimensions shown on final shop drawings, maintaining fabrication tolerances of applicable stone associations.
- D. Joint Widths: Cut to provide joint widths as indicated or, if not indicated, cut to allow for uniform $1/16"$ wide joints.
- E. Thickness: Provide stone of thickness indicated. Saw cut back surfaces which will be concealed in finished work.

3. EXECUTION

3.01 INSPECTION

- A. The installation of the granite shall be an indication of this contractor's acceptance of all subsurfaces and he will automatically assume the responsibility of any unacceptable finished work caused by subsurface conditions.

- B. Condition of surfaces: Inspect foundations and back-up block wall to assure surface to support granite panel as follows.
 - 1. To proper grades and elevations.
 - 2. Dry and free of all dirt and other deleterious material.
 - 3. All surfaces not properly prepared have been satisfactorily corrected.
- C. Granite panels shall be verified to determine any flaws or imperfections upon receipt at the site.

3.03 ALLOWABLE TOLERANCES:

- A. Maximum variation in the diversion of any piece shall be 1/4 of the specified bed and joint width.
- B. Flatness Tolerances shall be determined from a 4 foot long straight edge in any direction. The maximum variation from true plane shall not exceed 1/8".
- C. Variation from true plane to face surface shall not exceed 3/16" for thermal finish of moldings, washes and drips shall be constant in profile throughout their length in strict conformity with the details shown on approved shop drawings.

3.04 MOULDINGS, WASHES AND DRIPS: Mouldings, washes and drips shall be constant in profile throughout their length, in strict conformity with details shown on approved shop drawings.

3.05 INSTALLATION

- A. General: Do not install cracked, broken or chipped granite.
 - 1. Granite pieces shall be bedded and jointed as shown on the approved shop drawings.
- B. Protection of the Work
 - 1. Protect counter surfaces and edges throughout the course of the work.

3.06 PROTECTION OF FINISHED WORK

- A. After the granite work is installed, it shall be the responsibility of the General Contractor to see that it is properly protected from damage.
- B. Boxing or other suitable protection shall be provided wherever required, but no lumber which may stain or deface the granite shall be used. All nails used shall be galvanized or non-rusting.
- C. All granite work in progress shall be protected at all times during construction by use of a suitable strong, impervious film or fabric securely held in place.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Steel framing and supports for mechanical and electrical equipment.
- 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- 3. Elevator machine beams.
- 4. Support angles for elevator door sills.
- 5. Loose bearing and leveling plates.
- 6. Metal ladders.

- B. Products furnished, but not installed, under this Section include the following:

- 1. Loose steel lintels.

- C. Related Sections include the following:

- 1. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
- 2. Division 05 Section "Pipe and Tube Railings."
- 3. Division 06 Section "Rough Carpentry" for metal framing anchors.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

- 1. Provide ladders meeting the OSHA requirements of 29CFR 1910.27.

- B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

CITY OF PORTLAND FIREBOAT CREW QUARTERS RENOVATIONS

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METALS, GENERAL

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

2.3 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- E. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

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- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
 - C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
 - D. Anchor Bolts: ASTM F 1554, Grade 36.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
 - E. Eyebolts: ASTM A 489.
 - F. Machine Screws: ASME B18.6.3.
 - G. Lag Bolts: ASME B18.2.1.
 - H. Wood Screws: Flat head, ASME B18.6.1.
 - I. Plain Washers: Round, ASME B18.22.1.
 - J. Lock Washers: Helical, spring type, ASME B18.21.1.
 - K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
 - L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.
- 2.5 MISCELLANEOUS MATERIALS
- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

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- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
1. Available Products:
 - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - b. ICI Devco Coatings; Catha-Coat 313.
 - c. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
 - d. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - e. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
 - f. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
1. Available Products:
 - a. Sealmastic, Type 1; W. R. Meadows
 - b. Hydrocide 600; Sonneborn Building Products.
 - c. Karnak 100 AF; Karnac Chemical Corp.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
1. Available Products:
 - a. Five Star Grout by Five Star Products, Inc.
 - b. Masterflow 928 Grout by Master Builders Technologies.
 - c. SonogROUT 10K by Sonneborn.
 - d. 14K Hy Flow by Sonneborn.
- G. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

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- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts if units are installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

CITY OF PORTLAND FIREBOAT CREW QUARTERS RENOVATIONS

2.8 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Prime plates with zinc-rich primer.

2.10 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Provide coating for iron and steel fabrications applied by the hot-dipped process, Durogalv by Duncan Galvanizing. The galvanizing bath shall contain high grade zinc and other earthy materials. Immediately before galvanizing, the steel shall be immersed in a bath of zinc ammonium chloride. The use of the wet kettle process is prohibited. Comply with ASTM A123 for fabricated products and ASTM A 153 for hardware. Provide thickness of galvanizing specified in referenced standards.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

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1. Use nonshrink grout, nonmetallic, in concealed and exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

SECTION 05 80 00

FLEXIBLE GUTTER AND DRAIN TUBE ASSEMBLY

PART 1 - GENERAL

1.1 SUMMARY

- A. The work shall consist of furnishing and installing expansion joints in accordance with the details shown on the plans and the requirements of the specifications. The joints are proprietary designs utilizing extruded elastomeric seals, elastomeric headers and mounting plates. In the event of any discrepancy between the contract drawings and specifications, the specifications shall govern.

- B. Related Sections includes the following:
 - 1. Division 07 Section Joint Sealants

1.2 SUBMITTALS

- A. A.Standard Drawings - Submit typical expansion joint cross-section(s) indicating pertinent dimensioning, general construction, blockout dimensions and product data information. Approved Installers shall prepare and submit details of all special conditions to the manufacturer for review and approval prior to installation.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in each manufacturer's original, intact, labeled containers, pallets or bundles and store under shelter in a dry location with temperatures above 40°F until installed. Store off the ground, protect from freezing, direct sun exposure in elevated temperatures and construction activities.

1.4 MANUFACTURERS

- A. Products shall be as designed and manufactured by Watson Bowman Acme Corp., 95 Pineview Drive, Amherst, NY 14228

- B. Alternate manufacturers and their products will be considered, provided they meet the design concept and are produced of materials that are equal to or superior to those called for in the base product specification.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Shall be ISO-9001:2008, RC14001:2008 certified and shall provide written confirmation that a formal Quality Management System and Quality Processes have been adopted in the areas of, (but not limited to) engineering, manufacturing, quality control and customer service for all processes, products and their components. Alternate manufacturers will be considered provided they submit written proof that they are ISO 9001:2008, RC14001:2008 certified prior to the project bid date. Manufacturer: Shall have a minimum ten (10) years experience specializing in the design and manufacture of expansion control systems.
- B. Products: Expansion control systems shall be installed with manufacturer's blockout repair and infill materials.
- C. Application: The specified expansion control system(s) shall be installed by the manufacturer's factory trained installer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide flexible profile supplied by expansion control system manufacturer that will satisfy the required design movement and compress without damage during full joint closure. Profile shall contain and drain excess amounts of collected moisture through a drain tube that exhibits similar flexibility. Supply profile with fabric reinforcement to minimize material elongation from the collection of moisture or debris. Secure to concrete slab by utilizing blockout for expansion joint or under slab incorporating manufacturer's optional retainer profile.

Furnish Wabo® GutterFlex - Flexible Gutter System as manufactured by Watson Bowman Acme and as indicated on drawings.

Model "USG" Underslab Gutter

2.2 MATERIALS

- A. Gutter Profile - Provide 0.062" thick single ply fabric reinforced Neoprene sheet in accordance with the following properties.

Fabric Type:	4 ounce polyester cloth
Temperature Range:	-30F to +200F
Hardness Shore A	70 +/-5
Tensile, PSI	1000
Elongation, %	250
Tear, Die C, PPI	150

Width of profile shall be governed by joint type and movement requirements.

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- B. Drain Tube –Provide 1 ½” I.D. x 1/8” wall, clear PVC flexible tubing. Standard length shall be 24 inches unless otherwise noted.
- C. Transition Element - Provide pre-molded .060” thick EPDM tapered profile with pre-taped flange and adhesive for proper bonding to underside of gutter profile.
- D. Retainer Profile - Provide an Extruded Aluminum Retainer 6061-T6 alloy to receive a continuous bead of edge sealant.
 - Standard Finish: - Mill – no color.
 - Optional Finish: - Clear anodized in accordance with AA-M10 C22 A31 Class II (0.4 - 0.7 thick anodic coating).
- E. Edge Sealant - Utilize a one part polyurethane moisture cure sealant conforming to federal specification TT-S-00230C Type II Class A NON-SAG (Permathane SM7108).
- F. Anchors: Provide manufacturers standard ¼” dia. x 1 ¾” lg. CSK. flathead concrete screw anchor. Carbon steel anchor shall receive factory fluoropolymer coating.

2.3 FABRICATION

- A. Shop assembled transition element and drain tube utilizing RTV5818-12C silicone adhesive. Allow for curing of adhesive prior to shipment.
- B. Extruded retainers in standard 10 ft sections.

PART 3 - EXECUTION

3.1 GENERAL

- A. Limit of flexible gutter profile shall be continuous along length of joint. Refer to manufacturers instructions to cap ends.
- B. Spacing of drain tube assemblies shall be approximately 25 feet center to center along length of joint or as specifically outlined in contract documents.
- C. With flexible gutter profile properly prepared and on flat surface, field attach drain tube assembly by removing protective tape. Using hand roller, apply direct pressure to flange ensuring full contact and proper adhesion.
- D. Refer to WBA installation procedure for additional detailed information.

END OF SECTION 05 80 00

SECTION 06 20 23

INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior standing and running trim.

1.3 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
 - 1. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Samples for Initial Selection: For each type of paneling indicated.
- C. Samples for Verification:
 - 1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
 - 2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be

stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
 - 2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

2.2 STANDING AND RUNNING TRIM AND WOOD CAPS

- A. Softwood Lumber Trim for Painted Finish:
 - 1. Species and Grade: Eastern white pine, Premium or No. 2; NeLMA or NLGA.
 - 2. Clear poplar allowed at contractor option.
 - 3. Finger Jointing: Not allowed.

2.3 WOOD CAPS

- A. Hardwood Lumber Trim for Painted Finish:
 - 1. Species and Grade: Clear white birch.
 - 2. Clear poplar allowed at contractor option.
 - 3. Finger Jointing: Not allowed.
 - 4. Face Surface: Surfaced (smooth).

2.4 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
 - 1. Where galvanized finish is indicated, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.
- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
 - 1. Use wood glue that has a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.
 - 1. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FABRICATION

- A. Back out or kerf backs of the following members except those with ends exposed in finished work:
 - 1. Interior standing and running trim except shoe and crown molds.
 - 2. Wood board paneling.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
 - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 - 1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
 - 2. Install trim after gypsum board joint finishing operations are completed.

3.5 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during remainder of the construction period.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 20 23

SECTION 06 40 23

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. High pressure decorative laminate base cabinets.
 - 2. High pressure decorative laminate adjustable shelving.
 - 3. High pressure decorative laminate counters.
 - 4. Wood framing for millwork items as shown.
- B. Related Sections include the following:
 - 1. Division 06 Section "Interior Finish Carpentry".
- C. Work By Alternates:
 - 1. Refer to Part 2 Section 1.4 to determine extent, if any, work of this Section will be affected by any Alternates.

1.2 SUBMITTALS

- A. Product Data: For medium-density fiberboard, particleboard, plywood, high-pressure decorative laminate, adhesive for bonding plastic laminate, thermoset decorative overlay, cabinet hardware and accessories.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in architectural woodwork.
 - 4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
- C. Samples for Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
 - 1. High pressure decorative laminate.
 - 2. Exposed cabinet hardware and accessories, one unit for each type and finish.
- D. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.

1.3 QUALITY ASSURANCE

- A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
 1. Hardboard: AHA A135.4.
 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
 3. Particleboard: ANSI A208.1, Grade M-2.
 4. Softwood Plywood: DOC PS 1.
 5. Hardwood Plywood and Face Veneers: HPVA HP-1.

2.2 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Custom grade interior woodwork complying with the referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
 2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).
 3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).
- D. Complete fabrication, including assembly, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or

roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.3 INTERIOR ARCHITECTURAL WOODWORK

A. Plastic Laminate Countertops:

1. Grade: Premium, for all countertops.
2. Plastic Laminate Type: 0.050 in. thick; UL tested and labeled ratings of 25 for flame spread, 25 for fuel contributed and 100 for smoke developed when bonded to wood particle board.
3. Edging and Backsplashes: Self edged (plastic laminate) unless otherwise indicated, same material as face.
4. Core Material: Medium Density Fiberboard for dry areas. Countertops with integral sinks shall have plywood core.
5. Sealant: Type as manufactured or recommended in writing by manufacturer of plastic laminate, color to match plastic laminate.
 - a. Silicone Sealant: Mildew resistant type, formulated for pointing of tile, color to match the plastic laminate where feasible; or clear as directed by Architect.

B. Plastic Laminate Casework:

1. Grade: Custom.
2. Construction: Flush overlay.
3. Core Material: Medium Density Fiberboard.
4. Plastic Laminate Type: 0.050 in. thick; UL tested and labeled ratings of 25 for flame spread, 25 for fuel contributed and 100 for smoke developed when bonded to wood particle board.
5. Base Construction: Provide separate full ladder design subbase of Exterior Grade Plywood, high PVC molding channel around bottom of base, or snap in base with Exterior Grade Plywood and adjustable leveling legs, to protect against spilled or standing water on floor.
6. Hang Rails and Stiffeners: Provide 3/4" x 3" hardwood handrail top and bottom for wall cabinets, top of cabinet for base cabinets, sufficient stiffeners to support cabinets without backing material.
 - a. Designs depending on cabinet backing for support will not be acceptable.
7. Back of Cabinets: 1/2" minimum particleboard.
8. Exposed Portions:
 - a. Door and drawer fronts, end panels, divider panels at open cabinets and similar locations: High pressure plastic laminate on medium density fiberboard.
 - b. Exposed edges: Self edged 0.050" plastic laminate, same material as face.
 - c. Adjustable Shelving: Edge banding at both edges to allow for reversing; and at ends where exposed to view in the finished work.
 - d. Door and drawer edges: 3mm PVC edging, to match HPDL.
9. Semi Exposed Surfaces, (Concealed when doors are closed): One of following at option of Installer:
 - a. Plastic laminate.
 - b. Transparent finish, on plywood (birch acceptable).
 - c. Prefinished particleboard, edge banded.

- C. Fixed Utility and Adjustable Shelving (non part of casework): Medium density fiberboard with 0.050 plastic laminate edge banding.
 - 1. Thickness: 3/4"
 - 2. Plastic Laminate Type: 0.050 in. thick; UL tested and labeled ratings of 25 for flame spread, 25 for fuel contributed and 100 for smoke developed when bonded to wood particle board.
 - 3. For adjustable shelving provide edge banding both edges to allow for reversing, and one on ends where exposed to view in the finished work.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Cabinet Hardware Schedule:
 - 1. Shelf Supports, Plug-In Type: Hafele No. 282.11.761, nickel-plated, or equal.
 - 2. Vertical Slotted Shelf Standards and Brackets: KV #82/182.
 - 3. Drawer Slides: KV Series 8400.
 - 4. Door Hinges: Blum CLIP 120° Concealed Hinges.
 - 5. Door and Drawer Pulls: Ives #38 B26D.
 - 6. Cork Panel Finish: 1/4" Thick natural cork, Claridge "NuCork" or approved equivalent.
 - 7. Metal Counter Brackets: A+M Hardware, 1/8" powder coated steel, or approved equivalent.
 - 8. Door and Drawer Locks: CompX Timberline CB Series Cam Locks.
 - 9. Desk Grommets: 2" ø black ABS.
- D. Exposed Hardware Finish: Except where not available, provide exposed hardware with BHMA Code 626 satin chromium plate finish (US26D); where not available, provide either satin aluminum or satin stainless steel finish.

2.5 ROUGH CARPENTRY FOR ARCHITECTURAL MILLWORK

- A. General: Comply with requirements of section ROUGH CARPENTRY except as specified otherwise.
 - 1. Use only kiln dried lumber materials.

2.6 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where shorter single-length pieces are necessary.
 - 1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
 - 2. Install wall railings on indicated metal brackets securely fastened to wall framing.
 - 3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
 - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

CITY OF PORTLAND FIREBOAT CREW QUARTERS RENOVATIONS

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 40 23

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Foam-plastic board insulation.
2. Spray polyurethane foam insulation.
3. Unfaced Glassl Fiber batt insulation
4. Vapor Retarders

- B. Related Sections include the following:

1. Division 04 Section "Unit Masonry" for insulation installed in cavity walls and masonry cells.
2. Division 09 Section "Gypsum Board" and "Gypsum Board Shaft-Wall Assemblies" for insulation specified in those Sections.

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.

1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm (13-m/s) air velocity.
2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.
- D. Research/Evaluation Reports: For foam-plastic insulation.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.
- C. Recycled Content: Provide extruded polystyrene insulation with recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 30 percent.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FOAM-PLASTIC BOARD INSULATION

- A. Rigid Insulation: Extruded-Polystyrene Board Insulation; ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
1. Available Products:
 - a. Foamular 250; Owens Corning.
 - b. Styrofoam by Dow Chemical Co.
 - c. Amfoam-CM by Tenneco Building Products
 2. Type IV, 1.60 lb/cu. ft., unless otherwise indicated.
 3. Application: Foundation insulation. Rigid insulation below concrete slab-on-grade.

2.3 SPRAYED FOAM INSULATION

- A. Sprayed Polyurethane Foam Sealant for Perimeter of Doors and Windows: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft. density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
1. Products:
 - a. Great Stuff Window & Door by Dow
 - b. Froth-Pak by Insta-Foam Products, Inc.
 - c. Pur-Fill 1G by Todol Products, Inc.
 - d. Handi-Seal Window and Door Sealant by Fomo Products, Inc.
- B. Foamed-in-Place Insulation: ASTM C 1029, Type II, two-component, spray-in-place, 2 lb-density, plastic foam with closed-cell structure, conforming to the following:
1. Flame/Smoke Properties: 25/450 in accordance with ASTM E84.
 2. R-Value per Inch: 6.5 minimum.
 3. Products:

- a. Corbond® Performance Insulation System.
- b. Styrofoam™ SPF Insulation.
- c. BASF Comfort Foam 158 Series

2.4 BATT INSULATION

- A. ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
 1. Available Products:
 - a. CertainTeed Corporation.
 - b. Guardian Building Products.
 - c. Johns Manville Corporation.
 - d. Owens Corning.

2.5 VAPOR RETARDERS

- A. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 1. Available Products: 3M Builder's Sealing Tape No. 8086.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

- A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
 - 1. If not otherwise indicated, extend insulation to top of footing.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.
- D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- D. Place loose-fill insulation into spaces indicated, by machine blowing, to comply with ASTM C 1015. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
- E. Apply foamed-in-place insulation, by spray or froth method to a uniform monolithic density without voids into miscellaneous voids and cavity spaces where shown.

3.6 PROTECTION

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

END OF SECTION 07 21 00

SECTION 07 84 13

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes, unless specified elsewhere, through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Related Sections include the following:
 - 1. Division 07 Section "Fire-Resistive Joint Systems."
 - 2. Division 21 Sections specifying fire-suppression piping penetrations.
 - 3. Division 22 and 23 Sections specifying duct and piping penetrations.
 - 4. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
 - 3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 3.0 cfm/sq. ft at both ambient temperatures and 400 deg F.

- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 - 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 - 1. Types of penetrating items.
 - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
- D. Qualification Data: For Installer.
- E. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.
- F. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
- D. Special Inspections: Allow for 1 of each type of firestopping system to be removed and inspected for conformance with approved submittals. All firestopping shall be inspected prior to the installation of ceilings.
- E. Above Ceiling review: Prior to the installation of ceilings, a review of construction completion shall be conducted for firestopping and other items that will not be visible when the ceilings have been installed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include those systems indicated that are produced by one of the following manufacturers:
 - 1. Grace, W. R. & Co. - Conn.
 - 2. Hilti, Inc.
 - 3. Nelson Firestop Products.
 - 4. RectorSeal Corporation (The).
 - 5. Specified Technologies Inc.
 - 6. 3M; Fire Protection Products Division.
 - 7. Tremco; Sealant/Weatherproofing Division.
 - 8. USG Corporation.

2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.3 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials as required by UL approved Through-Penetration Firestop System. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Elastomeric Spray: Single component, water-based elastomeric compound.
- E. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- F. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- G. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- H. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- I. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

- J. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.
- K. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- L. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
 - 2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
 - 3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.
- M. Unfaced, Slag-Wool-/Rock-Wool-Fiber Board Insulation: ASTM C 612, maximum flame-spread and smoke-developed indices of 15 and 0, respectively; passing ASTM E 136 for combustion characteristics; and of the following density, type, thermal resistivity, and fiber color:
 - 1. Nominal density of 4 lb/cu. ft., Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F.
 - 2. Color: Natural.
 - 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fibrex Insulations Inc.
 - b. Owens Corning.
 - c. Thermafiber.

2.4 MIXING

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Through-penetration firestop system designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Through-penetration firestop system manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.
- D. Reinstall firestopping materials that have been removed for inspection.

3.6 CLEANING AND PROTECTING

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

END OF SECTION 07 84 13

SECTION 07 92 00

JOINT SEALANTS

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. Silicone joint sealants.
- 2. Latex joint sealants.

B. Related Sections:

- 1. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
- 2. Division 08 Section "Glazing" for glazing sealants.
- 3. Division 09 Section "Gypsum Board" for sealing perimeter joints.
- 4. Division 09 Section "Tiling" for sealing tile joints.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- D. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- F. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
- D. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

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

3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Sealant Type 1: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant; ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 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 Corning Corporation; 790 (VOC 43); 756 SMS (VOC 87) for cold applications.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. Pecora Corporation; 890 (VOC na).
 - d. Sika Corporation, Construction Products Division; SikaSil-C990.
 - e. Tremco Incorporated; Spectrem 1 (VOC 1).
- B. Sealant Type 2: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant; ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 1. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 756 SMS (VOC 87).

- b. GE Advanced Materials - Silicones; SilPruf LM SCS2700 (VOC 27).
 - c. Pecora Corporation; 890NST (VOC 98).
- C. Sealant Type 3: Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant; ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
 - 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 Corning Corporation; 790 (VOC 43).
 - b. Pecora Corporation; 301 NS (VOC 50).
 - c. Tremco Incorporated; Spectrem 800 (VOC 1).
- D. Sealant Type 4: Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 - 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 Corning Corporation; 786(VOC 33) (Food)
 - b. GE Advanced Materials - Silicones; Sanitary SCS1700.
 - c. Tremco Incorporated; Tremsil 200 Sanitary (VOC 1).

2.3 LATEX JOINT SEALANTS

- A. Sealant Type 5: Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 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. BASF Building Systems; Sonolac (VOC 41).
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. Pecora Corporation; AC-20 (VOC 31).
 - d. Tremco Incorporated; Tremflex 834.

2.4 JOINT SEALANT BACKING

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

2.5 MISCELLANEOUS MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

- a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
- 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
- 1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

3.4 CLEANING

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

3.5 PROTECTION

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

3.6 JOINT-SEALANT SCHEDULE

- A. Exterior Isolation and Contraction Joints in Cast-in-place Concrete Slabs.
 1. Silicone Joint Sealant: Sealant Type 3.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Exterior Control, Expansion, and Soft Joints in Masonry and Between Masonry and Adjacent Work.
 1. Silicone Joint Sealant: Sealant Type 1.
 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

- C. Exterior Control, Expansion, and Soft Joints Between Masonry and Metal Door Frames, Windows, Storefronts and Curtain Walls.
 - 1. Silicone Joint Sealant: Sealant Type 1.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Exterior Control, Expansion, and Soft Joints in Stone Work and Between Stone and Adjacent Work.
 - 1. Silicone Joint Sealant: Sealant Type 2.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Under Exterior Door Thresholds.
 - 1. Silicone Joint Sealant: Sealant Type 1.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Exterior Joints for Which No Other Sealant Type is Indicated.
 - 1. Silicone Joint Sealant: Sealant Type 1.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Interior Isolation and Contraction Joints in Cast-In-Place Concrete Slabs.
 - 1. Silicone Joint Sealant: Sealant Type 3.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- H. Concealed Interior Perimeter Joints of Exterior Openings.
 - 1. Silicone Joint Sealant: Sealant Type 1.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- I. Exposed Interior Perimeter Joints of Exterior Openings.
 - 1. Silicone Joint Sealant: Sealant Type 1.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- J. Perimeter Joints Between Interior Wall Surfaces and Frames of Interior Doors Windows and Elevator Entrances.
 - 1. Latex Joint Sealant: Sealant Type 5.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- K. Vertical Joints on Exposed Surfaces of Walls and Partitions.
 - 1. Latex Joint Sealant: Sealant Type 5.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- L. Joints between Plumbing Fixtures and Walls and Floors and Between Countertops and Walls.
 - 1. Silicone Joint Sealant: Sealant Type 4.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

M. Interior Joints for Which No Other Sealant is Indicated.

1. Latex Joint Sealant: Sealant Type 5.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Standard hollow metal doors
- 2. Standard hollow metal frames.

B. Related Sections:

- 1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
- 2. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
- 3. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

- A. General: Submittals for Sections 081113, 081416 and 087100 shall be made concurrently.
- B. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.
 - 1. Product Data indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
- C. Shop Drawings: Include the following:
 - 1. Elevations of each door design.

2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

D. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

E. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1. Doors: Provide doors as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:

- a. Clear Width: 32 inches (815 mm) with door 90 degrees open.
- b. Maneuvering Clearances: Refer to Code for various side and approach clearances.
- c. Double-Leaf Doorways: Provide at least one leaf that meets the clear width and maneuvering clearances.
- d. Two Doors in Series: Provide a distance of four feet plus the width of any door swinging into the space between hinged or pivoted doors.

2. Notify Architect of details or specifications not conforming to code.

F. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.
 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Standard Steel Frames:
 - a. Curries Company.

2.2 MATERIALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
 - 1. Wipe Coat Galvanneal materials will not be considered acceptable.
- E. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- J. Glazing: Comply with requirements in Division 08 Section "Glazing."
- K. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
 - a. Fire Door Core: As required to provide fire-protection ratings indicated.

- b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 10.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 1) Locations: Exterior doors and interior doors where indicated.
 - 3. Vertical Edges for Single-Acting Doors: Beveled edge.
 - a. Beveled Edge: 1/8 inch in 2 inches.
 - 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
 - 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
- 1. Level 2 (18 ga faces) and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
- 1. Level 2 (18 ga faces) and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).
 - 2. Face Design: Flush or embossed as shown.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- 2.4 STANDARD HOLLOW METAL FRAMES
- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
- 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as face welded unless otherwise indicated.
 - 3. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet, unless metallic-coated sheet is indicated.
- 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as knocked down unless otherwise indicated.

3. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.
4. Frames for Wood Doors: 0.053-inch- thick steel sheet.
5. Frames for Borrowed Lights: 0.053-inch- thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.7 LOUVERS

A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other, any angle.

3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

2.8 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.9 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. Glazed Lites: Factory cut openings in doors.
 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
 4. Full hinge cut-outs for non-handed doors will not be acceptable.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 6. Jamb Anchors: Provide number and spacing of anchors as follows:

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- a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
 - c. Compression Type: Not allowed.
 - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
- a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.10 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
- D. At exterior walls and masonry walls, coat inside of frame profile with bituminous coating to a thickness of 1/16 inch.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 13

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with clear factory finished wood-veneer faces.
 - 2. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections:
 - 1. Division 06 Section "Interior Finish Carpentry" for wood door frames.
 - 2. Division 08 Section "Glazing" for glass view panels in flush wood doors.

1.3 SUBMITTALS

- A. General: Submittals for Sections 08 11 13, 08 14 16 and 08 71 00 shall be made concurrently.
- B. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire-protection ratings for fire-rated doors.
- D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors from single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 and UL 10C.
 - 1. Include all requirements as part of the door construction per Category “A” guidelines.”
- D. Preinstallation Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 PROJECT CONDITIONS

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

1.7 WARRANTY

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flush Wood Doors:
 - a. Algoma Hardwoods Inc.
 - b. Eggers Industries; Architectural Door Division.

- c. Marshfield Door Systems, Inc.: Signature Series.
- d. Mohawk Flush Doors, Inc.
- e. Graham Wood Doors

2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- C. Particleboard-Core Doors:
 - 1. Particleboard: ANSI A208.1, Grade LD-2.
 - 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
- D. Structural-Composite-Lumber-Core Doors:
 - 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf.
 - b. Screw Withdrawal, Edge: 400 lbf.
 - 2. Provide doors with structural-composite-lumber cores instead of particleboard cores for the following doors:
 - a. Doors indicated to receive exit devices.
 - b. Doors where oversized glass lites exceed more than 40 percent of the door surface area.
 - c. Doors where louvers exceed more than 40 percent of the door surface area.
- E. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - 1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
- F. Mineral-Core Doors:
 - 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 - 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
 - 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR PAINT FINISH

- A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Select white birch.
3. Cut: Rotary cut.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening.
7. Exposed Vertical Edges: Same species as faces.
8. Core: Particleboard except where structural composite lumber is required.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.
10. Adhesives: Type I per WDMA TM-6.

2.4 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
 1. Wood Species: Same species as door faces.
 2. Profile: Flush, square shape.
 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings: Cut and trim openings through doors in factory.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Louvers: Factory install louvers in prepared openings.
- D. Factory Glazing: Provide glazing for all doors. Provide glass as specified in Division 08 Section "Glazing." Install fire-rated glass as required by the glazing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

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

END OF SECTION 08 14 16

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. This Section includes the following:
 - 1. Commercial door hardware for the following:
 - a. Swinging doors.
- B. Related Sections include the following:
 - 1. Division 08 Section "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
 - 2. Division 08 Section "Flush Wood Doors" for integral intumescent seals provided as part of fire-rated labeled assemblies.

1.3 SUBMITTALS

- A. General: Submittals for Sections 081113, 081416 and 087100 shall be made concurrently.
- B. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Samples for Verification: Submit minimum 2-by-4-inch plate Samples of each type of finish required, except primed finish.
- D. Product Certificates: For electrified door hardware, signed by product manufacturer.
 - 1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches and closers.
- F. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- G. Warranty: Special warranty specified in this Section.

H. Other Action Submittals:

1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 - b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - c. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, and material of each door and frame.
 - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
 - 3) Complete designations of every item required for each door or opening including name and manufacturer.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for door hardware.
 - 8) Door and frame sizes and materials.
 - 9) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
 - a) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
 - 10) List of related door devices specified in other Sections for each door and frame.
 - d. Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in Project construction schedule. Submit the final door hardware sets after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.
2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- D. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.
 - 1. Door Hardware: Provide hardware as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
 - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 - b. Door Closers: Comply with the following maximum opening-force requirements indicated:
 - 1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
 - 2) Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
 - 3) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
 - 2. NFPA 101: Comply with the following for means of egress doors:
 - a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
 - b. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force not more than 15 lbf for not more than 3 seconds.
 - c. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
 - d. Thresholds: Not more than 1/2 inch high.
- E. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.6 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.7 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. Failures include, but are not limited to, the following:

- a. Structural failures including excessive deflection, cracking, or breakage.
- b. Faulty operation of operators and door hardware.

- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
- 2. Warranty Period: One year from date of Substantial Completion, except as follows:
 - a. Exit Devices: Two years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements.
- C. 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 the manufacturers specified.

2.2 HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
 - 1. Two Hinges: For doors with heights up to 60 inches.
 - 2. Three Hinges: For doors with heights 61 to 90 inches.
 - 3. Four Hinges: For doors with heights 91 to 120 inches.
 - 4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Hinge Weight: Unless otherwise indicated, provide the following:
 - 1. Entrance Doors: Heavy-weight hinges.
 - 2. Doors with Closers: Antifriction-bearing hinges.
 - 3. Interior Doors: Antifriction-bearing hinges and standard-weight hinges as indicated.
- D. Hinge Base Metal: Unless otherwise indicated, provide the following:
 - 1. Exterior Hinges: Stainless steel, with stainless-steel pin.
 - 2. Interior Hinges: Steel, with steel pin.
 - 3. Hinges for Fire-Rated Assemblies: Steel, with steel pin.
- E. Hinge Options: Where indicated in door hardware sets or on Drawings:
 - 1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
 - 2. Corners: Square.
- F. Fasteners: Comply with the following:
 - 1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
 - 2. Wood Screws: For wood doors and frames.
 - 3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
 - 4. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors and wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.3 HINGES

- A. Butts and Hinges: BHMA A156.1.
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Available Manufacturers:
 - 1. Hager Companies (HAG).
 - 2. McKinney Products Company; an ASSA ABLOY Group company (MCK).
 - 3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
- D. The following is a guide for hinge size and type required for this project.

	Manufacturer	Interior:	Exterior
1-3/8" Doors up to 3'-0" wide	Stanley	F179-3 1/2"	
	Hager	1279-3 1/2"	
	McKinney	T2714-3 1/2"	
1-3/4" Doors	Stanley	FBB179-4 1/2"	FBB191-4 1/2"

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up to 3'-0" wide	Hager	BB1279-4 1/2"	BB1191-4 1/2"
	McKinney	TA-TB2714-4 1/2"	TA-TB2314-4 1/2"
1-3/4" Doors over 3'-0" wide	Stanley	FBB168-4 1/2"	FBB199-4 1/2"
	Hager	BB1168-4 1/2"	BB1199-4 1/2"
	McKinney	T4A-T4B3786-4 1/2"	T4A-T4B3386-4 1/2"
2-1/4" Doors	Stanley		FBB199-5"
	Hager		BB1199-5"
	McKinney		T4A-T4B3386-5"

2.4 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Lock Trim:
1. Levers: Cast.
 2. Escutcheons (Roses): Forged.
 3. Dummy Trim: Match lever lock trim and escutcheons.
- D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
1. Bored Locks: Minimum 1/2-inch latchbolt throw.
 2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
 3. Deadbolts: Minimum 1-inch bolt throw.
- E. Backset: 2-3/4 inches, unless otherwise indicated.
- F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
1. Strikes for Bored Locks and Latches: BHMA A156.2.
 2. Strikes for Mortise Locks and Latches: BHMA A156.13.
 3. Strikes for Interconnected Locks and Latches: BHMA A156.12.
 4. Strikes for Auxiliary Deadlocks: BHMA A156.5.
 5. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 6. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

7. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

2.5 HEAVY DUTY CYLINDRICAL LOCKS AND LATCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Mechanical Locks and Latches:
 - a. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
- B. Bored Locks: BHMA Grade 1; Series 4000.
 1. Provide one of the following manufacturers and designs:
 - a. Sargent: 10 Line
- C. Auxiliary Locks: BHMA Grade 1.
- D. Lock Trim: Comply with the following:
 1. Lockset Designs: Provide the lockset design designated below or, if sets are provided by another manufacturer, provide designs that match those designated:
 - a. Sargent: LL
- E. Lock Functions: Lock functions as indicated in the hardware schedule shall be as follows:

FUNCTION	SARGENT
(1) Utility	04
(2) Office	05
(3) Passage	15
(4) Classroom	37
(5) Public Entrance	16
(6) Privacy	65

2.6 DOOR BOLTS

- A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 1. Half-Round Surface Bolts: Minimum 7/8-inch throw.
 2. Interlocking Surface Bolts: Minimum 15/16-inch throw.
 3. Fire-Rated Surface Bolts: Minimum 1-inch throw; listed and labeled for fire-rated doors.
 4. Dutch-Door Bolts: Minimum 3/4-inch throw.
 5. Mortise Flush Bolts: Minimum 3/4-inch throw.
- B. Dustproof Strikes: BHMA A156.16, Grade 1.

C. Manual Flush Bolts: BHMA A156.16, Grade 1; designed for mortising into door edge.

1. Available Manufacturers:

- a. Door Controls International (DCI).
- b. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
- c. Rockwood.

2. Available Products for Wood Doors:

- a. Door Controls: 790.
- b. Glynn-Johnson: FB6W.
- c. Rockwood: 557.

2.7 KEYING

- A. All locks and cylinders shall be as required by Owner's instructions and shall be operated by masterkey group AA and grand masterkey group A.
- B. It is required that the key systems have visual key control and that all keys and cylinders be stamped with the alphanumeric key symbol designated for each key change as recommended by the Nomenclature for Masterkey Systems established by the Door and Hardware Institute.
- C. Provide six (6) construction masterkeys to be supplied with the locksets to General Contractor. The construction masterkey shall operate all locks and cylinders, and shall permit access to all areas by General Contractor, during the construction period, prior to Owner assuming control of the building.
- D. Upon completion of the building, General Contractor or Owner shall remove the construction masterkey biting section by means of an extractor key to be supplied by Finish Hardware Supplier. The removal of the construction masterkey biting section shall prohibit the operation of the construction masterkey from that moment on.
- E. Provide a total of six (6) masterkeys for each group and six (6) grand masterkeys. Each keyed different change shall have minimum of four (4) change keys.
- F. All change keys, master and grand masterkeys, shall be delivered directly to Owner by the Hardware Subcontractor who shall obtain a receipt for delivery of same. The key cabinet, completely set up and indexed shall be the container for all change keys at the time of delivery.
- G. Where noted in the hardware set numbers, provide high security cylinder with either interlocking pin tumblers or side cut pin tumblers.

2.8 KEY CABINET:

- A. Furnish a wall mounted key cabinet in grey neutratone finish with a capacity capable of containing all the keyed different and alike changes required for this project and an additional 20% greater quantity for future expansion.
- B. Provide a complete cross-indexing system, including: 1.Hook number, 2.Key number, 3.- Description of item to which key belongs.
- C. It shall be the responsibility of the hardware supplier to receive the keys from the lock manufacturer. He shall then prepare a complete type-written cross-file index system as prescribed in the manufacturers key index manual. It shall also be the hardware supplier's responsibility to attach the keys to the fibre tags and to install on corresponding numbered hook in the key cabinet.
- D. It shall be the general contractor's responsibility to install the key cabinet where directed by the Owner.
- E. Key control systems of the following manufacturers will be acceptable for this project:
 - 1. Telkee, Inc.
 - 2. Key Control Systems, Inc.

2.9 DOOR CLOSERS

- A. Manufacturer & Model: Provide Sargent 281 Series Powerglide cast iron door closers with aluminum enamel finish.

2.10 OPERATING TRIM

- A. Standard: BHMA A156.6.
- B. Materials: Fabricate from stainless steel, unless otherwise indicated.
- C. Available Manufacturers:
 - 1. Burns Manufacturing Incorporated (BM).
 - 2. Don-Jo Mfg., Inc. (DJO).
 - 3. Hager Companies (HAG).
 - 4. IVES Hardware; an Ingersoll-Rand Company (IVS).
 - 5. Rockwood Manufacturing Company (RM).
- D. Door Pulls, 1 inch diameter.
 - 1. Size: ADA compliant, unless indicated otherwise, provide 10 inches center to center, with 3 1/2 inch projection and 2 1/2 inch clearance.
 - 2. Available Products:
 - a. Hager Companies, H4J.
 - b. IVES Hardware; an Ingersoll-Rand Company; 8103EZ.
- E. Push Bars, 1 inch diameter.

2.11 TRIM UNITS

- A. Size: 1-1/2 inches less than door width on push side and 1/2 inch less than door width on pull side, by height specified in door hardware sets.
- B. Fasteners: Manufacturer's standard machine or self-tapping screws.
- C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:
 - 1. Material: 0.050-inch- thick stainless steel.
 - 2. Available Manufacturers:
 - a. Burns Manufacturing Incorporated (BM).
 - b. Don-Jo Mfg., Inc. (DJO).
 - c. Hager Companies (HAG).
 - d. IVES Hardware; an Ingersoll-Rand Company (IVS).
 - e. Rockwood Manufacturing Company (RM).
- D. Fabricate protection plates as follows:
 - 1. Push Plates: 16" high by 8" wide.
 - 2. Kick Plates: 10" high by 1-1/2" less than door width for single doors and 1" less than door width for pairs of doors. Kick plates shall be applied to push side of all doors where noted.

2.12 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.
 - 1. Provide wall stops for doors unless floor or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
 - 2. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.
- B. Wall Stops: Wall type bumpers with concealed type flange shall be used where ever possible.
 - 1. Available Products:
 - a. Ives - 407 1/2
 - b. Door Controls - 3211T
 - c. Rockwood - 409
- C. Floor Stops: Where wall type bumpers cannot be used, provide dome type, floor mounted stops of the proper height as follows:

1. Available Products:
 - a. Ives - 436, 438
 - b. Door Controls - 3310X, 3320X
 - c. Rockwood - 440, 442

D. Exterior doors striking masonry and doors specified to have door stops and holders, shall have cast bronze wall or floor type door stops with hook or staple type holders to selectively hold doors in open position. The following will be acceptable:

1. Available Products:
 - a. Ives - 445, 446
 - b. Door Controls - 3237X, 3347X
 - c. Rockwood - 473, 477

E. Door Catches: Provide surface-mounted roller catch where indicated. Ives No. 338 or approved substitute.

F. Roller Bumper: Provide curved roller bumper with 2-3/4 inch projection with brushed chrome finish; No. GJRB3 by Robert Brooke and Associates, Hager 273W, or approved substitute.

G. Silencers for Wood Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch; fabricated for drilled-in application to frame.

H. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

2.13 DOOR GASKETING

A. Standard: BHMA A156.22.

B. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

C. Weatherstripping:

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame. Basis-of-Design Product, No. A626A by National Guard Products or approved substitute.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed. Basis-of-Design Product, No. 600A by National Guard Products or approved substitute.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed. Basis-of-Design Product, No. 95WH by National Guard Products or approved substitute.

D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on fire-rated doors and on smoke-labeled doors. Basis-of-Design Product, No. 5050 by National Guard Products or approved substitute.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

2.14 MISCELLANEOUS DOOR HARDWARE

- A. Closet Bi-fold hinges & Track: Provide BFC-125N-00-60 by Stanley
- B. Closet Pulls: Provide No. BP19002SS by Amerock.

2.15 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 2. Steel Machine or Wood Screws: For the following fire-rated applications:
 - a. Mortise hinges to doors.
 - b. Strike plates to frames.
 - c. Closers to doors and frames.
 3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
 - a. Surface hinges to doors.
 - b. Closers to doors and frames.
 - c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.16 FINISHES

- A. Standard: BHMA A156.18, as indicated in door hardware sets.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide the following finishes:
 1. Butts and Hinges: 26D
 2. Locks & Lock Trim: 26D
 3. Exit Devices: 26D
 4. Door Controls - Closers: Sprayed Aluminum Finish
 5. Door Stops 26D
 6. Weatherstripping Gray
 7. Threshold Aluminum
 8. Kickplates 26D
 9. Pulls 26D

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

- B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- E. Strikes for Vertical Rod Exit Devices: Where vertical rod exit devices are used at interior doors, bottom strikes at floor are to be installed so that the top of the strike is flush with the adjacent flooring material.

3.4 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. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
 - 2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer shall examine and readjust, including adjusting operating forces, each item of door

hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

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

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 DOOR HARDWARE SETS

- A. The hardware sets listed below indicate the items of hardware required for each opening. It is the bidder's responsibility to accurately furnish the proper quantities, items, sizes, weights and functions as required by the plans and specifications. If an opening has, through error, been omitted from the following hardware sets, it shall be the bidder's responsibility to supply hardware of equivalent quality and quantity, as that which is specified for a comparable opening.

HW 1 PASSAGE DOORS

Doors 107

Hinges
Heavy Duty Cylindrical Passage Set
Silencers
Stop

HW2 PRIVACY DOORS

Doors 103, 104, 105, 112, 113

Hinges
Heavy Duty Cylindrical Lockset (Privacy Function 6)
Silencers
Stop

HW3 BI-FOLD CLOSET DOORS

Doors 109, 110

Bi-fold Hinges /Track
Closet Pull Each Leaf
(2) Magnetic Catches at Each Leaf

HW4 EXTERIOR ENTRY DOORS

Doors 101, 102, 107.1

Hinges
Heavy Duty Cylindrical Lockset (Entrance Function 16)
Dead Bolt
Weatherstripping
Threshold
Stop

END OF SECTION 08 71 00

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Doors.
- B. Related Sections:
 - 1. Division 08 Section "Flush Wood Doors" for wood doors to be factory glazed.

1.3 DEFINITIONS

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

1.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.

- B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- C. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Product Certificates: For glass and glazing products, from manufacturer.

1.6 QUALITY ASSURANCE

- A. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Glazing Manual."
- D. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- E. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.2 GLASS PRODUCTS

- A. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 2. For uncoated glass, comply with requirements for Condition A.

2.3 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

- G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.4 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.5 MONOLITHIC-GLASS TYPES

- A. Tempered Glass: Clear fully tempered float glass.
 - 1. Thickness: 6.0 mm.
 - 2. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 GLAZING, GENERAL

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

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

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

3.5 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00

SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
 - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
 - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).
- B. Related Sections include the following:
 - 1. Division 05 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses. **N/A**
 - 2. Division 07 Section "Thermal Insulation" for insulation installed with Z-shaped furring members. **N/A**
 - 3. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall joint systems installed with non-load-bearing steel framing. **N/A**
 - 4. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for non-load-bearing metal shaft-wall framing, gypsum panels, and other components of shaft-wall assemblies.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Steel Framing and Furring:
 - a. Clark Western Building Systems, UltraSteel™ Framing.
 - b. Dietrich Industries, Inc., UltraSteel™ Framing.
 - c. MarinoWare; Division of Ware Ind.
 - d. National Gypsum Company.
 - e. The Steel Network, Inc.
 - f. Unimast, Inc.

2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized or equivalent per ASTM A1003.
- C. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As indicated on Drawings or not less than 0.032 inch (20 Ga.).
 - b. Depth: As indicated on Drawings.
 2. Dimpled Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: As indicated on Drawings or not less than 0.032 inch (20 Ga.).
 - b. Depth: As indicated on Drawings.
- D. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.

2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
 - 2) Superior Metal Trim; Superior Flex Track System (SFT).
- E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 1. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Trak Corp.; Fire Trak.
 - b. Metal-Lite, Inc.; The System.
 - c. The Steel Network, Inc.; VertiClip SLD or VertiTrack VTD.
 - d. Dietrich: SLP-TRK Slotted Track.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Minimum Base-Metal Thickness: 0.0312 inch.
- G. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
 1. Depth: 1-1/2 inches.
 2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel or BridgeClip by The Steel Network, Inc.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base Metal Thickness: 0.0179 inch.
 2. Depth: As indicated on Drawings.
- I. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
 1. Configuration: Asymmetrical.
- J. Masonry Furring Channels: Adjustable wall furring designed for use on brick or block with cold-rolled channel. Provide No. FCWB by Dietrich or approved substitute.

- K. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: 3/4 inch.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch- diameter wire.
- L. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches.
- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 - 2. Steel Studs: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0179 inch.
 - b. Depth: As indicated on Drawings.
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base Metal Thickness: 0.0179 inch.
 - 4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- a. Armstrong World Industries, Inc.; Drywall Grid Systems.
- b. Chicago Metallic Corporation; 640-C Drywall Furring System.
- c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION, GENERAL

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

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
 - 1. Space studs as follows:
 - a. Single-Layer Construction: 16 inches o.c., unless otherwise indicated.
 - b. Multilayer Construction: 16 inches o.c., unless otherwise indicated.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two 0.312 inch (0.79 mm) (20 gage) studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- D. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- E. Z-Furring Members:

1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

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- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior specialty mold resistant gypsum board.
- B. Related Sections include the following:
 - 1. Division 05 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board. **N/A**
 - 2. Division 06 Section "Rough Carpentry" for wood framing and furring that supports gypsum board. **N/A**
 - 3. Division 06 Section "Sheathing" for gypsum sheathing. **N/A**
 - 4. Division 07 Section "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
 - 5. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
 - 6. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
 - 7. Division 09 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

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

1.4 PERFORMANCE REQUIREMENTS

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

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

1.5 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

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

2.2 SPECIALTY INTERIOR GYPSUM BOARD

- A. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
 - 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. Georgia-Pacific Gypsum LLC; DensArmour Plus.
 - 2. Core: 5/8 inch, Type X.
 - 3. Long Edges: Tapered.
 - 4. Mold Resistance: ASTM D 3273, score of 10.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material:
 - a. Galvanized or aluminum-coated steel sheet or rolled zinc.
 - b. Plastic where abutting exterior metal doors and windows.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Mold-Resistant Gypsum Wallboard: 10-by-10 glass mesh.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Pre-filling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
 - a. Use setting-type taping with mold-resistant gypsum wallboard.
3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: Not required.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Joint Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corporation; AC-20 FTR or AIS-919.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
 - 2. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."
- F. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."
- G. Firestopping: As specified in Division 07 Section "Penetration Firestopping."

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Provide sealant bed at flanges of electrical boxes prior to application of gypsum panels.
- F. Form control and expansion joints with space between edges of adjoining gypsum panels.
- G. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- H. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- I. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- J. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.
- K. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- L. Fire-Resistance-Rated Gypsum Board Assemblies: Provide firestop system at the top of fire-resistance-rated gypsum board assemblies. Provide firestop system around any structural penetration of wall assembly.
- M. Smoke-Rated Gypsum Board Assemblies: Provide a tight, taped joint at the top of smoke-rated assemblies and around any penetrations to assemblies at both side of the assembly. The use of acoustical sealant will be acceptable to fill gaps up to 3/8 inch wide.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Where required for fire-resistance-rated assembly.
 - 2. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels as follows:
 - a. Vertically (parallel to framing) for metal framing.
 - b. Horizontally (perpendicular to framing) for wood framing.
 - c. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - d. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings or according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners, unless otherwise indicated.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Where indicated on Drawings.
 - 3. Level 3: Where indicated on Drawings.
 - 4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.
 - 5. Level 5: Not required.

3.6 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
 - 1. Complete the following in areas to receive gypsum board ceilings:
 - a. Installation, insulation, and leak and pressure testing of water piping systems.
 - b. Installation of air-duct systems and air devices.
 - c. Installation of mechanical system control-air tubing.
 - d. Installation of ceiling support framing.
 - e. Installation of Penetration Firestopping.

3.7 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.

1.3 DEFINITIONS

- A. AC: Articulation Class.
- B. CAC: Ceiling Attenuation Class.
- C. LR: Light Reflectance coefficient.
- D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.
- C. Maine State Housing Authority Green Standards Submittals: N/A
 - 1. Product Data for products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- E. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 - 2. Suspension System: Obtain each type through one source from a single manufacturer.

1.6 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
 - a. Smoke-Developed Index: 450 or less.
- B. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - 1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with IBC.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.9 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
 - 3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

- A. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

- D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Where indicated, provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- 1. ACT 1:
 - a. Armstrong World Industries, Inc.; Fine Fissured No. 1728.
 - b. BPB USA; HHF-157.
 - c. USG Interiors, Inc.; Radar ClimaPlus No. 2210.
- 2. ACT 2:
 - a. Armstrong World Industries, Inc.; Ceramaguard Fine Fissured No. 607
 - b. BPB USA; Aquarock Gypsum Ceilings No. 1182-CRF-1SV
 - c. USG Interiors, Inc.; Radar Ceramic ClimaPlus No. 56644

- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

- 1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular or 2, water felted.
- 2. Pattern: CE (perforated, small holes and lightly textured) and I (embossed).

- C. Color: White.

- D. LR: Not less than 0.80.

- E. NRC: Not less than 0.55.

- F. CAC: Not less than 35.

- G. Edge/Joint Detail: Square.

- H. Thickness: 5/8 inch.

- I. Modular Size: 24 by 24 inches.

- J. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

- B. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
 - 1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- D. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- F. Hanger Rods or Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- G. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
- H. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.
 - 1. Available Product: UHDC by Armstrong or L15 by USG.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Prelude 15/16" Exposed Tee System (7300 Series); Armstrong World Industries, Inc.
 - 2. S11 System; Celotex Corporation.
 - 3. 1200 System; Chicago Metallic Corporation.
 - 4. DX 24 System; USG Interiors, Inc.
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.

2. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
3. Face Design: Flat, flush.
4. Cap Material: Steel cold-rolled sheet or aluminum.
5. Cap Finish: Painted white.

2.5 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:

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1. Hangers shall be single lengths of wire without splices; coordinate lengths in deep ceiling cavities.
 2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 4. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 5. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 6. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 7. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 8. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 9. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 10. Do not attach hangers to steel deck tabs.
 11. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 12. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 13. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Suspension system shall be reinforced to support diffusers, light fixtures and any additional members. Install hanger wires to grid at each corner of light fixtures. Coordinate location with electrical and other trades.
1. Each individual fixture and attachment with combined weight of 56 pounds or less shall have two 12-gage wire hangers attached at diagonal corners of the fixture. These wires shall be slack. Fixtures and attachments with a combined weight of greater than 56 pounds shall be independently supported from the structure at all four corners.
- E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- F. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- G. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - b. Install panels with pattern running in one direction parallel to long axis of space.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 5. Install hold-down clips in areas within 10 feet of exterior doors or vestibule doors; space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.

3.4 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs acoustical panel ceilings, conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of acoustical panels until deficiencies have been corrected.
1. Complete the following in areas to receive gypsum board ceilings:
 - a. Installation of 80 percent of lighting fixtures, powered for operation.
 - b. Installation, insulation, and leak and pressure testing of water piping systems.
 - c. Installation of air-duct systems.
 - d. Installation of air devices.
 - e. Installation of mechanical system control-air tubing.
 - f. Installation of penetration firestopping.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

SECTION 09 65 00

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Vinyl composition floor tile.
 - 2. Resilient wall base and accessories.
 - 3. Rubber stair treads, risers and tile
 - 4. Heat Welded Sheet vinyl floor coverings under Alternate #1.

1.2 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For flooring installed on walkway surfaces, provide products with the values indicated as determined by testing identical products per ASTM C 1028.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors and patterns available for each type of product indicated.
 - 1. For resilient accessories, manufacturer's standard-size samples, but not less than 12 inches long, of each resilient accessory color and pattern specified.
 - 2. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- C. Seam Samples: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.
- D. Product Certificates: Signed by manufacturers of resilient products certifying that each product furnished complies with requirements.
- E. Maintenance Data: For resilient flooring to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor covering manufacturer for installation techniques required.
- B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F.
- C. Store tiles on flat surfaces. Do not stake boxes of tiles over 5 high.
- D. Store rolls upright.
- E. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 70 deg F or more than 95 deg F in spaces to receive products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55 deg F or more than 95 deg F.
- B. Do not install products until they are at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by manufacturer.
- D. Install products and accessories after other finishing operations, including painting, have been completed.
- E. Where demountable partitions and other items are indicated for installation on top of resilient tile flooring, install tile before these items are installed.

- F. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test as well as acceptable pH range.

1.7 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. Furnish not less than one box of each type, color, pattern, class, wearing surface, and size of resilient tile flooring installed.
 - 2. Furnish not less than 10 linear feet in roll form of each different composition, wearing surface, color, and pattern of sheet floor covering installed.
 - 3. Furnish not less than 10 linear feet for each type, color, pattern, and size of resilient accessory installed.
 - 4. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the following paragraphs of Part 2.

2.2 RESILIENT TILE

- A. Vinyl Composition Tile: Where this designation is indicated, provide vinyl composition floor tile complying with ASTM F 1066 and the following:
 - 1. Products: As follows:
 - a. Armstrong: "Standard Excelon".
 - 2. Color and Pattern: As selected by Architect from manufacturer's full range of colors and as indicated on the drawings. Up to four (4) colors shall be selected by the Architect.
 - 3. Class: Class 2 (through-pattern tile).
 - 4. Static Coefficient of Friction: Level Surfaces, minimum 0.6.
 - 5. Thickness: 1/8 inch.
 - 6. Size: 12 by 12 inches.

2.3 RUBBER TILE:

- A. Rubber tile units composed 100% synthetic virgin rubber, pigments, stabilizing fillers, integral waxes and soil releasing agents; with raised surface pattern.
 - 1. Dimensions: Approximately 24"x24" cut tile size by 1/8" minimum thickness, 1.31" diameter pattern with profile height of 0.12".
 - 2. Product: Disc-O-Tile by R.C. Musson

2.4 RUBBER TREADS AND RISERS:

- A. Provide treads and risers where shown, consisting of single piece units for width of stair treads, or equal length units if tread width exceeds available manufactured lengths, sanded backs.
1. Style: Match color and design of raised disc pattern tile .210" thick tapering to .113" at rear, 1-7/8" deep nosing, 12-1/4" deep, length equal width of stairs.
 2. Product: Disc-O-Tred by disc pattern tile manufacturer.
 3. Manufacturer of disc pattern tile and stair treads must be same entity.

2.5 SHEET VINYL FLOOR COVERINGS (ALTERNATE #1)

- A. Sheet Vinyl: Where this designation is indicated, provide sheet vinyl floor covering with backing complying with ASTM F 1303 and the following:
1. Available Products: As follows:
 - a. Armstrong Medintech Tandem.
 2. Color and Pattern: As selected by Architect from manufacturer's full range of colors and patterns produced for sheet vinyl floor covering complying with requirements indicated. Up to two (2) colors shall be selected by the Architect.
 3. Type (Binder Content): Type II, minimum binder content of 34 percent.
 4. Wear-Layer Thickness: Minimum Grade 1 thickness according to ASTM F 1303 for Type indicated.
 5. Static Coefficient of Friction: Level Surfaces, minimum 0.6.
 6. Overall Thickness: As specified by manufacturer's product designation indicated above.
 7. Wearing Surface: Smooth.
 8. Backing Class: Class A (fibrous).
 9. Sheet Width: As standard with manufacturer for product designation indicated above.
 10. Seaming Method: Heat welded.
 11. Base: Provide integral flash coved wall base.
 12. Cove Filler: 1" radius, Johnsonite CFS-00-M or approved equal.
 13. Base Cap: Extruded aluminum J-molding for 0.080" material.

2.6 RESILIENT ACCESSORIES

- A. Vinyl Base: Where this designation is indicated, provide rubber wall base complying with FS SS-W-40, Type I and the following:
1. Products: As follows:
 - a. Armstrong World Industries
 - b. Johnsonite.
 2. Color and Pattern: As selected by Architect from manufacturer's full range of colors and patterns produced for vinyl wall base complying with requirements indicated.
 3. Style: Cove with top-set toe.
 4. Minimum Thickness: 1/8 inch.
 5. Height: 4 inches.
 6. Lengths: 120 feet (36.6 m) long.
 7. Outside Corners: Job formed.
 8. Inside Corners: Job formed.
 9. Surface: Smooth.

- B. Vinyl Accessory Molding: Where this designation is indicated, provide vinyl accessory molding complying with the following:
 - 1. Available Products: As follows:
 - a. Johnsonite.
 - 2. Color: As selected by Architect from manufacturer's full range of colors produced for vinyl accessory molding complying with requirements indicated.
 - 3. Transition Strip between VCT and Carpet: CE-XX-A by Johnsonite or approved substitute.

2.7 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. VCT Adhesives: 50 g/L.
 - b. Cove Base Adhesives: 50 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
 - 2. Verify that adhesion and dryness characteristics have been determined as required in Division 7 Section "Vapor Retarders, Vapor Barriers, and Air Barriers" and meet flooring manufacturer's recommendations.
 - 3. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving resilient flooring.
 - 4. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. For wood subfloors, verify the following:
 - 1. Underlayment over subfloor complies with requirements specified in Division 6 Section "Rough Carpentry."
 - 2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond, show through surface, or stain flooring.
- D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Use stair-tread-nose filler, according to resilient tread manufacturer's written instructions, to fill nosing substrates that do not conform to tread contours.
- D. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- E. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

- A. General: Comply with tile manufacturer's written installation instructions.
- B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter.
 - 1. Lay tiles square with room axis, unless otherwise indicated.
- C. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles in basket-weave pattern with grain direction alternating in adjacent tiles.
- D. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- E. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.
- G. Install tiles on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on covers. Tightly adhere edges to perimeter of floor around covers and to covers.
- H. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to comply with tile manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Hand roll tiles according to tile manufacturer's written instructions.

J. Provide waterproofing to set tiles where slip-resistant VCT is indicated on the drawings.

3.4 SHEET FLOORING INSTALLATION

A. General: Comply with sheet floor covering manufacturer's written installation instructions.

B. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting, if recommended in writing by manufacturer.

C. Lay out sheet floor coverings to comply with the following requirements:

1. Maintain uniformity of sheet floor covering direction.
2. Arrange for a minimum number of seams and place them in inconspicuous and low-traffic areas, and not less than 6 inches away from parallel joints in flooring substrates.
3. Match edges of sheet floor coverings for color shading and pattern at seams according to manufacturer's written recommendations.
4. Avoid cross seams.

D. Scribe, cut, and fit sheet floor coverings to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

E. Extend sheet floor coverings into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.

G. Adhere sheet floor coverings to flooring substrates to comply with floor covering manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Produce completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces. Coordinate welding rod with sheet vinyl color and pattern, as available by manufacturer.

I. Hand roll sheet floor coverings in both directions from center out to embed floor coverings in adhesive and eliminate trapped air. At walls, door casings, and other locations where access by roller is impractical, press floor coverings firmly in place with flat-bladed instrument.

3.5 RESILIENT ACCESSORY INSTALLATION

- A. General: Install resilient accessories according to manufacturer's written installation instructions.
- B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, locker bases, and other permanent fixtures in rooms and areas where base is required.
 - 1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 - 2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 3. Do not stretch base during installation.
 - 4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 - 5. Form outside corners on job from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 6. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
- C. Place resilient accessories so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.
 - 1. Locate reducer strips or transition strips to line up centered under doors, unless noted otherwise.
- D. Apply resilient products to stairs as indicated and according to manufacturer's written installation instructions with epoxy adhesive and nose filler.

3.6 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing resilient products:
 - 1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
 - 2. Sweep or vacuum floor thoroughly.
 - 3. Do not wash floor until after time period recommended by flooring manufacturer.
 - 4. Damp-mop floor to remove marks and soil.
- B. Clean floor surfaces as soon as possible after installation. Clean products according to manufacturer's written recommendations.
 - 1. After cleaning, apply polish to floor surfaces to provide protective floor finish according to flooring manufacturer's written recommendations. Apply stain resistant sealer under polish as recommended by manufacturer at all areas to receive VCT. Coordinate with Owner's maintenance program.
 - 2. Protect flooring with covers from time of installation to time of polish application per manufacturer's written instructions.

3.7 WASTE MANAGEMENT

CITY OF PORTLAND FIREBOAT CREW QUARTERS RENOVATIONS

- A. Separate waste in accordance with the Waste Management Plan and place in designated areas in the following categories for reuse:
 - 1. Sheet materials larger than 2 square feet.
- B. Close and seal tightly all partly used adhesive containers and store protected in well-ventilated, fire-safe area at moderate temperatures.

END OF SECTION 09 65 00

SECTION 09 91 13

EXTERIOR PAINTING

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 surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel.
 - 2. Concrete Masonry Units
- B. This Section includes exposed exterior items and surfaces with low VOC coatings complying with ME DEP regulations.
- C. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
 - 4. Division 09 painting Sections for special-use coatings.
 - 5. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Selection: For each type of topcoat product.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. VOC content.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - 1. Benjamin Moore & Co.
 - 2. Sherwin Williams
 - 3. ICI Paints

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Compliance for Exterior Paints and Coatings: Provide the manufacturer's formulation for the products specified below that are VOC compliant with the State of Maine Department of Environmental Protection Regulation, "Chapter 151: Architectural and Industrial Maintenance (AIM) Coatings" and the following chemical restrictions expressed in grams per liter:

1. Flat Paints and Coatings: VOC content of not more than 100 g/L.
2. Non-Flat Paints and Coatings: VOC content of not more than 150 g/L.
3. Non-Flat Paints and Coatings - High Gloss: VOC content of not more than 250 g/L.
4. Anticorrosive (Rust Preventative) Coatings: VOC content of not more than 400 g/L.
5. Fire Resistive Coatings: VOC content of not more than 350 g/L.
6. Industrial Maintenance Coatings (IMC): VOC content of not more than 340 g/L.
7. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
8. Quick-Dry Enamels: VOC content of not more than 250 g/L.
9. Quick-Dry Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
10. Specialty Primers, Sealers, and Undercoaters: VOC content of not more than 350 g/L.
11. Wood Preservatives: VOC content of not more than 350 g/L.

C. Colors: Provide color selections made by the Architect. Allow for up to 5 different color selections.

2.3 METAL PRIMERS

A. Ferrous-Metal and Galvanized Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.

1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04.

2.4 EXTERIOR LATEX PAINTS

A. Semi-Gloss Acrylic Latex Paint: Factory-formulated semi-gloss acrylic for exterior application on wood.

1. Moore: Super Spec Latex House & Trim Paint #170.

B. Exterior Semi-Gloss Acrylic Enamel: Factory-formulated semi-gloss acrylic enamel for exterior application on metals.

1. Benjamin Moore; DTM Acrylic Semi-Gloss Enamel M29: Applied at a dry film thickness of not less than 2.0 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints. Uniformly abrade galvanized surfaces with a palm sander and 60 grit aluminum oxide so surface is free of oil and surface contaminants.
- F. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Apply an additional coat of primer on metal surfaces that have been shop primed.
- B. Tinting: Tint primer of colors such as reds, yellows, and oranges with a gray basecoat system designed to help provide color coverage.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces. When using colors such as red, yellow or orange, an extra coat of finish may be necessary. Notify Architect when additional coats do not fix the problem.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

- A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements for the State of Maine Department of Environmental Protection in paragraph 2.02.C of this Section.

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- B. Steel Substrates: Provide the following finish systems over exterior ferrous metal. Primer is required on shop-primed items.
 - 1. Semi-Gloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.
 - a. Primer: Exterior ferrous-metal primer.
 - b. Finish Coats: Exterior semi-gloss acrylic enamel.
- C. Galvanized-Metal Substrates: Provide the following finish systems over exterior zinc-coated metal surfaces:
 - 1. Semi-Gloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.
 - a. Primer: Exterior galvanized metal primer.
 - b. Finish Coats: Exterior semi-gloss acrylic enamel.
- D. Concrete Masonry Units:
 - 1. Semi-Gloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.
 - a. Primer: Moore's High Build Acrylic Masonry Primer
 - b. Finish Coats: Exterior semi-gloss acrylic enamel.

END OF SECTION 09 91 13

SECTION 09 91 23

INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:
 - 1. Gypsum board
 - 2. Metals (door frames, handrail)
 - 3. Wood (doors)
- B. This Section includes exposed interior items and surfaces with low VOC coatings complying with ME DEP regulations.
- C. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 08 Sections for factory priming windows and doors with primers specified in this Section.
 - 4. Division 09 painting Sections for special-use coatings.
 - 5. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
 - 6. Division 09 Section "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 SUBMITTALS

- A. Product List: For each product indicated, include the following:
 - 1. Product data.
 - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

3. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 4. Include printed statement of VOC content for each product.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 8 inches square.
 2. Step coats on Samples to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers and undercoat materials for each coating system from the same manufacturer as the finish coats.
- C. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Project Manager will select one surface to represent surfaces and conditions for application of general wall paint system specified in Part 3.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
 3. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Project Manager at no added cost to Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - 1. Benjamin Moore & Co.
 - 2. Sherwin Williams
 - 3. ICI Paints

2.2 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - 1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - 2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 - 3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - 4. Floor Coatings: VOC not more than 100 g/L.
 - 5. Shellacs, Clear: VOC not more than 730 g/L.
 - 6. Shellacs, Pigmented: VOC not more than 550 g/L.
 - 7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
 - 8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 - 9. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 - 10. Floor Coatings: VOC not more than 100 g/L.
 - 11. Shellacs, Clear: VOC not more than 730 g/L.
 - 12. Shellacs, Pigmented: VOC not more than 550 g/L.

13. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
14. Dry-Fog Coatings: VOC content of not more than 400 g/L.
15. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
16. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.
 - s. Methyl ethyl ketone.
 - t. Methyl isobutyl ketone.
 - u. Methylene chloride.
 - v. Naphthalene.
 - w. Toluene (methylbenzene).
 - x. 1,1,1-trichloroethane.
 - y. Vinyl chloride.

D. Colors: Provide color selections made by the Architect. Allow for up to ten (10) different color selections. Each color may be specified in varying sheens for varying substrates.

1. Accent Colors: Up to 20% of wall surface area as designated by the Architect shall be painted with deep toned accent colors.

2.3 PRIMERS/SEALERS

A. Low-VOC Latex Primer/Sealer:

1. Moore: Pristine Eco Spec Interior Latex Primer Sealer, No. 231
- B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.4 METAL PRIMERS

- A. Rust-Inhibitive Primer (Water Based):
 1. Moore: IMC Acrylic Metal Primer M04. (51 g/L)

2.5 LATEX PAINTS

- A. Low-VOC Latex (Flat):
 1. Moore: Pristine Eco Spec Interior Latex Flat, No. 219.
- B. Low-VOC Latex (Low Luster):
 1. Moore: Pristine Eco Spec Interior Latex Eggshell, No. 223
- C. Low-VOC Latex (Semigloss):
 1. Moore: Pristine Acrylic Semi-Gloss, No. 214

2.6 HIGH PERFORMANCE EPOXY PAINTS

- A. Waterborne Epoxy Finish:
- B. Moore: Moorcraft Super Spec Acrylic Epoxy Coating No. 256.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.
 3. Wood: 15 percent.
 4. Gypsum Board: 12 percent.

- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 - 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints. Uniformly abrade galvanized surfaces with a palm sander and 60 grit aluminum oxide so surface is free of oil and surface contaminants.
- H. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- I. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
- J. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Apply an additional coat of primer on metal surfaces that have been shop primed.
- B. Tinting: Tint primer of colors such as reds, yellows, and oranges with a gray basecoat system designed to help provide color coverage.
 1. Do not tint prime or base coat for multi-colored finishes.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces. When using colors such as red, yellow or orange, an extra coat of finish may be necessary. Notify Architect when additional coats do not fix the problem.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
 1. Mechanical, Plumbing and Fire Protection Work:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Tanks that do not have factory-applied final finishes.
 - e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

- g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
2. Electrical Work:
- a. Switchgear.
 - b. Panelboards.
 - c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements for the State of Maine Department of Environmental Protection in paragraph 2.2 of this Section.
- A. Steel Substrates: Including, but not limited to steel doors and frames, steel stairs (including risers and stringers), handrails and guardrails, lintel plates and angles, wood door glass lite kits and astragals, access panels (both sides), metal fabrications; see Division 05 Section "Metal Fabrications", and miscellaneous metal items.
 - 1. Low-VOC Latex Over DTM Primer System:
 - a. Prime Coat: DTM anticorrosive metal primer.
 - b. Intermediate Coat: Low-VOC latex paint matching topcoat.
 - c. Topcoat: Low-VOC latex semi-gloss paint.
- B. Galvanized-Metal Substrates:
 - 1. Low-VOC Latex Over DTM Primer System:
 - a. Prime Coat: DTM anticorrosive metal primer.
 - b. Intermediate Coat: Low-VOC latex paint matching topcoat.
 - c. Topcoat: Low-VOC latex semi-gloss paint.

C. Wood For Painted Finish: Including windows and architectural woodwork.

1. Low-VOC Latex System:

- a. Prime Coat: Interior latex-based wood primer.
- b. Intermediate Coat: Low-VOC latex paint matching topcoat.
- c. Topcoat: Low-VOC latex (semigloss) paint.

D. Wood For Natural Finish: Including windows and architectural woodwork.

1. Low-VOC Polyurethane System:

- a. Prime Coat: Stain.
- b. Two (2) Intermediate Coats: Water based gloss polyurethane.
- c. Topcoat: Water based satin polyurethane.

E. Gypsum Board Substrates:

1. Low-VOC Latex System:

- a. Prime Coat: Low-VOC latex primer/sealer.
- b. Intermediate Coat: Low-VOC latex paint matching topcoat.
- c. Topcoat: Low-VOC latex (flat for ceilings) (eggshell for walls) paint.

2. High-Performance Epoxy System (Provide for Bathrooms):

- a. Prime Coat: Latex primer/sealer.
- b. Intermediate Coat: High-performance epoxy matching topcoat.
- c. Topcoat: High-performance epoxy (semigloss).

END OF SECTION 09 91 23

SECTION 10 14 00

SIGNS

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 types of signs:
 - 1. Panel signs as shown and as listed herein.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 01 Section "Temporary Facilities and Controls" for temporary project identification signs.
 - 2. Divisions 22 and 23 Sections for labels, tags, and nameplates for mechanical equipment.
 - 3. Division 26 Sections for labels, tags, and nameplates for electrical equipment.
 - 4. Division 26 Section "Interior Lighting Fixtures" for illuminated exit signs.

1.3 SUBMITTALS

- A. Product Data: For each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: Show fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components.
 - 1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
 - 2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
- C. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.
 - 1. Samples for selection of color, pattern, and texture:
 - a. Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.

CITY OF PORTLAND FIREBOAT CREW QUARTERS RENOVATIONS

1.4 QUALITY ASSURANCE

- A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.
- B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.
- C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.
 - 1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
 - a. Illuminated Exit Signs: Refer to Division 26.
 - b. Signs for Accessible Spaces:
 - 1) Accessible entrances when not all are accessible (inaccessible entrances shall have directional signage to indicate the route to the nearest accessible entrance.
 - 2) Accessible toilet and bathing facilities when not all are accessible.
 - 2. Notify Architect of details or specifications not conforming to code.
- D. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Manufacturers of Panel Signs:
 - a. Mohawk Sign Systems.
 - b. Welch Architectural Signage.

2.2 MATERIALS

CITY OF PORTLAND FIREBOAT CREW QUARTERS RENOVATIONS

- A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F, and of the following general types:
 - 1. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.
- B. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.3 PANEL SIGNS

- A. Substrate: Fabricate signs from 1/8 inch thick matte clear acrylic with edges mechanically and smoothly finished to eliminate cut marks. Background color to be subsurface.
 - 1. Background Color: As selected by the Architect from manufacturer's standard colors.
 - a. Provide additional backer sheet, projecting 1/4 in. beyond face panel at all sides.
 - b. Contrasting color as selected by the Architect.
 - 2. Edge Condition: Beveled.
 - 3. Corner Condition: Rounded to 3/8 inch radius.
 - 4. Size: 6 by 6 inch, unless noted otherwise.
- B. Copy: Helvetica.
- C. Letterform: route copy into face of substrate 1/32 inch deep. Chemically weld (inlay) computer precision cut tactile copy into routed letter openings so that tactile copy is embedded in substrate and remains at least 1/32" above surface of substrate.
 - 1. Height: 5/8 inch minimum letter height.
- D. Braille: Use engrave process for all Braille areas. Engrave Braille dots into surface of clear material.
- E. Symbols of Accessibility:
 - 1. Accessible elements: Provide international symbol of accessibility.
 - a. Provide male and female symbols as required for toilets.
- F. Provide characters complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille.

2.4 FINISHES

- A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

PART 3 - EXECUTION

CITY OF PORTLAND FIREBOAT CREW QUARTERS RENOVATIONS

3.1 INSTALLATION

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 - 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
 - 2. Locate signs in accordance with approved shop drawings and ADA requirements.
- B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:
 - 1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

3.2 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

3.3 PANEL SIGN SCHEDULE

- A. Provide an informational sign at each room entrance door. Rooms with more than one entrance door shall have a sign at each door. Allow for 3 digit numbers at all doors.
- A. Final room names and numbers will be verified during the submittal.

END OF SECTION 10 14 00

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Grab Bars
2. Towel Bars
3. Robe Hooks
4. Mirrors
5. All other accessories to be supplied by Owner and installed by contractor.

1.3 SUBMITTALS

- A. Product Data: For each type of product, not supplied by the Owner, indicated. Include the following:
 1. Construction details and dimensions.
 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 3. Material and finish descriptions.
 4. Features that will be included for Project.
 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 1. Identify locations using room designations indicated.
 2. Identify products using designations indicated.
- C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.
- D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.
- C. Coordinate installation of all required blocking in walls prior to concealment of spaces.

1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering accessories that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Toilet and Bath Accessories:
 - a. Bobrick.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Toilet and Bath Accessory Schedule as shown.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.3 TOILET AND BATH ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated as shown or substitute product by approved substitution.

2.4 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

SECTION 10 44 13

FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Sections:
 - 1. Division 10 Section "Fire Extinguishers."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
 - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
 - 2. Show location of knockouts for hose valves.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.
- D. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.
- C. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304.
- C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
- B. Basis of Design Product: Potter-Roemer 1700 Series, Semi-recessed, white powder coated steel
- C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following.
 - 1. J.L. Industries: Cosmopolitan Series .
 - 2. Larsen's: Architectural Series.
 - 3. Potter-Roemer: Alta Series.
- D. Cabinet Construction: Fire rated.
- E. Cabinet Material: Powder Coated Steel
 - 1. Shelf: Enameled steel.
- F. Semi-recessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.

1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- G. Cabinet Trim Material: Powder Coated Steel
- H. Door Material: Powder Coated Steel Sheet
- I. Door Style: Fully glazed panel with frame.
- J. Door Glazing: Clear tempered glass, 3 mm.
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide projecting door pull and friction latch.
 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- L. Finishes:
1. Manufacturer's standard baked-enamel paint for the following:

2.3 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
 - 1. Fire Protection Cabinets: 54 inches above finished floor to top of cabinet.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 44 16

FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Sections:
 - 1. Division 10 Section "Fire Extinguisher Cabinets."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.
- C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - f. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - g. Larsen's Manufacturing Company.
 - h. Potter Roemer LLC.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 3-A : 40-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
 - 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. Amerex Corporation.
 - b. Ansul Incorporated; Tyco International Ltd.
 - c. Badger Fire Protection; a Kidde company.
 - d. Buckeye Fire Equipment Company.
 - e. Fire End & Croker Corporation.
 - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - g. Larsen's Manufacturing Company.
 - h. Potter Roemer LLC.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 12 32 00

KITCHEN CASEWORK

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. Wood-faced kitchen cabinets.
- B. Related Sections include the following:
 - 1. Section 04410 Stone Countertops

1.3 DEFINITIONS

- A. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.
- B. Semi-exposed Surfaces of Casework: Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers. Bottoms of wall cabinets are defined as "semiexposed."
- C. Concealed Surfaces of Casework: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as "concealed."

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Cabinets.
 - 2. Laminate materials.
 - 3. Cabinet hardware.
- B. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, cutouts for plumbing fixtures, and methods of joining countertops.

- C. Samples for Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material exposed to view.
 - 1. One unit of each type of exposed hardware.
 - 2. One cabinet sample showing fit & finish of components.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Cabinets: Obtain cabinets through one source from a single manufacturer.
- B. Product Designations: Drawings indicate size, configurations, and finish material of casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes, similar door and drawer configurations, same finish material, and complying with the Specifications may be considered. Refer to Division 1 Section "Substitutions."
- C. Quality Standards: Unless otherwise indicated, comply with the following standards:
 - 1. Cabinets: KCMA A161.1.
 - a. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit and showing compliance with the above standard.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cabinets:
 - a. Armstrong.
- B. Available Products: Subject to compliance with requirements, cabinets that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Armstrong: Extreme Series, Maple.
 - a. Style: Rutledge w/ solid slab drawer fronts.

2.2 COLORS, TEXTURES, AND PATTERNS

- A. Colors, Textures, and Patterns: As selected by Architect from manufacturer's full range for these characteristics.

2.3 CABINET MATERIALS

- A. Exposed Materials: Comply with the following:
 - 1. Exposed Wood Species: As follows. Do not use two adjacent exposed faces that are noticeably dissimilar in color, grain, figure, or natural character markings.
 - a. Maple.
 - 2. Solid Wood: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, and kiln dried to 7 percent moisture content.
- B. Semiexposed Materials: Unless otherwise indicated, provide the following:
 - 1. Plywood: 1/2 inch thick hardwood plywood with exposed edges banded with hardwood edge.
- C. Back Panels: 1/4 inch thick hardwood plywood.

2.4 CASEWORK HARDWARE

- A. General: Manufacturer's standard units complying with BHMA A156.9, of type, material, size, and finish as selected from manufacturer's standard choices.
- B. Hinges: Concealed European-style hinges.
- C. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05091.
- D. Door and Drawer Pulls:
 - 1. Barrier Free Kitchens: Amerock BP53003-ORB, 96mm arc pull, brushed chrome finish.

2.5 CABINET CONSTRUCTION

- A. Face Style: Reveal overlay; door and drawer faces partially cover cabinet body or face frames.
 - 1. Provide built-up base for cabinets where indicated on the drawings.
- B. Face Frames: 3/4-inch solid wood.
 - 1. Vertical Stiles: 2 3/4 inch wide.
 - 2. Horizontal Rails: 1 3/4 inch wide.
 - 3. Center Mullions: 3 inch wide.
- C. Door Fronts: Solid-wood stiles and rails, 1/2 inch thick, with 1/4-inch-thick, veneer-faced plywood center panels.
- D. Drawer Fronts: Solid Wood Slab
- E. Exposed Cabinet Ends: 1/2-inch-thick hardwood plywood.

- F. Cabinet Tops and Bottoms: 1/2-inch- thick hardwood plywood, fully supported by and secured in rabbets in end panels, front frame, and back rail.
- G. Back, Top, and Bottom Rails: 3/4-by-3-inch solid wood, interlocking with end panels and rabbeted to receive top and bottom panels. Back rails secured under pressure with glue and with mechanical fasteners.
- H. Wall-Hung Unit Back Panels: 1/4-inch thick hardwood plywood fastened to rear edge of end panels and to top and bottom rails.
- I. Base Unit Back Panels: 1/4-inch thick hardwood plywood fastened to rear edge of end panels and to top and bottom rails.
- J. Front Frame Drawer Rails: 3/4-by-1-1/4-inch solid wood mortised and fastened into face frame.
- K. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or with glued dovetail joints.
 - 2. Subfronts, Backs, and Sides: 11/16-inch thick solid wood.
 - 3. Bottoms: 1/4 thick plywood.
- L. Shelves: 1/2-inch- thick plywood.
- M. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.
- N. Factory Finishing: To greatest extent possible, finish casework at factory. Defer only final touchup until after installation.
- O. Provide easily removable sink base fronts and interior bottoms at all accessible or adaptable units where indicated. Sink base shall be self supporting and have finished surfaces when the sink front is removed

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install casework with no variations in flushness of adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework face.
- B. Install casework without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.
- C. Install casework and countertop level and plumb to a tolerance of 1/8 inch in 8 feet.

- D. Fasten cabinets to adjacent units and to backing.
 - 1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.

3.2 ADJUSTING AND CLEANING

- A. Adjust casework and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- B. Clean casework on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 12 32 00

**SECTION 22 00 00
FIRE SPRINKLERS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

General Provisions of Contract, including General and Supplementary conditions and General Requirements (if any) apply to work specified in this Section.

1.2 DEFINITIONS

- A. Equal: Shall mean essentially the same as that product specified, but a model of a different manufacturer.
- B. Concealed: Shall mean in walls, in chases, above ceilings, within enclosed cabinets, otherwise enclosed.
- C. Exposed: Shall mean in finished spaces, in closets, under counters, behind and/or under equipment and/or otherwise visible.
- D. 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.
- E. Others: Shall mean provided by sections other than this section. If not purposely assumed by another section, shall be provided by the General Contractor.
- F. Materials: Shall mean any product used in the construction, including but not limited to: fixtures, equipment, piping and supplies.
- G. Piping: Shall mean pipe, fittings, hangers and valves.
- H. Provide: Shall mean the furnishing and installing of materials.
- I. Reviewed equal: Shall mean that the Engineer, not the contractor, shall make final determination whether materials are an equal to that which is specified.
- J. Substitution: Shall mean materials of significantly different physical, structural or electrical requirements, performance, dimensions, function, maintenance, quality or cost, than that specified.

1.3 DESCRIPTION OF WORK

A. Work Included

Provide all design services, construction documents, labor, transportation, equipment, permits, materials, tools, inspections, incidentals, tests and perform all operations in connection with the addition of sprinkler coverage in the project area. Comply with requirements of all Authorities Having Jurisdiction. Include aesthetic considerations into the design. Coordinate with interfacing trades. Submit equipment and components for review. Prepare Shop and Record Drawings and Owner's Manuals. Assure quality of workmanship. Provide guarantees and warranties.

1. Wet Automatic Sprinkler System shall meet the standards of the most recent edition of the National Fire Protection Association's (NFPA) NFPA 13R Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height.

1.4 SUBMITTALS

A. Shop Drawings:

1. Within 30 working days after the General Contractor has received a fully executed contract, prepare and submit Plans / Shop Drawings in accordance with the requirements of NFPA and obtain the Engineer's approval and Owner's Insurance Underwriter approval before proceeding with the fabrication and work.
2. Drawings shall include, but not be limited to:
 - a. Name of Owner and Occupant
 - b. Name and address of Contractor.
 - c. Physical Location
 - d. Plan view of system
 - e. Full height cross section or schematic diagram including ceiling construction and spray obstructions.
 - f. Locations of all partitions, with fire partitions noted.
 - g. Occupancy class for each area and minimum density of water application.
 - h. Locations of concealed spaces
 - i. Make, model and nominal K factor of sprinkler heads.
 - j. Control valves, check valves, drain pipes and test connections.
 - k. Details showing riser piping configurations.
 - l. Pipe sizes.
 - m. Switches and supervisory devices.
 - n. Interface with Fire Control Panel.
 - o. Professional Stamp of a Certified and State Licensed Fire Protection Designer/Engineer.
3. To obtain an electronic copy of the building plan and sections, contact the Engineer. Specify required CAD format when requesting the files.

4. Procedure
 - a. As soon as possible after award of Contract, before any material or equipment is purchased, this Contractor shall submit to the Engineer no less than six (6) copies for approval. Shop drawings shall be properly identified and shall describe in detail the material and equipment shall be provided, including all dimensional data, performance data, curves, computer selection print-outs, etc.
 - b. Corrections or comments made on the submittals do not relieve the contractor from compliance with requirements of the specification. Shop drawing review 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 all quantities and dimensions, selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.
 - c. All related items shall be submitted as a package.
4. Submit data on the following items:
 - a. Piping, fittings and couplings.
 - b. Check valves and trim.
 - c. Backflow preventer.
 - d. Valves and supervisory devices.
 - e. Sprinkler heads and escutcheon plates.
 - f. Supports, hangers and accessories.
 - g. Fire Department Connections.
 - h. Any other significant item valued over \$100.00
5. Submit to the Owner's Insurance Underwriter sufficient copies for approval to allow one copy to be incorporated into each Owner's Manual in addition to the required As-Built Plans

1.5 HYDRAULIC DESIGN DATA

- A. Water Density and Square Foot Requirements: Provide per NFPA.
- B. Codes and Requirements:
 1. Comply with the standards of most recent edition of the National Fire Protection Association.
 2. Comply with the International Building Code, all Maine State laws as well as local codes and ordinances.
 3. Comply with the requirements of the State Fire Marshals Office, Local Fire Chief, Owners Insurance Underwriter, Local Water District and other Authorities Having Jurisdiction

1.6 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner.

1.7 MAINTENANCE MANUAL

On completion of this portion of the work, and as a condition of its acceptance, submit for review two copies of a manual describing the system. Prepare manuals in durable 3-ring binders approximately 8.1/2" by 11" in size with at least the following:

- A. Project name on the spine and front cover, and identification on the front cover stating the project name, general nature of the manual, and name, address and telephone number of the General and Sprinkler Contractors.
- B. Neatly typewritten index.
- C. Complete instructions regarding operation and maintenance of all equipment involved.
- D. Complete nomenclature of all frequently replaceable parts and supplies, their part numbers, and name, address and telephone number of the vendor.
- E. Copy of all guarantees and warranties issued, and dates of expiration.
- F. Shop drawings and equipment/fixtures manufacturer's catalog pages.

PART 2 – PRODUCTS

All products shall be new and must be either Factory Mutual (FM) or Underwriters' Laboratory (U.L.) listed or both.

2.1 MANUFACTURERS

- A. Equipment: Grinnell, Standard, Viking, Central Sprinkler Corp., Reliable, or equal.
- B. Heads: Viking, or equal.
- C. Flow Switch and Supervisory Device: Potter Electric Signal Company or equal.
- D. Backflow preventer: Ames or equal.

2.2 MATERIALS

A. Piping:

- 1. Shall be schedule 40 black steel, standard weight welded, threaded or Victaulic fittings for sizes 2-1/2" and under. Install flanged fitting and flanges at valves and where required. Threadable light wall pipe (schedule 10) shall be permitted only for sizes 3" and over.
- 2. Where CONCEALED, and permitted by code and based on the construction the contractor may substitute CPVC sprinkler system piping in lieu of the piping specified in the base bid above for the sprinkler system. Install according to manufacturer's requirements and restrictions. Piping and fittings, shall be Harvel Blazemaster CPVC fire sprinkler piping or approved equal. Piping shall be installed only by a factory trained and certified installer. Where piping is exposed or where manufacturers requirements cannot be met, piping shall be the same as specified above..

B. Sprinkler Heads:

- 1. Temperature Classification:
 - a. Finished area shall be ordinary temperature rating.
- 2. All shall be Quick Response type head.
- 3. All heads shall be glass bulb type.
- 4. Type:
 - a. Generally shall be white, concealed pendant.
 - b. Concealed spaces shall be the type best suited for the configuration of the individual space.
 - c. Any minor unheated spaces shall be dry type.

5. Provide and install a spare head case per NFPA requirements. The case shall contain not less than 12 heads total, no less than two of each style of heads and one wrench for each style of head. Locate case in the sprinkler room near the check valve assemblies.
- C. Hangers: Provide per NFPA. Provide seismic protection unless specifically exempt by the Authority Having Jurisdiction. Hang from building structure, not piping of other trades.
- D. Sleeves:
1. Pipes Through Floors: Form with Schedule 40 (galvanized) steel pipe and extend 1" above surrounding floor.
 2. Pipes Through Interior Fire-rated or Sound-rated Partitions: Form with steel pipe or 16 gauge galvanized steel.
 3. Size: The minimum sleeve diameter shall be either 2 pipe sizes or 2" in diameter larger than the outside diameter of the pipe.
 4. Fire caulk all penetrations through floors and fire rated partitions.
- E. Valves:
1. Riser Control Valve: OS&Y cast iron construction.
 2. Sectionalizing Valves: OS&Y cast iron body.
 3. Drain and Test Valves: Bronze body, gate type or ball type, capable of being padlocked in either open or closed position.
- F. Provide all miscellaneous items required for a complete system, such as: paint, signs, valve tags, pipe markers, chains and locks, relief valves, and water additives.

2.3 COMPONENTS

- A. Electric Supervisory Switch: All valves shall have an electric supervisory device with 2 sets of DPDT contacts to report to the building fire alarm system.
- B. Backflow preventer: Double check, testable, replaceable seats.
- C. Provide all shut-off valves with tamper switches. Lock or chain open valves with break-away padlocks.
- D. Water pressure gauge: Provide one before the valve on each inspectors test connection. Range applicable to fire protection application.

PART 3 – EXECUTION

3.01 PREBID EXAMINATION AND INVESTIGATION

- A. Visit the site and become acquainted with the conditions.
- B. Study all Drawings and Specifications for all related and interfacing trades. No claim will be recognized for extra compensation due to failure to become familiarized with the conditions and extent of the proposed work as indicated within.
- C. Ascertain all Authorities Having Jurisdiction, and consult where needed.

3.2 OBTAINING DRAWINGS AND SPECIFICATIONS

- A. Obtain a FULL set of drawings and specifications as soon as is practical.

3.3 SPECIFIC INSTALLATION REQUIREMENTS

- A. Head and piping locations shall be located for BEST aesthetic effect. The Architect / Engineer retains the right to require the contractor to relocate or redo any work that he deems not esthetically satisfactory.
- B. All piping in finished areas shall be run concealed wherever possible.
- C. Where piping must be exposed apply two coats of rust inhibiting paint. Do not paint sprinkler heads or obscure equipment nameplate data. Exposed piping shall be painted to match adjacent color schemes.
- D. For aesthetic reasons, locate sprinkler heads neatly and symmetrically, relative to the walls, ceiling grid, diffusers and light fixtures. Center heads in tiles in suspended ceilings.
- E. All piping shall be run as high as practicable to conserve headspace. Pitch piping slightly to allow the system to be drained.
- F. System drains shall be valved and piped to discharge. No valve shall be provided ahead of the electric alarm devices.
- F. All sprinkler work shall avoid proposed locations of, and installation clearances for, lighting, ducts, piping, framing and equipment.
- G. Holes that may be required in the steel beams must be coordinated with the General Contractor as soon as possible after the contract is awarded.

3.4 COORDINATION

- A. Coordinate sprinkler work with that of other trades. Coordinate space early for locations of mains. Ductwork, mechanical equipment, electrical panels and large

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gravity piping will be given priority over sprinkler piping, unless all effected parties agree otherwise. No compensation will be given for neglect to comply with the above and no claim will be recognized for sprinkler piping, heads and miscellaneous appurtenances which must be modified, removed and reinstalled or relocated, due to conflicts with other work which is or will be installed per the Contract Documents.

- B. Contact Electrical Contractor and assure that all requirements for power and fire alarm system have been met.

3.5 TESTS

- A. The entire installation shall be tested with water in accordance with all NFPA requirements, all requirements of the local Fire Department and local Water District; and the Owner's Insurance Underwriter; this includes the testing of all alarms.
- B. All tests shall be witnessed by the Owner's representative and local Fire Chief's representative. Submit copies of all test certificates, properly signed, to the Engineer.

END OF SECTION

**SECTION 22 00 00
PLUMBING**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings, Addenda, General Provisions of Contract, including Division 1 General and Supplementary conditions and General Requirements apply to work specified in this Section.

1.02 DEFINITIONS

- A. ADA: Designed to meet the requirements of the Americans with Disabilities Act.
- B. Concealed: Shall mean in walls, in chases, above ceilings, within enclosed cabinets, otherwise enclosed.
- C. Equal: Shall mean essentially the same as that product specified, but a model of a different manufacturer
- D. Exposed: Shall mean in finished spaces, in closets, under counters, behind and/or under equipment and/or otherwise visible.
- E. 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.
- F. Materials: Shall mean any product used in the construction, including but not limited to: fixtures, equipment, piping and supplies.
- G. Others: Shall mean provided by sections other than this section. If not purposely assumed by another section, shall be provided by the General Contractor.
- H. Piping: Shall mean pipe, fittings, hangers and valves.
- I. Provide: Shall mean the furnishing and installing of materials.
- J. Reviewed equal: Shall mean that the Architect or a designated Consultant, not the contractor, shall make final determination whether materials are an equal to that which is specified.
- K. Substitution: Shall mean materials of significantly different physical, structural or electrical requirements, performance, dimensions, function, maintenance, quality or durability, than that specified.

1.03 ALTERNATES

There are no alternates that apply to this section of the project.

1.04 DESCRIPTION OF WORK

A. Work Included

1. Furnish all labor, materials, equipment, transportation, and perform all operations required to install complete plumbing systems in the building, in accordance with these specifications and applicable drawings.
2. Perform demolition and removal as required.
3. Provide the following:
 - a. Sanitary, waste and vent systems.
 - b. Domestic hot and cold water system.
 - c. Natural gas system
 - d. Pipe, valve and fittings
 - e. Water specialties
 - f. Drainage specialties
 - g. Plumbing fixtures and accessories
 - h. Gas water heater
 - i. Insulation
 - j. Installation and/or connections to fixtures/equipment provided by others.
4. Specifications and accompanying drawings do not indicate every detail of pipe, valves, fittings, hangers, fixtures and equipment necessary for complete installation; but are provided to show general arrangement and extent of work to be performed.
5. Before submitting proposal, This Contractor shall be familiar with all conditions. Failure to do so does not relieve This Contractor of responsibility regarding satisfactory installation of the system.

1.05 PERMITS

- A. This Contractor shall be responsible for providing and filing all Plans, Specifications and other documents, pay all requisite fees and secure all permits, inspections and approvals necessary for the legal installation and operation of the systems and/or equipment furnished under this Section of the Specifications.
- B. The Contractor shall frame under glass/ clear plastic all permits, secured by him, adjacent to the respective system and/or equipment and required to be displayed by Code, law or ordinance. Those permits secured but not required to be displayed shall be laminated in plastic and included in the Owner's maintenance manual.

1.06 CODES AND ORDINANCES

- A. All work performed under this Section of the Specifications shall be done in accordance with applicable Federal Laws, Maine State Laws, Uniform Plumbing Code, Subsurface Wastewater Disposal Rules, and local plumbing codes and ordinances. The following standards are also to be followed when applicable:

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ADA	Americans With Disabilities Act
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASTM	American Society for Testing and Materials
BOCA	Building Officials & Code Administrators International, Inc.
NFPA	National Fire Protection Association (a.k.a. NFC, National Fire code)
NEMA	National Electrical Manufacturer's Association
OSHA	Occupational Safety and Health Act
UL	Underwriter's Laboratories

- B. If an obsolete code section or standard is specified, the latest replacement issue of each Code or standard for the application, in effect at the time of bidding, shall be used. Code requirements are the minimum quality and/or performance acceptable. Where the Specifications and/or Drawings indicate more stringent requirements, these requirements shall govern.

1.07 QUALITY ASSURANCE

- A. Use sufficient qualified workmen and competent supervisors in execution of this portion of the work to ensure proper and adequate installation of the system throughout. Work performed shall conform to manufacturers recommendations, good standard practice and industry standards.
- B. Any work deemed unacceptable by the Engineer, Architect or Clerk of the Works shall be redone correctly, at no additional cost to the owner.

1.08 ELECTRONIC DRAWINGS AND FILE SHARING

Plans and specifications may be made available in electronic format on request. Plans may be provided in either Adobe (.pdf) or CAD (.dwg or .dxf) formats and will be compressed using WinZip (.zip format). Recipient is responsible to obtain the necessary software to open the files. Note: CAD drawings will be made available to successful bidders only after a contract is awarded.

CAD drawings are produced with AutoCAD 2006 and may be provided in either the 2000 or 2004 file formats. Upon request for CAD files a release form will be provided which must be signed and returned to the Engineer prior to transmission of electronic files. Physical mailing address, telephone numbers and e-mail address for this office are indicated on each drawing. A signed release will not be required for Adobe based files.

All contract documents are copyrighted material. No portion of materials may be reproduced or duplicated except as indicated in the release form. Where release forms are not required (Adobe based files), materials may be printed for use by the intended recipient only and may not be reproduced or copied in any other manner unless written permission is obtained.

1.09 MATERIALS AND SUBSTITUTIONS

All materials and equipment shall be new and of the latest design of respective manufacturers. All materials and equipment of the same classification shall be the product of the same manufacturer, unless specified otherwise.

- A. Any proposal for substitution of Plumbing equipment shall be made in writing PRIOR TO OPENING OF BIDS, see Division 1. Submit full details for consideration and obtain written approval of the Architect. The phrase "or reviewed equal" shall be intended to mean that the Architect, not the contractor, shall make final determination whether or not substitute materials are an equal to that which is specified. The contractor shall be responsible to certify within his submittals that any equipment to be considered as an "reviewed equal" meets or exceeds the requirements of this specification in all aspects and will physically fit within the space provided and still provide adequate space adjacent to the equipment for service. If requested by the Architect the contractor shall provide said certification in the form of scale drawings before review will be made. Architect will not be responsible to provide drawings for substituted materials unless the substitution is agreed upon prior to opening of bids. Architect's decision on acceptability of substitute materials shall be final.
- B. Approval by Architect for such substitution shall not relieve the Plumbing Contractor from responsibility for a satisfactory installation and shall not affect his guarantee covering all parts of work
- C. Any material or equipment submitted for approval which are arranged differently or is/are of different physical size from that shown or specified shall be accompanied by shop drawings indicating different arrangements of size and method of making the various connections to equipment. Final results will be compatible with system as designed.
- D. Materials and equipment determined as an "reviewed equal" and /or substitutions must meet the same construction standards, capacities, code compliances, etc. as the equipment (i.e. manufacturer, model, etc.) specified.
- E. Any additional cost resulting from the substitution of equipment shall be paid by this Contractor.

1.10 PLANS AND SPECIFICATIONS FOR SUPPLIERS

This Contractor shall provide his Suppliers, and any related subcontractors, with a copy of the specification pages, and letter sized photocopies of equipment details and schedules, that pertain to the item to be supplied.

1.11 ELECTRONIC DRAWINGS AND FILE SHARING

Plans and specifications may be made available in electronic format on request. Plans may be provided in either Adobe (.pdf) or CAD (.dwg or .dxf) formats and will be compressed using WinZip (.zip format). Recipient is responsible to obtain the necessary software to open the files. Note: CAD (.dwg and .dxf) files will be made available to successful bidders only after a contract is awarded.

CAD drawings are produced with AutoCAD and may be provided in the 2004 or 2010 file format. Upon request for CAD files a release form will be provided which must be signed and returned to the Engineer prior to transmission of electronic files. Physical mailing address, telephone numbers and e-mail address for this office are indicated on each drawing. A signed release will not be required for Adobe based files. Contact the Engineer via telephone or e-mail

at rob@mechanicalsystemseng.com and request the drawings, indicating CAD format required and a return e-mail address.

All contract documents are copyrighted material. No portion of materials may be reproduced or duplicated except as indicated in the release form. Where release forms are not required (Adobe based files), materials may be printed for use by the intended recipient only and may not be reproduced or copied in any other manner or for any purpose other than for use pertaining to the construction of this project unless written permission is obtained.

1.12 SHOP DRAWINGS & SUBMITTALS

- A. As soon as possible after award of Contract (but not longer than 21 calendar days), before any material or equipment is purchased, Plumbing Contractor shall submit to the Architect no less than ten (10) copies of shop drawings for approval. If shop drawings are not submitted within the allotted time frame all substitutions included the late shop drawings will be invalid and the equipment specified must be provided. Any costs resulting from delays in the project schedule due to failure to submit shop drawings related to this section in a timely manner shall be the responsibility of the Plumbing Contractor.
- B. Each item shall be properly identified, preferably by fixture/equipment tag number (such as WC-3), and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused.
- C. Corrections or comments made on the shop drawings do not relieve the contractor from compliance with requirements of the drawings and specifications. Shop drawing review 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 all quantities and dimensions, selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.
- D. Should any materials or products be purchased and/or installed without prior review and comment the contractor shall be required to remove or replace those products and/or materials if directed by the Architect at his own expense. If the materials are not removed (or replaced) or if the project is delayed as a result the Architect reserves the right to order the withholding of payment until the situation is resolved in a manner satisfactory to the Architect.
- E. Plumbing shop drawings shall be separate from Mechanical shop drawings. All submittals shall have a clear area on the front no less than 4inches x 3inches to be reserved exclusively for the Engineers' shop drawing stamp or they will be refused for re-submittal.
- F. It is desirable for shop drawings to be submitted electronically, including all documentation outlined in paragraph "A" above. Hard copies of shop drawings must be original documents or good quality photocopies of original documents (photocopies of color samples are not acceptable). Faxed copies of submittal sheets will be refused.

- G. Review must be obtained on all items specified in Section 2 Products or shown on the drawing, and any significant items implied or otherwise required but not specified.
- H. Format
 - 1. Related items shall be stapled or Bound together as a package, or if electronic all part of the same file. The number of copies of each package shall be as listed above. Examples of packages of related items include:
 - a. Hangers and Supports
 - b. Identification
 - c. Insulation
 - d. Valves
 - e. Piping
 - f. Plumbing Fixtures with accessories
 - g. Drainage Specialties
 - h. Water Specialties
 - i. Equipment
 - 2. If due to circumstances beyond his control, the contractor is unable to include all the related items in the submitted package, he shall insert in its place a plain sheet of paper with a notation stating that the item will be submitted separately.

1.13 PRODUCT HANDLING

Use all means necessary to protect materials before, during and after installation, and to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

1.14 AS-BUILT DRAWINGS

Keep in good condition at the job, apart from all other prints used in actual construction, one complete set of all blueprints furnished for this job. On this special set of blueprints, record *completely and accurately* all differences between the work as actually installed and the design as shown on the drawings. These record prints must be kept up to date by recording all changes within one week of the time that the changes are authorized. At the completion of the work, this set of drawings shall be delivered to the Architect for the Owner electronically in the form of CAD drawings. If a complete record of changes is not made and electronic CAD drawings not provided by the Plumbing Contractor, a record shall be made by the Engineers, and *the cost of the record shall be the responsibility of the Contractor*. Copies of the Plumbing CAD drawings (minus professional engineering stamps) may be made available at no cost to the Contractor of record if desired. Drawings shall be dated accordingly and clearly identified as "AS-BUILT".

1.15 MAINTENANCE MANUAL

On completion of this portion of the work, and as a condition of its acceptance, submit for review two copies of a manual describing the system. Plumbing equipment manuals shall be separate from mechanical manuals. All manuals shall be original copies, not photocopies, or they will be refused for resubmittal. Prepare manuals in durable 3-ring binders approximately 8.1/2" by 11"

in size with at least the following:

- A. Project name on the spine and front cover, and identification on the front cover stating the project name, general nature of the manual, and name, address and telephone number of the General and Plumbing Contractors.
- B. Neatly typewritten index.
- C. Complete instructions regarding operation and maintenance of all equipment involved.
- D. Complete nomenclature of all frequently replaceable parts and supplies, their part numbers, and name, address and telephone number of the vendor.
- E. Copy of all guarantees and warranties issued, and dates of expiration.
- F. Shop drawings and equipment/fixtures manufacturer's catalog pages. Clearly indicate the precise item included in this installation and delete, cross out or otherwise clearly indicate, all manufacturers' data with which this installation is not concerned.

1.16 OBJECTIONABLE NOISE AND VIBRATION

All equipment shall operate without objectionable noise and vibration. Should objectionable noise or vibration be transmitted to any occupied part of the building by apparatus, piping or ducts, as determined by the Architect, the necessary changes eliminating the noise or vibration shall be made by this Contractor at no extra cost to the Owner.

1.17 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner. Any additional costs required to extend manufacturer's guarantee and warranty for the period specified, shall be included in Contractor's base bid.

1.18 DEVIATIONS, DISCREPANCIES AND OMISSIONS

- A. The drawings are intended to indicate only diagrammatically the intent, extent, general character and approximate locations of plumbing work. Work indicated, but having details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. This shall include but not limited to:
 - 1. All items that are required to meet all applicable codes and referenced standards.
 - 2. Piping for cold and hot water supply, drain, vent, gas, etc to each plumbing fixture/equipment shown on the drawings or scheduled as required.
 - 3. Shut-off valves on lines feeding individual fixtures without integral stops.
 - 4. Minor single phase electrical or control wiring between plumbing provided items that require it, unless indicated on the Division 16 Electrical Drawings.

5. Plumbing related items indicated on the drawings of other trades.
 6. Items indicated on one plumbing drawing but not shown on a corresponding drawing.
 7. Items implied on the plumbing drawings but not shown.
 8. All plumbing related items clearly shown in dark print on the Plumbing drawings but not included in the specification (See paragraph 2.01), unless it is noted as being provided by the owner or other contractor or unless other sections assume the responsibility.
- B. The drawings and specifications are complimentary to each other and what is called for in one, shall be as binding as if called for by both. In the event of conflicting information on the drawings, or in the specifications, or between drawings and specifications, or between trades, that which is better, best or most stringent shall govern.

1.19 WORKPLACE SAFETY

The Trade Contractor alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances and methods, and for any damage, which may result from their failure of their improper construction, maintenance, or operation.

1.20 CHANGE ORDERS

- A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by the Architect or Engineer of record.
- B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Unless otherwise indicated, the materials to be furnished under this contract shall be new and the standard products of manufacturers regularly engaged in the production of such equipment, and shall be the manufacturer's latest standard design that complies with the specification requirements.
- B. All materials and equipment of the same classification shall be the product of the same manufacturer, unless specified otherwise. An entire product line may be rejected if one or more of the products submitted are not an equal to that specified.
- C. All products shall be manufactured within the United States, unless specified otherwise, and supplied locally (within the State) wherever possible. It is preferable to obtain materials that are manufactured within 500 miles of the work site when practical.
- D. Unspecified items shall be by the same manufacturer and level of quality and as similar items specified when possible. When no similarity exists the Contractor shall submit for review an appropriate commercial/institutional quality item, complete to perform the functions intended, using his best discretion. Match existing materials when possible. The Architect or a designated Consultant, not the contractor, shall make final determination whether materials are of suitable quality and perform the functions intended.

2.02 HANGERS AND SUPPORTS

- A. General
 - 1. All hangers and supports shall be especially manufactured for that purpose and shall be the pattern, design and capacity required for the location of use.
 - 2. Piping specified herein shall not be supported from piping of other trades.
 - 3. All steel hangers shall be factory painted.
 - 4. Hangers shall be heavy-duty steel adjustable clevis type, plain for steel, cast iron and plastic pipe, and copper plated for piping in direct contact with copper tubing (i.e. copper hot water piping) shall be equal to Carpenter & Paterson Inc., Fig. 100 (Fig. 100CT copper plated).
 - 5. Hangers shall go outside of insulation for domestic water piping. Each hanger shall be furnished with metal shield.
 - 6. Exposed vertical risers $\frac{3}{4}$ inch and smaller shall be supported at 6 foot intervals between floor and ceiling with split ring type hangers; copper plated for piping in direct contact with copper tubing equal to Carpenter & Paterson Inc. ALL PIPING DROPS TO FIXTURES SHALL BE ANCHORED SOLID TO WALL WITH A STEEL SUPPORT BRACKET WITH ADJUSTABLE CLIP, ESPECIALLY PIPING TO FLUSH VALVES
 - 7. Piping suspended from walls and partitions shall be supported by steel support

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bracket with adjustable clips equal to Carpenter & Paterson Inc. All attachments to bar joists shall be from top chord.

B. Hanger Rods & Attachments

1. Hanger rods shall be galvanized all thread rod. Rod size shall be as follows:

<u>Pipe Size</u>	<u>Rod Size</u>
3/8" to 2"	3/8"
2.1/2" to 3.1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

2. All nuts for hanger rods and hangers to be galvanized steel.
3. Provide lag points with rod couplings for fastening to wood, toggle bolts in concrete blocks and compound anchor shields and bolts in poured concrete.
4. Provide toggle bolts with rod couplings for fastening in the pre-cast concrete plank decks.
5. Provide and install angle iron supports for pipe hangers in locations as required. Angle iron supports shall be adequate size for span and piping or equipment.
6. Hot and cold water piping at each fixture shall be securely fastened in wall with split ring type hanger fastened to studs within wall.

2.03 SEISMIC RESTRAINT

All seismic restraints shall be in accordance with the International Building code.

A. Piping Suspended by Hangers

Piping suspended by individual hangers 12 inches or less in length, need not be braced. The following piping ,if with hangers longer than 12", shall be braced: Gas piping.

B. Equipment

1. All floor/pad mounted equipment including: water heaters, above ground water storage tanks, expansion tanks and boilers shall be anchored to the floor.
2. Suspended equipment shall be cross braced in all directions.

2.04 IDENTIFICATION

- A. Tag each new pump /equipment, and switch with 2½ inches x ¾ inch rectangular engraved nameplates with white letters on black, #2060-20 by Seton Name Plate Corp. or reviewed equals. Nameplates shall be mechanically fastened to equipment (adhesives are not acceptable). Embossed labels are not acceptable.
- B. Identify all new water and drain piping with "Set Mark" snap-around pipe markers by

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Seton Name Plate Corporation or reviewed equal. Markers shall include both identification and arrows indicating direction of flow. Markers shall be placed on pipe segments 5 feet and longer, and spaced no less than 10 feet apart. Heating hot water piping shall be labeled differently from Domestic hot water piping. On parallel runs of piping, plumbing markers shall be grouped together, and grouped with heating markers whenever practical.

<u>Legend</u>	<u>Background/Letter Color</u>
“Cold Water”	Green/ white letters
“Domestic “120°F Water”	Yellow/ black letters
“Domestic 140°F Water”	Yellow/ black letters
“Gas”	Yellow/ black letters
“Plumbing Vent”	Green/ white letters
“Sanitary Drain”	Green/ white letters

- C. Tag all new valves with Seton #M4506 1½ inch square brass tags and #6 bead chains, stamped with the following identification: “CW”, “HW”, “HWR” or “140HW”. Tag shall be consecutively numbered. **DO NOT DUPLICATE EXISTING VALVE IDENTIFICATION NUMBERS.** Fixture stops, control valves or valves adjacent to equipment, the use of which is obvious, are not to be tagged.
- D. Provide valve charts identifying valve number, valve identification and service (i.e. Apt. 203, HW). Mount charts in Boiler Room and Mechanical Room in 8½ inch x 10 inch and 8½ inch x 11 inch self-closing aluminum frame with plastic windows. Provide additional copies for maintenance manuals.

2.05 INSULATION

A. Domestic Water Piping

- 1. Insulate all above grade Cold, Hot and Recirculating Water Piping with fiberglass heavy density sectional pipe insulation system, with minimum of 7 lb. density and 450° temperature rating having a factory applied vapor barrier with butt and longitudinal adhesive.
 - a. Concealed Piping.

Insulation shall have standard paper all service jacket (ASJ).
 - b. Exposed Piping.

Shall be Owens Corning Evolution SSL II paper free ASJ with tough, wrinkle resistant, easy-to-clean jacket. Or reviewed equal.
- 2. Insulations Thickness
 - a. Cold Water – ½” minimum.
 - b. Hot and Recirculating – 1” minimum
- 3. Shields of 28 gauge metal approximately 8 inches long and forming an arc of approximately 120 degrees to fit the insulation shall be provided at each hanger

for all Domestic Water piping. (Note: this is done on cold water lines to prevent points of condensation that may promote mold growth, and on hot and recirculating water lines to minimize rate of cooling between uses, as well as to prevent unintentional overheating of the building in the warmer months.) Shields to be provided by this Contractor. Hangers shall be provided large enough to be outside the covering.

4. Insulate any below grade hot water piping runouts with ½” Armaflex closed cell piping insulation.

B. Fittings

1. All fittings and valves shall be covered with a one piece PVC insulated fitting cover secured.
2. The ends of insulation on exposed pipes at valves, flanges, unions, etc., shall be finished neatly with covering to match jacket and secure with mastic.
3. Valves, flanges and unions on hot water piping shall not be insulated.

C. Installation

All insulation work shall be executed by skilled insulation workmen regularly in the trade.

D. Covering

Wherever insulation is exposed in occupied or potentially wet areas, it shall be carefully and neatly covered with a white PVC plastic covering material. Covering shall be applied in no less than 4 foot lengths with shingle joints. Longitudinal joints shall be on the top or back sides so as to be out of sight and sealed with adhesive materials provided with the jacketing. Material shall be butted to finish walls or Insulation. Jacketing material shall be Zeston pre-cut, pre-curved 0.030 thickness. Or reviewed equal.

2.06 VALVES

A. General

1. Valves shall be provided as shown and as required to make the installation and its apparatus complete in operation; locate to permit easy operation, replacement and repair.
2. All valves must be so constructed that they may be repacked under pressure while open.
3. Valves shall have name and/or trademark of manufacturer as well as working pressure stamped or cast on valve body.
4. Valves shall comply with Manufacturer’s Standards Society (MSS) specifications and be so listed.

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B. Types and Manufacturers

All valves shall be of one manufacturer and by one of the manufacturers listed. The following list is provided as a means of identifying the quality and type required.

1. Gate Valves 3 inches in size and smaller

Shall have bronze bodies, rising stem, solid wedge, union bonnet, rated for 150# WSP, 300# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	1169	1151
Stockham	B-124	B-120
NIBCO	S-134	T-134
Hammond	IB648	IB629

2. Globe Valves 2 inches in size and smaller

Shall have bronze bodies, union bonnet, renewable composition disc for service intended, rated for 150# WSP, 300# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	1590-T	590-T
Stockham	B-24-T	B-22-T
NIBCO	S-235-Y	T-235-Y
Hammond	IB423	IB413T

3. Angle valves

Same general description and manufacturers as globe valves above, only outlet at 90 degree angle from inlet.

4. Ball valves 1¼ inches in size and smaller

Shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blowout proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Ports shall be "full port". Rated for 400# WOG and 350°F:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	BA-350S	BA-300S
Apollo	82-200	82-100
Watts	B-6081	B-6080
NIBCO	-----	-----
Hammond	8614	8604

5. Ball valves 1½ inches in size and larger

Shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blowout proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Ports shall be "conventional

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port". Rated for 400# WOG and 350°F:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Apollo	70-200	70-300
Watts	B-6000-SS	B-6001-SS
NIBCO	S-585-66	T-585-66
Hammond	8514	8503

6. Check Valves 2 inches in size and smaller

Shall be horizontal swing type with bronze body, Teflon disc. Rated for 125# WSP, 200# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	1509-T	509-T
Stockham	B-310-T	B-320-T
NIBCO	S-413-Y	T-413-Y
Hammond	IB945	IB904

7. Drain Valves

Shall be conventional ball valves and provided with hose nipples and threaded metal cap on chain. Watts B-6001-CC or reviewed equal.

2.07 DOMESTIC WATER PIPING

A. Interior

1. All hot and cold water piping above finish floor (not buried) shall be hard-drawn type "L" copper tube with cast or wrought fittings and made up with Silvabrite 100 lead-free solder.
3. All buried water and trap primer piping shall be AquaPEX or type "K" soft copper tubing. No joints below slab.
4. All exposed, uninsulated water piping in finished areas shall be chromium plated I.P.S. copper or red brass pipe or tubing and fittings. Valves shall also be chrome plated brass or bronze. Any chrome trim with wrench marks shall be removed and new trim installed.
5. Type of tubing shall be stamped or printed on each length by Manufacturer.

2.08 SANITARY WASTE AND VENT PIPING

A. Sanitary and Waste Piping

All piping and fittings shall be Schedule 40 PVC polyvinyl chloride plastic, as per ASTM-A-2665 or latest standard, Solvent as per ASTM-D-2564, with DWV fittings, or service weight Cast-iron with no-hub fittings.

B. Plumbing Vent Piping,

All piping and fittings shall be the same as sanitary above OR PVC Schedule 40 polyvinyl chloride plastic, as per ASTM-A-2665 or latest standard. Solvent as per ASTM-D-2564.

2.09 PIPE SLEEVES AND ESCUTCHEONS

A. Sleeves

1. Contractor shall set sleeves for all piping penetrating walls and floors. Sleeves through masonry shall be steel pipe sleeves two sizes larger than pipe. Piping passing through walls other than masonry shall be provided with # 24 gauge galvanized steel tubes with wired or hemmed edges.
2. Sleeves set in concrete floors shall finish flush with underside, but extend minimum of 1 inch above finish floor. Weld clips to sleeves for support in concrete pre-cast planks of a size that will be covered by concrete topping. Sleeves set in partitions shall finish flush with each side.
3. Space between sleeves and pipes shall be sealed to make smoke and water tight with 3M Brand Fire Barrier Caulk CP25 or Putty 303.
4. Masonry sleeves shall be Schedule 40 steel pipe.
5. This Contractor has the option to use the Pro-set system on lieu of the above.

C. Escutcheons

Where piping passes through finish walls, floors, ceilings and partitions, provide and set two piece nickel plated steel floor and ceiling plates.

2.10 PLUMBING FIXTURES

A. CW-1 Clothes Washer

1. Appliance is not provided by this Plumbing contractor.
2. Guy Gray WB-200 recessed supply and drain unit for automatic washers, 1/2" Watts Duo-cloz valve, 2" drain. Or approved equal.
3. Provide two (2) PPP Laundry Mini water hammer arresters. Or approved equal.
4. Provide two (2) Braided Stainless Washing Machine Hoses one side has 90 degree elbow, NSF 61 listed, UPC rated 3/4" FHT x 3/4" 90 degree FHT 5ft (60") hose.

B. DW-1 Dishwasher, Under Counter (if any)

1. Appliance is not provided by this Plumbing contractor.

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2. Provide PPP Mini water hammer arrester. Or approved equal.
- C. LV-1 Lavatory, Wall – ADA
1. Kohler model K-2005 Kingston wall-mount lavatory, 4” center holes, ADA, vitreous china, drilled for concealed arms carrier.
 2. Zurn model Z81000-3M AquaSpec Single control faucet, for 4” enters, chrome, ceramic disc cartridge, 0.5 GPM aerator.
 3. McGuire Prowrap pre-insulated P-trap with supply covers, chrome plated angle supplies, wheel stops, wrought escutcheons, chrome grid drain. Or reviewed equal.
 4. Provide concealed arms carrier
- D. SH-1 Shower, Transfer – ADA
1. Enclosure shall be Aquatic bathware model 1363BFCTC gelcoat with simulated smooth tile finish, color “white”, no curb, ¾” high collapsible dam, open top, outside dimensions 38” x 37” x 77”, textured floor, soap dish. Provide factory installed full wall plywood reinforcement for added strength. Accessories: fold-up frameless HDP seat, stainless steel grab bars, collapsible dam. Provide no-caulk brass drain with stainless steel strainer, stainless steel curtain rod, heavy duty weighted washable shower curtain. Or reviewed equal.
 2. Controls shall be Moen model 8346EP15 metal commercial hand shower system with valve – Posi-temp pressure balanced valve with trim, single handle, integral stops, single function hand shower with slide bar, chrome, 69” flexible hose assembly, integral vacuum breaker, 1.5 GPM shower head. Install slide bar with A750 secure mount anchor. Or reviewed equal. Note: if submitting equal, the shower head flow shall be 1.5 to 1.7 GPM.
 3. Provide heavy duty chrome brass roller ball curtain rings available from www.clawfootsupply.com. Or Reviewed equal.
- E. SK-1 Sink, Double, Kitchen – ADA
1. Elkay LRAD-3322-65-4 double bowl stainless steel sink, 6-1/2” deep bowl, 18 gauge, type 302 SS, self-rim, satin finish, sound guard undercoating, 4 hole drilling, rear drains. Or reviewed equal. LK35 Strainers. Counter by G.C. Single source.
 2. Zurn Z82300-CP8-HS-2M commercial brass, single lever deck mounted faucet with hose and spray, 5” high, 10” reach faucet with, ceramic control components, chrome, optional 2.2 GPM flow aerator, meets ADA. Single source.
 3. McGuire Prowrap pre-insulated P-trap with supply covers, chrome plated angle supplies, wheel stops, wrought escutcheons, chrome grid drain, chrome continuous waste. Or reviewed equal.

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F. UR-1 Urinal, Wall

1. Kohler model K-4904-ET, Bardon urinal, 0.125 GPF, 3/4" top spud, siphon jet, 2" threaded outlet, high efficiency water saver, white, vitreous china, wall mounted. Or reviewed equal.
2. Sloan Royal 186-0.125-SG, chrome, quiet exposed flush valve with check angle stop, Saniguard lever handle, and wall flange. Sweat solder adapter kit. Or reviewed equal.
3. Provide adjustable floor mounted carrier as specified under Plumbing Specialties, Drainage.

G. WC-1 Water Closet, Floor, flushvalve - ADA

1. Kohler model K4368-WHI Highcliff, 1.6 GPF, white, vitreous china, 1.1/2" top spud, floor mounted, siphon jet action, bolt caps, rim 17-1/2" above finished floor.
2. Sloan Royal WES-111-YO, dual flush, chrome, quiet exposed flush valve for 1.1/1.6 GPF, wall flange, 1" screwdriver angle check stop, vacuum breaker, spud coupling flange, ADA green handle, sweat solder adapter kit, two adhesive backed wall plates (place one over flush valve). Rough-in flushvalve with handle on open side of fixture.
3. Kohler model K-4731-C white, elongated, heavy duty, solid plastic open front seat with integral handle, antimicrobial, stainless steel posts and hardware. Single source.

2.11 EQUIPMENT OR PLUMBING FIXTURES BY OTHERS

Any equipment and fixtures by other sections will be provided and set in place by those sections. This contractor will connect gas, domestic hot water, waste and vent as required.

2.12 PLUMBING SPECIALTIES, DRAINAGE

A. Carriers

1. Wall hung fixtures including water closets, urinals, lavatories, lav-decks and drinking fountains shall be supported with adjustable floor mounted carriers to fit building conditions, piping system, and fixtures specified. Each carrier shall be provided with a wall finishing frame. All carriers shall be secured to the floor with tie down lugs.
2. Carriers shall be as manufactured by Watts or reviewed equal by Zurn, Smith, Josam or Wade.

B. Traps

1. Traps of material and design as approved by the State and shall be furnished and installed at all fixtures and appliances. Trap each fixture separately, keeping all

trap screws below water line; vent each trap. Make offsets in vent piping with 45-degree angle fittings when possible. Pitch horizontal vents toward waste lines, group vents and take through roof as shown. All traps, at fixtures and appliances shall be provided with accessible clean outs.

2. All traps under sinks and lavatories, and all piping and fittings shall be chrome-plated.

C. Cleanouts

Provide cleanouts for soil and waste where shown on the drawings and as required by code.

1. Floor Cleanouts (FCO)

All floor cleanouts in concrete or tile shall be flush with finish floor.

- a. Type "1", Round
Zurn ZN-1400-BP-K, nickel bronze top, bronze plug, anchor flange.

2. Wall Cleanouts

All wall cleanouts shall be Zurn Z-1445 cleanout tee with threaded plug. Square smooth polished nickel bronze cover, Zurn ZANB-1462 or reviewed equal. Note: Round plate covers and scoriated covers will not be accepted as an equal.

3. Flashing

Flash each above grade floor clean out with Chloraloy® 240 thermoplastic elastomeric sheet membrane for concealed waterproofing, or other approved flashing material, extending 24" beyond perimeter of clean out and lock into clamping collar.

D. Floor Drains (FD)

1. All floor drains above grade shall be complete and each provided with flashing flange, flange device, and 24"x24", Chloraloy® 240 thermoplastic elastomeric sheet membrane for concealed waterproofing, or other approved flashing material, lock into drain clamping collar.

2. Traps for floor drains shall be deep seal traps.

- a. Type "1" General, Round

Cast iron body, flashing collar, nickel bronze, 6" adjustable strainer head, inside caulk, trap primer connection. Zurn ZN-415-6B-P or reviewed equal by Josam, Wade or Smith.

- b. Type "2" Indirect Waste

Cast iron body, flashing collar, sediment bucket, nickel bronze, 7"

adjustable deep flanged grate, inside caulk, trap primer connection. Zurn ZN-415-7N-P-Y or reviewed equal by Josam, Wade or Smith.

2.13 PLUMBING SPECIALTIES, WATER

A. Trap Primer (TP)

1. Type "1" General

Precision Plumbing Products Inc. Model PR-500 Self-adjusting automatic trap primer. Provide DU-2 distribution unit where indicated. Or reviewed equal. NOTE: As the trap primer may be on a line larger than 1/2", submitting / providing a "flow through" type trap primers smaller than the actual pipe size is not acceptable.

B. Hose Bibs (HB)

1. Type "1" Exterior Hose Bib

Zurn Z-1321 exposed Ecolotrol "Anti-Siphon" automatic draining, non-freeze wall hydrant, integral backflow preventer, all bronze interior parts, operating key. Or reviewed equal.

C. Shock Absorbers (SA)

Shock protection shall be provided where shown on drawings and at all quick closing devices. Devices shall be stainless steel shell, welded expansion bellows surrounded by on-toxic mineral oil or gas, pressurized compression chamber charged and factory sealed, all, in-line design, threaded nipple and PDI reviewed. Sized to meet the conditions.

1. Type "1", 'A' P.D.I. units

Zurn Z-1700, #100. Or reviewed equal.

D. Thermometer (T)

Units to be dial type, 4.1/2" with 30° to 180° range; Terice Universal angle or reviewed equal.

E. Pressure Gauge (P.G.)

Furnish and install pressure gauges with gauge cocks on piping where shown on drawings. The dial range shall be such that the normal pressure shall be approximately mid-way of dial. Gauges shall be Terice No. 600 or equivalent by Weiss or Nurnburg, 4.1/2" dial size, cast aluminum case, with brass "T" handle cocks and No. 872 bronze pressure snubbers on water units.

F. Vacuum Relief Valve

Watts Model N36 or reviewed equal.

G. Backflow Preventers (BFP)

Provide and install all necessary components to provide protection against potentially hazardous backflow or back siphonage and the contamination of the potable water system at the required GPM demand. Unit shall be UL, USC, ASSE, IAPMD and AWWA approved.

1. Type "1", Entrance

Watts 909M1QT-S reduced pressure zone backflow preventer, 1", quarter turn full port ball valves, strainer, Airgap Watts 909-AGF. Or reviewed equal. Note: as a double check valve type is less expensive, if it is allowed by the water district, then a Watts double check model may be submitted if accompanied by a confirmation letter by contractor.

H. Mixing Valves (MV)

1. Type "1" Master Mixer

Leonard 220-BV thermostatic mixing valve, inlet size 1/2", outlet size 1/2" capacity 5.5 GPM @ 10 psi differential pressure drop for exposed piping, 0.5 GPM min flow, check stops, set at 120°F. Or reviewed equal.

I. Expansion Tank

Watts Model DET5M1. Potable water expansion tank, 2.1 gallon, .85 gallon acceptance, 3/4" connection, precharged to 40 psi. Or reviewed equal.

J. Pressure Relief Valve

Watts #530 calibrated pressure relief valve. Set at 100 PSI. Or reviewed equal.

K. Braided Stainless Steel Water Connectors

EPDM tubing jacketed by type 304 stainless steel braid, stainless ferrule, brass nuts. By Zurn or reviewed equal.

L. Dielectric Unions

Series 3000 as manufactured by Watts or reviewed equal.

M. Meter

Provide a meter that meets the criteria of the local water district and has remote reader.

N. Pressure Regulating Valve

1. Type "1" Water Entrance, only needed if street pressure is over 80 psi.

Watts model 223-S water pressure reducing valve, bronze body, strainer.

2.14 VALVE BOXES, ACCESS DOORS AND PANELS

- A. Furnish General Contractor with valve boxes, access doors/ panels for all locations where service access is required behind walls, above sheetrock and masonry ceilings, and below floors for equipment, piping, valves, and specialties furnished under Division 15.
- B. Shall be located in closets, storage rooms and/or other non-public areas whenever possible, in a workmanlike manner, positioned so that junction can be easily reached and the size shall be sufficient for this purpose . When required in corridors, lobbies or other habitable areas, they shall be located as directed by the Architect.
- C. Units shall have 16-gauge steel frame and 14-gauge steel hinged door panel. Door shall have concealed spring hinges allowing door to be opened to 175°.
- D. Units shall be factory primed for field painting by Section 09900.
- E. Provide UL-rated 1-1/2 hour Class B access panels where required to comply with applicable Code requirements.

2.15 FUEL GAS SYSTEM

- A. Interior Piping shall be Schedule 40 black steel pipe, ASTM 120 with 150# fittings.
 - a. Piping 2” and less in diameter shall be screwed pattern malleable iron fittings, shall meet ASTM A-47, ASA B16.3. Pipe joint compound shall be used on all threaded joints.
 - b. Piping shall use welded fittings if over 2” in diameter, or if pressure in excess of 14” W.C.
- B. Provide dirt leg, gas cock and union at each boiler.
- C. Installation shall meet the requirements of the gas supplier and NFPA 54.

2.16 WATER HEATER WH-1

AO Smith GPD-500 ProMax Closed Combustion Power Direct Vent water Heater, 50 gallons, 0.59 energy factor, 120V/, 40,000 BTU, 2 inch foam insulation, ASME rated relieve valve, ten year limited warranty. Provide optional Concentric Vent kit. Coordinate electrical requirements with Electrical Contractor.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that plumbing may be installed in strict accordance with all pertinent codes and regulations and the reviewed Shop Drawings.

B. Discrepancies

1. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.02 COORDINATION WITH OTHER TRADES

A. Establish and resolve areas of conflict and congestion, especially those indicated on the drawings. Priority to be given to HVAC equipment and large ductwork, then gravity piping, then small ductwork, then piping based on descending order of size. Special consideration given to allow access to valves, dampers etc. .

B. Failure to coordinate will result in this contractor removing and relocating his piping at no additional expense to the owner.

3.03 INSTALLATION OF PIPING AND EQUIPMENT

A. General

1. Install all piping promptly, making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
2. Provide uniform pitch of at least ¼ inch per foot for all horizontal waste and soil piping.
3. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective material from the jobs site.
4. Install pipes to clear all beams and obstructions. Do not cut into or reduce the size of load carrying members without the approval of the Architect.
5. Plumbing vents
 - a. Back vent all plumbing fixtures.
 - b. Pitch all vents at 1/32" per foot minimum toward waste lines for proper drainage to prevent unintended traps.
 - c. Install vent piping with each bend 45 degrees minimum from the

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- horizontal, wherever structural conditions will permit.
- d. Group plumbing vents and take through roof as shown.
 - e. Increase vents 3" and smaller one size before going thru roof. Make size transition a minimum of 12" below the surface of flat roofs and 72" (or as structure permits) below sloped roofs.
 - f. Terminate 18" to 24" above roof.
 - g. If installing in locations other than as shown on the drawings, line up with other plumbing vents for a neat appearance.
 - h. Do not install plumbing vents within 10 feet of an operable window or door or within 25 feet of a ventilation air intake.
6. All risers and off-sets shall be substantially supported.
 7. Pipe hangers shall be placed on center as follows:

<u>MATERIAL</u>	<u>HORIZONTAL</u>	<u>VERTICAL</u>
Cast-iron	At joints not to exceed 10'	15' or at each story whichever is less, and stacks at the base
Copper 1-1/4" & less	6'	6'
1-1/2"	6'	10'
2" & up	10'	10'
PVC, DWV	4'	4'
Steel	10'	10'

8. Arrange all piping to maintain required grade and pitch to lines to prevent vibration. Expansion loops to anchors shall be provided where shown on drawings.
9. Make all changes in pipe size with reducing fittings.
10. All low points in water piping shall be drained with 1/2" gate valve with hose nipple and metal cap.
11. No piping shall be installed in such a manner to permit back-siphonage or flow of any liquid in water piping under any conditions.
12. No water piping shall be installed outside of building or in an exterior wall unless adequate provisions are made to protect such pipe from freezing.
13. All piping and drain openings left unattended will be capped, plugged or securely covered to prevent accidental entry of foreign matter. Roof drains in use will be provided with domes.

B. Joints and Connections

1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside the fittings; use graphite on all clean out plugs.
2. Smoothly ream all cut P.V.C. pipe. Clean and use solvent for fitting connection and in strict accordance with the manufacturer's recommendations.

3. Make all joints in copper water tube with solder applied in strict accordance with the manufacturer's recommendations.

3.04 STERILIZATION AND FLUSHING OF PIPES

- A. After preliminary purging of the system, chlorinate the new potable water system in accordance with the current recommendations of the American Water Works Association, and in accordance with all pertinent codes and regulations. Chlorinate only when the building is unoccupied.
- B. Upon completion of the sterilization, thoroughly flush the entire potable water system.
- C. After sterilization and flushing are complete, a sample shall be collected from the end of the longest main, or at any other location selected by the Architect, and a water analysis test provided. The test must prove the water acceptable or additional disinfecting of system performed. A copy of the test report shall be submitted to the Architect.

3.05 CLOSING IN UNINSPECTED WORK

- A. Do not cover up or enclose work until it has been properly and completely inspected and approved.
- B. Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required and after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Architect and at no additional cost to the Owner.

3.06 TESTING OF PIPING

Tests shall be applied to the plumbing installation as required by codes and where as directed by the Architect, and in all cases before work is covered by earth fill or pipe covering.

- A. Sanitary piping shall be tested when all underground work is complete (before covering) and again, after all piping is installed, but before it is further closed in. Sanitary systems shall be securely stopped, except at the highest point, and the entire system filled with water to the point of overflow for 24 hours. All leaks shall be repaired. Cracked pipes and fitting shall be removed and replaced. No doping of soil pipe or fittings will be allowed. Plan testing around expected weather and temperature conditions or provide protection so that pipes do not freeze.
- B. New domestic water piping shall be filled and subjected to a hydrostatic pressure test of 150 psi for 8 hours with no leaks. If leaks are detected they shall be repaired and the test repeated until tight. NOTE: Testing with compressed air only is NOT ACCEPTABLE.
- C. Testing of Fuel Gas piping shall conform to NFPA 54. Testing of natural gas piping shall also conform to the requirements of the gas supplier.

3.07 CLEANING

- A. Prior to acceptance of the buildings, thoroughly clean all exposed portions of the this

installation, removing all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item, being careful to avoid all damage to finished surfaces. Additional attention may be required to thoroughly clean any used, re-used or owner provided fixtures.

B. Clean out all strainers and aerators and adjust or replace washers, cartridges, etc

3.08 INSTRUCTIONS

On completion of the job, this Contractor shall provide a competent technician to thoroughly instruct the Owner's Representative in the care and operation of the system. The time of instruction shall be arranged with the Owner.

3.09 RECYCLING

Discarded materials, both new and removed, shall be recycled whenever practical through metal salvage dealers (piping, etc.), paper salvage (cardboard shipping containers, etc.), wood products, etc. The Plumbing Contractor shall retain the salvage value of discarded materials and may use this value to offset his project bid price if so desired. Toxic materials such as adhesives, coolants, etc. SHALL be disposed of in a manner acceptable to the State of Maine Department of Environmental Protection.

3.10 HAZARDOUS MATERIALS

Mercury or any other material deemed by the Federal Environmental Protection Agency or the State Department of Environmental Protection to be hazardous shall not be used in any components of the plumbing systems.

END OF SECTION

**SECTION 23 00 00
MECHANICAL**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

General Provisions of Contract, including General and Supplementary conditions and General Requirements (if any) apply to work specified in this Section.

1.02 ALTERNATES

There are no alternates that apply to this section of the project.

1.03 DEFINITIONS

ATC Automatic Temperature Control
EC Electrical Contractor (Division 26)
GC General Contractor
HC Heating (mechanical) Contractor
PC Plumbing Contractor

1.04 DESCRIPTION OF WORK

A. Work Included

1. Furnish all labor, materials, equipment, transportation and perform all operations required to install a complete heating, ventilating and air conditioning system in the building, in accordance with these specifications and applicable drawings.
2. All temperatures are expressed in degrees Fahrenheit.
3. Perform demolition and removal as required.
4. Work to be performed shall include, but is not limited to, the following:
 - a. Provide and install warm air heating system as shown on drawings
 - b. Provide and install 410A split system air conditioning system as shown on drawings
 - c. Insulation
 - d. Fans
 - e. Sheetmetal
 - f. PVC venting and condensate drains
 - g. Kitchen Hood exhaust system KH-1
 - h. Automatic Temperature Control (ATC)
 - i. Tests and balance
5. Specifications and accompanying drawings do not indicate every detail of pipe,

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valves, fittings, hangers, ductwork and equipment necessary for complete installation; but are provided to show general arrangement and extent of work to be performed.

6. Before submitting proposal, Mechanical Contractor shall be familiar with all conditions. Failure to do so does not relieve Mechanical Contractor of responsibility regarding satisfactory installation of the system.
7. Mechanical contractor shall be responsible for rigging to hoist his own (and his sub-contractors') materials and equipment into place.
8. Mechanical contractor and his sub-contractors shall be responsible for start-up of all equipment provided under this section.

B. Related Work Described Elsewhere

1. Excavation and backfill
2. Cutting and patching
3. Firestopping between building construction and pipe sleeves and between building construction and ductwork, Section 07900.
4. Electrical conduit and wiring, except as noted below
5. Roofing, and framing of openings.

C. Mechanical Electrical Work

1. Provide and erect all motors, temperature controls, limit switches as specified.
2. Power supply to switches, fused switches, outlets, motors, line terminals of equipment and all related wiring and fuses to properly connect and operate all electrical equipment specified shall be furnished and installed under Division 26, "ELECTRICAL". Division 26 shall not mount electrical equipment to indoor mechanical equipment without the consent of Division 23. Division 26 shall not drill wiring holes in equipment casings but shall make use of factory wiring knockouts when present. Coordinate all wiring between Mechanical and Electrical to provide a complete and operating system.
3. All wiring provided under this section shall be in accordance with the latest rules and regulations of the National Fire Underwriters, National Electric code, State of Maine Oil Burner Code, and Local Codes Division 26. Install all wiring under the supervision of the Division 26. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 26 in type, quality and appearance shall be corrected by Division 26 at the expense of this section.
4. Automatic Temperature Control (ATC) Systems

Electric wiring specific to ATC shall be furnished and installed by ATC Contractor under supervision of Division 26. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 26 in type, quality

and appearance shall be corrected by Division 26 at the expense of this section.

5. Furnace

Division 26 shall provide power to Furnace.

6. Fans

- a. Division 26 to wire to unit mounted disconnect switch with overload protection provided with unit.
- b. Fans shall operate as indicated on "FAN SCHEDULE", drawing M3 and as indicated in "Automatic Temperature Control" section of this specification.
- c. Division 26 to provide 120 volt power to motor operated dampers. Dampers and actuators to be provided by ATC Contractor.

7. Automatic Temperature Control (ATC) Panels

Division 26 shall provide power to ATC Panels.

8. Split System Air Conditioning Unit

Division 26 shall provide and wire disconnect switch and junction box for ATC connection.

1.05 PERMITS

- A. This Contractor shall be responsible for providing and filing all Plans, Specifications and other documents, pay all requisite fees and secure all permits, inspections and approvals necessary for the legal installation and operation of the systems and/or equipment furnished under this Section of the Specifications.
- B. The Contractor shall frame under glass/ clear plastic all permits, secured by him, adjacent to the respective system and/or equipment and required to be displayed by Code, law or ordinance. Those permits secured but not required to be displayed shall be laminated in plastic and included in the Owner's maintenance manual.

1.06 CODES, ORDINANCES AND PERMITS

- A. All work performed under this Section of the Specifications shall be done in accordance with applicable National, State and local Codes, Laws and Ordinances. The following abbreviations are used for reference to standards which are to be followed:

AABC	Associated Air Balance Council
ADA	Americans With Disabilities Act
AMCA	Air Movement & Control Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute

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ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BOCA	Building Officials and Code Administrators
NEC	National Electrical Code
NFPA	National Fire Protection Association
NEMA	National Electrical Manufacturer's Association
OSHA	Occupational Safety and Health Act
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UL	Underwriter's Laboratories

- B. The latest issue of each Code in effect at the time of bidding shall be used. Code requirements are the minimum quality and/or performance acceptable. Where the Specifications and/or Drawings indicate more stringent requirements, these requirements shall govern.

1.07 QUALITY ASSURANCE

- A. Qualification of Workpersons

Use sufficient qualified workpersons and competent supervisors in execution of this portion of the work to ensure proper and adequate installation of system throughout.

- B. Work performed shall conform with all Local and State Rules and Regulations, as well as those of the National Fire Protection Association (N.F.P.A.).
- C. Piping design shall conform to ANSI, ASME B31.9 and AWS D10.9 codes.

1.08 MATERIALS AND SUBSTITUTIONS

All materials and equipment shall be new and of the latest design of respective manufacturers. All materials and equipment of the same classification shall be the product of the same manufacturer, unless specified otherwise.

- A. The phrase "or approved equal" shall be defined to mean that the Architect, not the contractor, shall make final determination whether or not substitute materials are an equal to that which is specified. The contractor shall be responsible to certify within his submittals that any equipment to be considered as an "approved equal" meets or exceeds the requirements of this specification in all aspects and will physically fit within the space provided and still provide adequate space adjacent to the equipment for service. If requested by the Architect the contractor shall provide said certification in the form of scale drawings before review will be made. Architect will not be responsible to provide drawings for substituted materials unless the substitution is agreed upon prior to opening of bids. Architect's decision on acceptability of substitute materials shall be final.
- B. Approval by Architect for such substitution shall not relieve Mechanical Contractor from responsibility for a satisfactory installation and shall not affect his guarantee covering all

parts of work

- C. Any material or equipment submitted for approval which are arranged differently or is/are of different physical size from that shown or specified shall be accompanied by shop drawings indicating different arrangements of size and method of making the various connections to equipment. Final results will be compatible with system as designed.
- D. Materials and equipment determined as an “approved equal” and/or substitutions must meet the same construction standards, capacities, code compliances, etc. as the equipment (i.e. Manufacturer, model, etc.) specified.
- E. Any additional cost resulting from the substitution of equipment, regardless of acceptance by the Architect or Engineer, shall be paid by this Contractor.
- F. All materials not specified otherwise shall be manufactured within the United States and supplied locally (within the State of Maine) when available. It is preferable to obtain materials that are manufactured within 500 miles of the work site when practical.

1.09 PLANS AND SPECIFICATIONS

Mechanical Contractor shall provide his sub-contractors with a copy of the ENTIRE portion of Part 1 of this specification, portions of this specification and copies of drawings which pertain to the equipment to be supplied at no cost to the sub-contractor. Provide ATC Contractor with entire set of Electrical plans and specifications. Provide Testing and Balancing sub-contractor with copies of shop drawings indicating coil gpm’s, air handling unit air volumes, etc. Failure to do so may result in the Architect providing the required materials at the Contractor’s expense.

1.10 SHOP DRAWINGS & SUBMITTALS

- A. Refer to Division 1 for information regarding requirements for shop drawing submittals. Shop drawings shall be properly identified and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data clearly indicated, fan curves, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused.
- B. It is desirable for shop drawings to be submitted electronically, including all documentation outlined in paragraph “A” above. Hard copies of shop drawings must be original documents or good quality photocopies of original documents (photocopies of color samples are not acceptable). Faxed copies of submittal sheets will be refused.
- C. Mechanical shop drawings shall be properly identified and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data clearly indicated, fan curves, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused. Review must be obtained on the following items:
 - 1. Ductwork and Accessories

- a. Registers, diffusers, and grilles
 - d. Duct sealant
 - e. Turning vanes
 - f. Side takeoff fittings
 - g. Flexible duct
2. Mechanical Equipment (sound data must be provided with all interior motorized equipment).
 - a. Full warrantee information must be included with all submittals.
 - b. Air Conditioning units and accessories - provide curves for fan wheels submitted and computer selection printouts.
 - c. Fans and accessories - provide full fan curves and computer selection printouts.
 - d. Furnaces.
 - e. Kitchen exhaust hood.
 3. Piping and Accessories
 - a. Pipe
 4. Insulation
 - a. Duct
 6. Automatic Temperature Control (ATC) System

1.11 PRODUCT HANDLING

A. Protection

Use all means necessary to protect heating, ventilating and air conditioning materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

1.12 AS-BUILT DRAWINGS

See section 01720, "Project Record Documents".

1.13 MAINTENANCE MANUAL

- A. On completion of this portion of the work, and as a condition of its acceptance, submit for

approval two copies of a manual describing the system. Mechanical equipment manuals shall be separate from plumbing manuals. All manuals shall be original copies, not photocopies or they will be refused for re-submittal. Prepare manuals in durable 3-ring binders approximately 8½ inches by 11 inches in size with at least the following:

1. Identification on the front cover and spine stating general nature of the manual.
 2. Neatly typewritten index.
 3. Complete instructions regarding operation and maintenance of all equipment involved.
 4. Complete nomenclature of all replaceable parts, their part numbers, current cost, and name, address and telephone number of nearest vendor of parts.
 5. Copy of all guarantees and warranties issued.
 6. Where contents of manuals including manufacturer's catalog pages, clearly indicate the precise item included in this installation and delete, or otherwise clearly indicate, all manufacturers' data with which this installation is not concerned.
- B. In addition to above, provide two (2) separate offset style binders properly identified, each containing a copy of all reviewed shop drawings and catalog cuts. (NOTE: May be incorporated in Maintenance Manuals, if binders are of adequate size.)

1.14 OBJECTIONABLE NOISE AND VIBRATION

Mechanical equipment shall operate without objectionable noise and vibration. Should objectionable noise or vibration be transmitted to any occupied part of the building by apparatus, piping or ducts, as determined by the Architect, the necessary changes eliminating the noise or vibration shall be made by this Mechanical Contractor at no extra cost to the Owner.

1.15 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner. Any additional costs required to extend manufacturer's guarantee and warranty for the period specified, shall be included in Contractor's base bid.

1.16 MINOR DEVIATIONS AND DISCREPANCIES

- A. The drawings are intended to indicate only diagrammatically the extent, general character and approximate locations of mechanical work. Work indicated, but having minor details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, plumbing and electrical drawings so that work under this section is properly installed and coordinated with other Sections.
- B. The drawings and specifications are complimentary to each other and what is called for in one, shall be as binding as if called for by both. In the event of conflicting information on

the mechanical drawings, or between drawings and specifications, or between trades, that which is better, best or most stringent shall govern.

- C. Questions to the Architect or Engineers are encouraged, but any answers or advice is non-binding. Therefore, inquires about such items should be made at least 4 days prior to when bids are due to allow time for a clarifying addendum to be issued.
- D. Any conflicts arising from duplication of equipment specified in different portions of the specifications shall be brought to the attention of the Architect prior to submitting bids. Failure to do so does not relieve the Contractor from responsibility of providing said materials and equipment and a credit will be taken for the duplicated item(s).

1.17 CHANGE ORDERS

- A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by Engineer.
- B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

1.18 COORDINATION

- A. Contractor shall be responsible to coordinate his work with that of other trades to adjust to field conditions prior to commencing work. If a reasonable solution cannot be achieved without compromising the integrity of the intended design or would result in additional cost the Architect must be notified immediately prior to commencement of work. Failure to do so does not relieve the Contractor from providing and installing the systems to the satisfaction of the Architect at no additional cost.
- B. Contractor shall be responsible to review job conditions and identify conflicts and/or obstructions to ductwork and piping prior to fabrication. If conflicts and/or obstructions are noted the Architect must be notified immediately prior to commencement of work. The cost of any fabrication work performed without confirmation and notification of conflicts and/or obstructions shall be the responsibility of the contractor.

1.19 WORKPLACE SAFETY

Mechanical contractor shall be responsible for the safety of his workpeople.

PART 2 - PRODUCTS

2.01 PIPING

A. General

Provide and erect in accordance with best practice of trade all hot water supply and return, chilled water supply and return, low pressure steam, condensate return, pump discharge, drain and vent piping shown on the plans and as required to complete intended installation. Contractor shall make offsets as shown or required to place all piping in proper position to avoid other work, and to allow application of insulation and finish painting.

B. Pipe Materials:

- | | | |
|----|--------------------------------|----------------------------|
| 1. | Condensate Piping | Schedule 40 PVC Plastic |
| 2. | Combustion Air and Vent Piping | Schedule 40 PVC Plastic |
| 3. | Refrigerant Piping | Type "K" hard drawn copper |

C. Pipe Fittings:

- | | | |
|----|-------------|--|
| 1. | Refrigerant | Cast bronze or wrought copper, long radius elbows. |
|----|-------------|--|

D. Refrigerant piping shall have Brazed Connections

2.02 REFRIGERANT SPECIALTIES

- A. A complete charge of R-410A shall be provided for the system.

2.03 FURNACE F-1

- A. Furnish and install boiler where shown on the drawings. Furnace shall be natural gas condensing type. Must comply with ANSI A21.13b.
1. Fully condensing – 95% AFUE Efficiency
 2. 2-stage gas heating
 3. Four-speed motor.
 4. AL29-4C stainless steel secondary heat exchanger.
 5. Lifetime limited warranty on heat exchanger, 10 Year limited warranty on internal.

functional parts.

B. One Year Service

Furnance unit shall be provided with free service period of one (1) year after acceptance by Owner. This service will include parts replacement and repair, excluding normal maintenance and adjustment. This service shall be a factory authorized service.

C. Furnace to be Trane Model TUH2B approved equal by American Standard, Carrier, Lennox or York will be considered.

2.04 SPLIT SYSTEM CONDENSING UNIT CU-1 AND COOLING COIL CC-1

A. General

1. Provide and install split system air conditioning unit where shown on plans.
2. Trane Model 4TTA30 approved equal by American Standard, Carrier, Lennox or York will be considered.
3. Cooling coil to be a cased horizontal coil.
4. The combination condensing unit and cased cooling coil to have a minimum SEER or 13.0.

B. Units shall be tested in accordance with ARI 21-/240. Unit shall be UL 1995 listed in U. S. and Canada and complies with NFPA 90A.

2.05 FANS

A. General

1. Fans with capacity and types shown on the drawings shall be provided and installed.
2. Fan selection shall be based on sloping portion of curve with spare capacity of 20% of total CFM and static pressure without increasing motor size. Provide full fan curves with submittals that shown the entire operating range of the fan - not just the operating point. Fans that are submitted without this data will not be accepted.
3. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance and shall be listed by the Canadian Standards Association Testing Laboratory (CSA). Sones indicated on drawings are maximum allowable.

2.06 SHEETMETAL

A. General

The work under this section includes all the required sheetmetal and duct work, extensions for grilles, manual dampers, automatic counterbalanced (backdraft) dampers, deflectors, setting of control dampers, grilles, registers, diffusers, flexible connections and roof hoods as shown on the drawings or required to make the installation complete in accordance with the intent of the drawings and specifications.

B. Ducts

1. The size of ducts marked on the drawings will be adhered to as closely as possible. The right is reserved to vary duct sizes to accommodate structural conditions during the progress of the work without additional cost to the Owners. The duct layout is schematic to indicate size and general arrangement only. All ducts shall be arranged to adjust to "field conditions". The Sheet Metal Contractor shall coordinate his work with Division 26 and other trades.
2. Ducts shall be constructed of galvanized steel in accordance with the following table of duct sizes OR the latest SMACNA HVAC Duct Construction Standards for Metal and Flexible Duct unless otherwise shown on drawings.

<u>Dimensions of Longest Side</u> (inches)	<u>Minimum Sheet</u> <u>Metal Gauge</u>
Up thru 12	26
13 --> 30	24

3. Methods of fabrication and installation shall be in strict accordance with guidelines set forth in the latest SMACNA Guide and Data Book for Low and Medium Pressure Duct Construction unless otherwise shown on drawings. Cross break all ducts with largest dimension being 18 inches and larger. Beaded ducts are not acceptable except for ductwork less than 18 inches in either direction.
4. All dampers and deflectors shall be a minimum of #22 gauge and stiffened as required. Splitter dampers shall not be acceptable.
5. All joints in ducts shall be made air tight, and all branches and turns shall be made with long radius elbows and fittings. Long radius elbows are defined as having a centerline radius of 12 times the width of the duct. If long radius elbows are not used, elbows 18 inches wide and larger shall be provided with fixed double wall airfoil turning vanes designed to reduce the resistance of the elbow to the equivalent of a long radius elbow with a throat radius of not less than duct width. Square elbows less than 18 inches wide shall be provided with single wall turning vanes. Square elbows with outside corners cut at 45° or rounded are not acceptable.
6. All ducts shall be installed with necessary offsets, changes in cross sections, risers, and drops which may be required. They shall be constructed with approved joints

and be supported in an approved manner.

7. Round ductwork shall be constructed in accordance with the latest SMACNA HVAC Duct Construction Standards for round and oval duct construction. Ductwork larger than 8 inches in diameter shall employ spiral seams. All turns shall be made with smooth (not segmented), long radius elbows and fittings. All seams shall be type RL-5, grooved seam pipe lock or better. *Lap seams are not permissible.* Gauge thicknesses shall be as outlined in SMACNA for galvanized steel round duct gauge selections for maximum 2 inches w.g. static pressure. Ductwork shall be supported with full wrap-around band and single hanger strap as indicated in Figure 4-4 of the 1985 edition of the SMACNA HVAC Duct Construction Standards handbook.
8. Furnish and install flexible connections on all air handling units and cabinet unit heater. Connections shall be made from Ventglas neoprene coated glass fabric as furnished by Ventfabrics, Inc., or approved equal.
9. Every precaution shall be taken to keep interior of duct system free from dirt and rubbish and to protect all ducts and equipment during construction. At completion, this Mechanical Contractor shall thoroughly clean all equipment to the satisfaction of the Architect.
10. Spaces between ducts and wall or floor construction shall be caulked to make smoke and water tight with 3M brand fire barrier caulk CP25 or putty 303, Ciba-Geigy CS240 Firestop Sealant or approved equal.
11. Testing, Balancing and Leak Testing... See Part 3, EXECUTION
12. Requirements set forth in applicable codes (see part one) shall supercede SMACNA standards.

C. Diffusers, Registers and Grilles

1. Grilles and/or registers shall be installed at all air supply and return openings as shown. All units to be aluminum, except as noted, and provided with baked enamel finish to match color of grille or register and countersunk screw holes. Mounting screws shall be oval head type with head painted to match finish. Unless stated otherwise, the following list is based on model numbers of Price to establish a standard of quality (if substituting, certified sound criteria shall be included with submittals indicating CFM and NC levels of each register and grille) or approved equal units by Krueger, Anemostat and Titus only.
2. Diffusers, grilles and register shall be installed at all air supply openings as shown. All units to be aluminum with white baked enamel finish.

D. Sealing of Ducts

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1. All interior ductwork (except prefabricated grease ducts and welded duct) shall be sealed with low VOC water based duct mastic, either "MP" (Multi-Purpose), Hardcast "Iron-grip 601", Polymer Adhesive "Airseal #11", or United Duct Seal (United McGill Corp.) water base, latex or acrylic type sealant. All transverse joints to be continuously sealed. Note that, except as noted, oil or solvent based sealants are specifically prohibited for use on this project. Duct tape, in any form or material, is also prohibited.
2. For exterior applications, "Uni-Weather" (United McGill Corp.) neoprene based sealant shall be used. No other sealants may be used.
3. All seams and joints in shop and field fabricated ductwork shall be sealed by applying one layer of sealant, then immediately spanning the joint with a single layer of 3" wide open weave fiberglass tape. Sufficient additional sealant shall then be applied to completely imbed the cloth. All sealants shall be UL rated at no more than flame spread of 5 and smoke developed of 0. At contractor's option Hardcast 1602 sealant tape may be used in lap joints and flat seams.

E. Motor Operated Dampers

1. Motor operated dampers shall have 16 gauge galvanized frames not less than 2 inches in width with airfoil blades not less than 14 gauge galvanized steel, and shall be adequately braced to form a rigid assembly. No dampers shall have blades more than 6 inches wide. Dampers shall be painted with one coat of lacquer. Dampers shall be two position or proportioning as required by specific application, opposed blade type with linkage concealed within the frame. Oilite bronze bearings shall be provided at the ends of damper blades. ALL DAMPERS SHALL BE MOUNTED WITH BLADES ORIENTED HORIZONTALLY.
2. Damper operators shall be provided with bracket arrangement for location outside of air stream wherever possible. All damper motors shall be sufficient size to operate dampers, including slow opening and fast closing.
3. Dampers shall be provided with flexible metal edge and jamb seals and neoprene blade edge seals for tight closure. Leakage shall be certified to be no more than 2.0 CFM per square foot at 1 inch w.g. on units 24 inches wide and larger, 3.0 CFM per square foot at 1 inch w.g. on units less than 24 inches wide.
4. Ruskin Model CD60, Air Balance Model AC-516, Arrow or approved equal.

F. Manual Dampers

1. See Part 3, EXECUTION for installation notes.
2. Manual dampers with smallest dimension 5 inches or less shall be shop fabricated, single 22 gauge blade, 3/8 inch rod, provided with position indicator and locking quadrant.

3. Manual dampers with smallest dimension larger than 5 inches but smaller than 11 inches shall be single blade steel, 16 gauge construction, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.
4. Manual dampers with smallest dimension larger than 11 inches shall be opposed blade steel, 16 gauge construction, linkage concealed in frame, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.
5. Dampers to be installed in aluminum ductwork shall be fabricated of aluminum or isolated from ductwork with rubber grommets between the damper and the duct to prevent oxidation between dissimilar metals.
6. Provide hand quadrants for all manual dampers, Ventline Model 560 or approved equal.

G. Backdraft Dampers

Provide and install automatic counterbalanced backdraft dampers where indicated on the drawings. Unit frames shall be channel type, constructed of 0.090 inch extruded aluminum. Blades shall be 0.025 inch formed aluminum with extruded vinyl edge seals. Unit shall employ aluminum blade linkage concealed in the frame and adjustable zinc plated counterbalance bar on blades (except on top blade). Units shall be capable of being mounted in any position, Ruskin Model CBD2 or approved equal. Contractor shall seal dampers to ductwork to provide a completely waterproof and airtight seal between damper frames and ductwork.

H. Fire Dampers

1. Fire dampers shall be installed to comply with NFPA Code No. 90A and shall bear a U.L. label. ALL FIRE DAMPERS TO BE 2-HOUR RATED
2. All fire dampers to be provided by damper manufacturer with integral sleeves with access doors and mounting angles. Sleeves provided "in-field" are not acceptable. Models indicated are Ruskin to establish a standard:
 - a. Wall and floor types, 12 inches in height and less; Model IBD2-D, style "B".
 - b. Wall and floor types, greater than 12 inches in height; Model IBD2-D, style "A".
 - c. Wall type behind grilles; Model IBDT, Style G
3. Provide factory mounted fusible links designed to melt at 165°F. and close the damper.
4. Installation shall be in accordance with damper manufacturer's instructions.

I. Flexible Duct

Provide and install insulated flexible duct where shown on drawings. Ducts 20 inches in diameter and smaller shall be a double lamination of polyester encapsulating a steel wire helix forming an air-tight inner core. The core shall be wrapped in a blanket of fiberglass insulation (R 4.2) and sheathed in a rugged and durable reinforced metallized polyester jacket. Duct shall be class 1, U.L. 181 compliant and rated for not less than 2 inches w.g. positive working pressure. Duct internal diameter shall be same size as diffuser served. Atco UPC 030 or approved equal.

J. Side Takeoff Fittings (for flexible duct)

Provide and install, at all flexible duct branches to diffusers, a bellmouth side takeoff fitting similar to detail on drawing M2, "*Flexible Duct and Diffuser Connection Detail*"; with manual damper. Fittings shall be pre-manufactured with bell end shall have a 1½ inch radius and employ a self-adhesive gasket seal and be pre-drilled for attachment screws. Units with manual dampers shall be heavy duty with bearings and hand quadrants. Fittings shall be anchored to ductwork with *not less than* three (3) screws. Final diameter shall be same size as diffuser served. Units shall be no thinner than 22 gauge, G-90 galvanized steel. Buckley Bellmouth HD-BM, HD-BMD or approved equal by Flexmaster or United Enertech.

K. Turning Vanes

1. Provide and install at all square duct elbows 18 inches and larger, and where shown on drawings, fixed double wall airfoil type turning vanes. Turning vanes shall be constructed as outlined in the latest SMACNA HVAC Duct Construction Standards guidebook, Figure 2-3.
2. Provide and install at all square duct elbows less than 18 inches in width, and where shown on drawings, fixed single wall turning vanes. Turning vanes shall be constructed as outlined in the latest SMACNA HVAC Duct Construction Standards guidebook, Figure 2-3.

L. Brick Vents and Louvers

1. All exterior Brick Vents and Louvers shall be extruded aluminum construction with interior bird screens and anodized in color to be selected by Architect. Provide not less than 2 color chip cards with submittals for review (photocopies not acceptable). Frames and blades shall a free area of not less than 47% (combination type) and 55% (stationary type) and no less than 0.081 inches thick.

2.07 INSULATION AND CONDENSATE PROTECTION

A. General

1. Insulation shall be provided for all new hot water supply and return piping, refrigerant piping, outside air intakes, supply ducts, exhaust ducts and other

insulation where shown on drawings.

2. Insulation systems shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.

B. Indoor ductwork

1. Insulate the following ducts with 1-1/2" inches thick fiberglass duct wrap with factory applied vapor barrier facing:
 - a. All supply air ductwork. To have of 1-1/2" duct wrap.
3. Material to carry U. L. label. All laps to be sealed and held in place with adhesive and flare staples. All lap joints to be folded under before stapling so no raw insulation will be showing. On the bottom of ducts 24 inches or wider, mechanical fasteners shall be provided approximately 12 inches O.C.

C. Condensate Protection

Solder or weld bottom and sides of ducts connected to outdoors to prevent water leaks from rain and snow. Seal duct wrap and liner to minimize condensation.

D. Installation

All insulation work shall be executed by skilled insulation workmen regularly employed in the trade.

2.08 FURNACE VENTING AND CONDENSATE PIPING

- A. Furnish and install a PVC gas venting and PVC combustion air intake system as shown on drawings.
- B. Furnish and install a PVC indirect condensate drain to nearest floor drain.

2.09 KITCHEN EXHAUST SYSTEM

- A. Furnish and install a kitchen hood exhaust system.

Automatic Fire Suppression Range Hood

1. Hood: Provide and install a CookSafe Model CV-IN-E range hood or approved equal.
 - a. Stainless steel construction. No sharp edges and a brushed finish.
 - b. Stainless grease impingement filter and drip cup.
 - c. Suppression activation will be by two independent methods; automatic (fusible links) and remote pull station.
 - d. Extinguishing Agent: potassium carbonate solution in a pressurized

- cylinder.
 - e. Unit to be ETL listed to UL300A and UL507 test standards.
 - f. Unit shall automatically disconnect range energy once a certain pre-set temperature is reached via electric relay.
2. Duct: Exhaust duct can be single wall 26 ga. Sheetmetal. Where duct penetrates roof provide Type "B" UL listed gas vent with tall cone flashing, storm collar and topper.
 3. Kitchen Exhaust Fan shall be CookSafe K10XL or approved equal.

2.10 AUTOMATIC TEMPERATURE CONTROL (ATC)

A. General

1. Furnish and install a complete system of electric/electronic temperature controls.
2. ATC Contractor must be capable of providing, installing and servicing the control system in its entirety. Sub contracting of ATC wiring is permissible but the ATC contractor shall be ultimately responsible and liable for proper installation as outlined in Divisions 23 and 24 of this specification.
3. The control systems shall be provided and installed by trained control mechanics regularly employed in installation and calibration of ATC equipment.
4. Shop drawings of entire control system shall be submitted for approval before work is started.
5. Provide Temperature Control technician to test the complete ATC systems sequences for specified cycles of operation with the Testing and Balancing Contractor.
6. ATC Contractor must, at the end of the warranty period, furnish the Owner with all access codes and passwords assigned to the ATC control systems. ATC Contractor shall also instruct the Owner in the use of all digital control software and provide a backup copy of the final software package to the Owner on CD.

B. Scope

Control system shall consist of all area thermostats, air stream thermostats, valves, dampers, damper operators, relays, transformers, labor, 7day program clocks and other accessory equipment, and a complete system of wiring to fulfill intent of ATC specification. Control shall be provided for, but not limited to the following:

1. Furnance F-1 and condensing unit CU-1
2. Electrical Room control of fan EF-1
3. Control of motorized outside air damper.

C. Incidental Work by Others

1. The following incidental work shall be furnished by the designated contractor under the supervision of the Control Contractor.
 - a. Sheet Metal Contractor shall:
 - (1) Install all automatic dampers.
 - (2) Provide necessary blank-off plates required to install dampers that are smaller than duct size.
 - (3) Assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper motors.
 - (4) Provide access doors or other approved means of access through ducts for service to control equipment.
 - c. The General Contractor shall:
 - (1) Provide all necessary cutting, patching and painting.
 - (2) Provide access doors or other approved means of access through ceilings and walls for service to control equipment.

D. Electric Wiring

1. All low voltage and data wiring for installation of temperature controls shall be by ATC Contractor, except as noted. Power wiring for equipment shall be by Division 26, "ELECTRICAL". See Part 1, Paragraph 1.03, sub-paragraph C, "MECHANICAL ELECTRICAL WORK" for specific requirements. Exception: Power wiring from circuit breaker to temperature control panel(s) will be provided and installed by the ATC Contractor.
2. Temperature Control Contractor shall be responsible for coordinating installation of his wiring conduits with Division 26, "ELECTRICAL".

E. Submittal Brochure

1. The following shall be submitted for approval:
 - a. Control drawings with detailed wiring diagrams, including bill of material and description of operation for all systems.
 - b. Panel layouts and name plate lists for all local and central panels.
 - c. Valve and damper schedules showing size, configuration, capacity and location of all equipment.
 - d. Product data for all control system components.

F. Instruction and Adjustment

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Upon completion of the project, the ATC Contractor shall:

1. Adjust for use by Owner, all thermostats, controllers, valves, damper operators, and relays provided under this section.
2. Furnish two (2) instruction manuals covering function and operation of control systems for use of the Owner's operating personnel. A competent technician shall be provided for instruction purposes. Allow for an instruction period of not less than 2 hours.

G. Guarantee

Control system shall be guaranteed to be free from original defects in both material and workmanship for a period of not less than one (1) year of normal use and service. This guarantee shall become effective starting the date Architect agrees Owner has begun to receive beneficial use of the system.

H. Hazardous Materials

Mercury, or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the ATC system.

I. Thermostats

1. Furnace F-1 and Condensing Unit CU-1 Thermostat shall be electric/electronic.
2. Line voltage heating and cooling thermostat for EF-1
3. All thermostats shall be mounted according to ADA requirements (<http://www.access-board.gov/adaag/html/adaag.htm#4.27>). Maximum 48" to top of thermostat.

.. Miscellaneous Devices

Provide all the necessary relays, positioners, solenoid valves, transformers, etc. to make a complete and operable system.

L. Description of Operation

1. Occupied-Unoccupied Control
Not required
2. Exhaust Fans EF-1

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- a. To be energized on when room temperature exceeds 85 deg. (adjustable) or falls below 50 deg. (adjustable).
3. Outside air damper
 - a. To energize open whenever the blower in F-1 is energized.
4. Condensing Unit CU-1 and Furnace F-1
 - a. Call for cooling to activate compressor and indoor fan.
 - b. Call for heating to activate 2-stage gas valve and indoor fan.
 - c. Thermostat to include”
 - one stage cooling
 - two stage heating
 - fan on or auto function.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all work is complete to the point where this installation may properly commence.
2. Verify that Mechanical systems may be installed in strict accordance with all pertinent codes and regulations and the approved shop drawings.

B. Discrepancies

1. In the event of discrepancy, immediately notify Architect.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 INSTALLATION OF PIPING AND EQUIPMENT

A. General

1. All piping shall be installed within building insulation.
2. Size and general arrangements as well as methods of connecting all piping, valves, and equipment shall be as indicated, or to meet requirements for complete installation.
3. All pumps shall be supported independently of the piping system.
4. All piping shall be erected to provide for easy and noiseless passage of water under all working conditions. Inverted eccentric reducing fittings shall be used whenever water pipes reduce in size in the direction of flow. Tee fittings with reduction in the main direction of flow (run) are not acceptable.
5. All hot water mains shall be run level or pitch slightly upward so that no air pockets are formed in piping. Mains shall be set at elevations so runouts feeding heating equipment shall have no pockets where air can collect or automatic vents shall be provided.
6. Provide drains with hose threads and metal caps at all low points in the water piping system.
7. In erection of piping, care must be taken to make allowance for expansion and contraction; piping shall be anchored as necessary to control expansion.

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8. Install dielectric fittings at all points of dissimilar piping connections.
9. Install a sufficient number of unions or flanges to facilitate assembly and disassembly of piping and removal of equipment.
10. Install all piping promptly, capping or plugging all open ends and making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
11. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective materials from the job site.
12. Install pipes to clear all beams and obstructions; do not cut into or reduce the size of load carrying members without the approval of the Architect.
13. All risers and offsets shall be substantially supported.
14. Make all changes in pipe size with reducing fittings.
15. All low points in water piping shall be provided with an accessible plug tee or drain valve.
16. All high points in water piping shall be provided with an accessible automatic vent.
17. Maximum spacing of hangers for steel piping shall be as follows:

<u>Pipe Size</u>	<u>Spacing</u>
½", ¾" & 1"	6'-0"
1¼" & 1½"	8'-0"

18. Maximum spacing of hangers for copper piping shall be as follows:

<u>Pipe Size</u>	<u>Spacing</u>
½", ¾" & 1"	6'-0"
1¼" & 1½"	6'-0"

19. Whenever possible valves shall be installed with the operating stems in the upright position, however when conditions dictate it is acceptable to position valves 90° to either side of vertical. Valves shall not be installed with the stems in the downward position.
20. Do not substitute one style of valve indicated on drawings for another unless authorized by the Architect. Example: If a gate valve is shown use ONLY a gate valve or if a ball valve is shown use ONLY a ball valve.

B. Joints and Connections

1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside of fittings; use graphite on all plugs.
2. Make all joints in copper tube (water and drains) with 95-5 tin-antimony solder applied in strict accordance with the manufacturer's recommendations.
3. All joints in refrigerant tubing shall be brazed.

C. Fire Safety

Fire extinguishing equipment shall be kept within 25 feet of soldering areas at all times. Contractor shall take additional measures when welding close to wood structures to protect the wood from igniting.

3.03 INSTALLATION OF DUCTWORK AND EQUIPMENT

A. General

1. Size and general arrangements as well as methods of connecting all diffusers, registers, grilles, duct coils and equipment shall be as indicated, or to meet requirements for complete installation.
2. Construction standards and sheet metal gauges shall be as outlined in the latest edition of the SMACNA HVAC Duct Construction Standards handbook for metal and flexible ducts unless specifically indicated otherwise.
3. Manual Dampers
 - a. Manual dampers may be shop-fabricated on units 5 inches in height and less. All dampers larger than 5 inches MUST be pre-fabricated as previously outlined in this specification.
 - b. All manual dampers located within 10 feet of a fan outlet shall have the blades oriented perpendicular to the fan shaft.
 - c. Provide duct access door as large as possible up to 12 inches x 12 inches at EACH manual damper larger than 5 inches.

B. Protection and Cleaning

1. All open ends of ductwork which is to be unattended for 4 hours or more shall be temporarily protected with plastic sheeting and duct tape (or similar method) to reduce the collection of construction dust and debris.
2. Prior to testing and balancing and at the end of the construction, clean the interiors of all supply and return air ductwork before changing filters in air handling

equipment. Careful coordination must be maintained between the time of testing and balancing and final delivery to avoid re-accumulation of dust and debris within the duct systems which will require additional cleaning by the Mechanical Contractor.

C. Testing

1. All ductwork shall be tested for leakage prior to installation of insulation and concealment.
2. Leakage test procedures shall follow the outlines and classifications in the latest edition of the SMACNA HVAC Duct Leakage Test manual. See Section 4 of the SMACNA leakage test manual for normal duct classifications.
3. Leakage amount shall not exceed the allotted amount for the pressure class or the allotted amount for that portion of the system, whichever is applicable.
4. Any ductwork which fails to meet the allotted leakage level shall be modified to bring it into compliance and shall retest it until acceptable leakage is demonstrated.
5. At completion of construction, Contractor shall provide written certification, on his company letterhead, indicating that all ductwork has been tested according to specified requirements. Document shall include date of test, test pressures used, leakage class and construction class of each section of ductwork tested.

3.04 TESTING, ADJUSTING AND BALANCING (TAB)

A. General

1. TAB work can be done by the mechanical contractor or a subcontractor to the Mechanical contractor.
2. TAB contractor shall perform functional performance test of all Division 15 equipment and entire ATC system for specified operation and control sequences.
3. The mechanical contractor shall startup all Division 15 equipment as required by the equipment specifications. Mechanical contractor shall verify that systems are complete and operable before TAB commencing work. Ensure the following conditions:
 - a. Systems are started and operating in a safe and normal condition.
 - b. Temperature control systems are installed complete and operable.
 - c. Proper thermal overload protection is in place for electrical equipment.
 - d. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - e. Duct systems are clean of debris.
 - f. Fans are rotating correctly.
 - g. Volume dampers are in place and open.

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- h. Air coil fins are cleaned and combed.
 - i. Access doors are closed and duct end caps are in place.
 - j. Air outlets are installed and connected.
 - k. Duct system leakage is minimized.
 - l. Hydronic systems are flushed, filled, and vented.
 - m. Pumps are rotating correctly.
4. TAB Contractor shall submit field reports to General Contractor. Report defects and deficiencies noted during performance of services which prevent system testing and balance.
 5. TAB contractor shall submit all verification and functional performance checklists/results, signed by indicated personnel, organized by system and sub-system.
 6. TAB contractor shall submit other reports described below.

B. Work Included

1. Test, adjust and balance all air and water systems, including components to conform to air and water flow rates shown on drawings.
2. Test complete automatic temperature control sequences for specified operations described under AUTOMATIC TEMPERATURE CONTROLS.
3. Complete and submit balance report. Report shall be submitted with information noted on one side of sheet only (i.e., backside of sheet shall be blank.).
4. Testing of air and water systems will be done by the same agency.
5. Mechanical Contractor SHALL PROVIDE copies of shop drawings indicating coil gpm's, air handling unit air volumes, etc. to the Testing and Balancing contractor at no cost to the contractor.
6. Careful coordination must be maintained between the time of testing and balancing and final delivery to avoid re-accumulation of dust and debris within the duct systems which will require additional cleaning by the Mechanical Contractor.

C. Execution of TAB Work

1. TAB Contractor shall visit job site and determine that control devices, test devices and valves are correctly installed and ready for balancing.
2. Examine each air and hydronic distribution system to see that it is free from obstructions. Determine that all dampers, registers and valves are in a set or full open position; that moving equipment is lubricated, and that required filters are clean and functioning. Request that Installing Contractor perform any adjustments

necessary for proper functioning of the system.

3. TAB Contractor shall use test instruments that have been calibrated within a time period recommended by the manufacturer, and have been checked for accuracy prior to start of testing, adjusting and balancing activity.
4. Verify that all equipment performs as specified. Adjust, volume dampers, control dampers, balancing valves and control valves as required by TAB work.
5. Test pressure profile of systems by traverse as required.
6. Adjust each register and diffuser terminal unit and damper to handle and properly distribute design airflow within 5% of specified quantities. Mark all setpoints.
7. Adjust all balancing valves so that each heating/cooling coil is furnished with design fluid flow within 5% of the specified quantities. Mark all set points.
8. Document results of all testing on approved TAB report formats and submit 3 copies for approval and record within 15 days of completion of TAB work. Include a warranty period of 90 days, during which time the Architect/Engineer may request a re-check or re-adjustment of any part of the work.
9. Reports shall be compiled on a spreadsheet such as Excel, Quattro-Pro, Lotus, etc. and shall clearly indicate the following *minimum* information:
 - a. Air (Rated and Actual)
 - 1) System/unit name
 - 2) HP, BHP, voltage, amperage and fan rpm
 - 3) Static pressures; suction, discharge and total
 - 4) Total system flow rate
 - 5) Individual terminal flow rates (Terminal readings must show location, make, model and size of register, grille or diffuser).
 - 6) Provide a static pressure profile of all AHU's components in the two extreme operating modes; minimum outdoor air and economizer cycle.
 - 7) Filter status report

Reports to have a minimum of color or must be compatible with monochrome printers. Reports must be submitted to the Architect electronically in addition to hard copies.

E. Drawings

Drawings in CAD format may be made available to the TAB Contractor after the contract for this work is awarded. Contact the Engineer via telephone or at mechsyst@maine.rr.com and request the drawings, indicating CAD format required and a return e-mail address. Files will

be compressed and will require WinZip to extract them (available at <http://www.winzip.com>).

F. Acceptable TAB Contractors (listed alphabetically)

1. Central Air Balance
2. Maine Air Balance
3. Tab-Tech International
4. Tekon-Technical Consultants
5. Yankee Balancing

3.05 CLOSING IN UNINSPECTED WORK

A. General

Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Noncompliance

Should any work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required. After it has been inspected completely and approved, make all repairs and replacements with materials necessary for approval by the Architect and at no additional cost to the Owner.

3.06 TEMPORARY HEATING

A. Mechanical Contractor shall install the new heating system and related equipment as soon as those portions of the building are ready and the work can be performed.

B. Mechanical Contractor will be required to permanently connect as many units as possible for temporary heat.

C. At the conclusion of the temporary heating period, the complete system shall be thoroughly cleaned.

D. General Contractor will be required to assume full responsibility for the care and operation of the new equipment during its temporary use and to return the equipment to the Mechanical Contractor in perfect order, normal wear and tear excepted.

E. Water, fuel and electric power required to operate the heating system for temporary heat shall be provided by the General Contractor.

3.07 CLEANING

Prior to acceptance of the buildings, thoroughly clean all exposed portions of the Heating, Ventilating and Air Conditioning installation, including the removal all labels and all traces of foreign substance. Prior to testing and balancing vacuum and clean inside of all convectors, finned radiators (spackle

droppings), unit ventilators, air handling units, VAV units, fans and cabinet unit heaters. Clean the interiors of ductwork as outlined in 3.04, "INSTALLATION OF DUCTWORK AND EQUIPMENT"; paragraph "B", "Protection and Cleaning".

3.08 INSTRUCTIONS

On completion of the job, the Mechanical Contractor shall provide a competent technician to thoroughly instruct the Owner's Representative in the care and operation of the system. The total period of instruction shall not exceed twenty-four (24) hours. ATC system instruction shall be in addition to this instruction period. The time of instruction shall be arranged with the Owner.

3.09 RECYCLING

Discarded materials, both new and removed, shall be recycled whenever practical through metal salvage dealers (ductwork, piping, etc.), paper salvage (cardboard shipping containers, etc.), wood & plastic products, etc. The Mechanical Contractor shall retain the salvage value of discarded materials and may use this value to offset his project bid price if so desired. Toxic materials such as adhesives, coolants, refrigerants, etc. SHALL be disposed of in a manner acceptable to the State of Maine Department of Environmental Protection.

3.10 HAZARDOUS MATERIALS

Mercury, or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the mechanical systems.

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END OF SECTION 23 00 00

Section 26 05 00

Common Work Results for Electrical Work

Part One: General

1.1 General Requirements

1.1.1 Definition of Work

Conditions of the Contract, Specifications, Change Orders, Addenda and Drawings apply to work of this section.

1.1.2 Provisions

As used in this section, "provide" means "furnish and install", "furnish" means "to purchase and deliver to the project site complete with every necessary appurtenance and support and to store in a secure area in accordance with manufacturers instructions", and "install" means "to unload at the delivery point at the site or retrieve from storage, move to point of installation and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project".

1.1.3 Existing Site Conditions – Responsibilities Prior to Bid

Before submitting a bid, the Electrical Subcontractor shall visit and carefully examine site to identify existing conditions and difficulties that may affect the work of this Section. No extra payment will be allowed for additional work caused by unfamiliarity with site conditions.

1.1.4 Existing Site Conditions – Responsibilities Prior to Starting Work

Before starting work in a particular area of the project, the Electrical Subcontractor shall examine the conditions under which work must be performed including preparatory work performed under other Sections of the Contract, or by the Owner and report conditions which might adversely affect the work in writing to the Engineer. Do not proceed with work until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing conditions and preparatory work.

1.2 Applicable Codes and Standards

1.2.1 Work

All work shall be in accordance with the laws, rules, codes, and regulations set forth by Local, State, and Federal authorities having jurisdiction. All products and materials shall be manufactured, installed and tested as specified, but not limited to the latest accepted edition of the following codes, standards and regulations:

NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Act
NEC	National Electrical Code (NFPA 70)
UL	Underwriters Laboratory
NESC	National Electrical Safety Code
FM	Factory Mutual Association
MBC	Maine State Building Code
IECC	International Energy Conservation Code - 2009
Local AHJ	Local and State building, electrical, fire and health department and public safety codes agencies.

1.2.2 Code Conflicts

When requirements cited in this Paragraph conflict with each other or with Contract Documents, the most stringent requirements shall govern conduct of work. The Engineer may relax this requirement when such relaxation does not violate the ruling of authorities that have jurisdiction. Approval for such relaxation shall be obtained in writing. Should the Electrical Subcontractor perform any work that does

not comply with the requirements of the applicable building codes, state laws, and industry standards, he shall bear all costs arising in correcting these deficiencies.

1.3 Contract Documents

1.3.1 Work to be Provided

Work to be provided under this division is shown on the electrical drawings listed in Division 1, General Requirements and in these Contract Specifications.

1.3.2 Coordination of Work

The listing of electrical drawings does not limit the responsibility of determining the full extent of work that is required by these contract documents. The Electrical Subcontractor shall refer to the drawings and other specification sections included in the complete Contract Package, that indicate types of construction with which work of this section must be coordinated. The General Contractor shall coordinate the work of all trades including that of the electrical contractor, with all other subcontractors to determine whether there will be any interference with the electrical work. If the Electrical Subcontractor fails to check with the General Contractor and the electrical work is later found to interfere with the work of other subcontractors, then he shall make necessary changes, without additional cost to the Owner, to eliminate such interference.

1.3.3 Intent of Design

Drawings are diagrammatic and indicate the general arrangement of systems and work to be included in the Contract. Information and components shown on riser diagrams or called for in the specifications but not shown on plans, and vice versa, shall apply and shall be provided as though required expressly by both. The contract documents are not intended to indicate and specify each component required, but do require that the components and materials be provided for a complete and operational installation.

1.3.4 Discrepancies in Documents

Each bidder shall be responsible for examining the drawings and specifications carefully before submitting his bid, with particular attention to errors, omissions, conflicts with provisions of laws and codes imposed by authorities having jurisdiction, conflicts between portions of drawings, or between drawings and specifications, and ambiguous definition of the extent of coverage in the contract. Any such discrepancy discovered shall be brought to the immediate attention of the Engineer for correction. Should any of the aforementioned errors, omissions, conflicts or ambiguities exist in either or both the drawings and specifications, the Electrical Subcontractor shall have the same explained and adjusted in writing before signing the contract or proceeding with work. Failure to notify the Engineer in writing of such irregularities prior to signing the Contract will cause the Engineer's interpretation of the Contract Documents to be final. No additional compensation will be approved because of discrepancies thus resolved.

1.3.5 Conflicts with Codes and Regulations

The drawings and these specifications are intended to comply with all the above mentioned Codes, Rules and Regulations. If discrepancies occur, the Electrical Subcontractor shall immediately notify the Engineer in writing of said discrepancies and apply for an interpretation and, unless an interpretation is offered in writing by the Engineer prior to the execution of the contract, the applicable rules and regulations shall be complied with as a part of the contract.

Part Two: Scope of Work

2.1 General Requirements

2.1.1 General Scope

The work to be accomplished under these specifications includes providing all labor, materials, equipment, consumable items, supervision, administrative tasks, tests and documentation required to install complete and fully operational electrical systems as described herein and shown on the Drawings.

2.1.2 Administrative Responsibilities

The Electrical Subcontractor shall file plans, obtain permits and licenses, pay fees and obtain necessary inspections and approvals from authorities that have jurisdiction, as required to perform work in accordance with all legal requirements.

2.1.3 Coordination with Local Utility Companies

The Electrical Subcontractor shall coordinate with the local Power, Telephone, and Cable System Utilities. The Electrical Subcontractor shall be responsible for paying any Utility charges and excess costs. The Electrical Subcontractor shall perform all work in accordance with utility company requirements.

2.2 Work to be Provided Under this Division

2.2.1 General Scope

The Work shall be complete from point of service to each outlet or device with all accessory construction and materials required to make each item of equipment or system complete and ready for operation. The work shall include but not be limited to the following. The Electrical Subcontractor shall provide:

- A. **Service Entrance:** Provide service lateral and service entrance conductors and raceway.
- B. **Utility Metering:** Provide meter socket for utility company revenue metering. Coordinate make and model with Central Maine Power.
- C. **Grounding System:** Provide a complete grounding system and all equipment and interconnection wiring.
- D. **Temporary Power:** Intent is that existing service shall serve as temporary service during construction..
- E. **Service Entrances for Other Utilities:** Provide empty conduits from the existing building service demarcation point to the new space for telephone and CATV.
- F. **Power Distribution Systems:** Provide power and lighting distribution systems including service disconnect, panelboards, transformers, overcurrent devices, raceway, cable and wire.
- G. **Feeder and Branch Circuit Wiring:** Provide feeder and branch circuits and devices for power to equipment and convenience receptacles. This includes branch wiring to system control panels furnished under other sections.
- H. **Motor Circuit Wiring:** Provide all motor wiring, safety disconnects, and motor starters unless integral with equipment.
- I. **Interior Lighting Systems:** Provide complete interior lighting system including normal and emergency fixtures, exit signs, lamps, controls, trim and accessories.
- J. **Exterior Lighting Systems:** Provide complete exterior lighting fixtures, controls, lamps and accessories, where required.
- K. **Fire Alarm Systems:** Provide fire alarm system and non-system smoke and CO detectors and other devices shown on the Drawings.
- L. **Telephone and Data Systems:** Provide CAT6 wiring and conduits for voice/data outlets as specified on the drawings.
- M. **Cable Television Systems:** Provide empty conduit for CATV outlets.
- N. **Supports and Fittings:** Provide all support material and hardware for raceway, cable tray and electrical equipment.

- O. **Terminations:** Provide terminations of all cable and wire unless otherwise noted.
- P. **Penetrations:** Provide all building wall, floor and roof penetrations for raceway and cable tray where not provided by the General Contractor.
- Q. **Other Items Furnished By Others:** Install the following equipment furnished by others:
 - 1. Motors
 - 2. Control Panels
 - 3. Wiring to magnetic door holders.

2.3 Work not Included Under this Division

2.3.1 Related Work Included in Other Sections

The following work is not included in this Section and shall be performed under other sections:

- A. Excavation and backfill.
- B. Concrete work, including concrete housekeeping pads and other pads and blocks for vibrating and rotating equipment.
- C. Cutting and patching of masonry, concrete, tile, and other parts of structure, with the exception of drilling for hangers and providing holes and openings in metal decks. The Electrical Subcontractor shall identify locations of penetrations, excavations, structural supports, etc. required for the completion of the Work of this Section to the General Contractor in a timely manner.
- D. Installation of access panels in ceilings and wall construction.
- E. Painting, except as specified herein.
- F. Temporary water, heat, gas and sanitary facilities for use during construction and testing.
- G. Outdoor air intake or exhaust louvers.
- H. Cathodic anti-corrosion protection for buried piping and tanks.
- I. Control wiring specifically indicated as part of Division 15.

2.4 General Equipment and Materials Requirements

2.4.1 General Requirements

All equipment and materials shall be new and of the quality specified. All materials shall be free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged during construction shall not be repaired at the jobsite, but shall be replaced with new materials.

2.4.2 Representation of Equipment

All equipment installed on this project shall have local representation, local factory authorized service and a local stock of repair parts.

2.4.3 Warranties

No equipment or material shall be installed in such a manner as to void a manufacturer's warranty. The Electrical Subcontractor shall notify the Engineer of any discrepancies between the Contract Documents and manufacturer's recommendations prior to execution of the work. Refer to Division 1, General Requirements for Warranty Requirements.

2.5 Shop Drawings

2.5.1 General Requirements

After the Contract is awarded, but prior to proceeding with the Work, the Electrical Subcontractor shall obtain complete shop drawings, product data and samples from manufacturers, suppliers, vendors, and Subcontractors for all materials and equipment specified herein, and submit data and details of such materials and equipment for review by the Engineer. Submission of such items shall follow the guidelines set in the General Section of the Specification Document. Prior to submission of the shop drawings, product data and samples to the Engineer, the Electrical Subcontractor shall review and certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Further, the Electrical Subcontractor shall check all materials and equipment after their arrival on the jobsite and verify their compliance with the Contract Documents. A minimum period of ten working days, exclusive of transmittal time will be required in the Engineer's office each time shop drawings, product data and/or samples are submitted or resubmitted for review. This time period shall be considered by the Electrical Subcontractor when scheduling his Work.

2.5.2 Information to be included in Submittal

The shop drawing submittal shall include all data necessary for interpretation as well as manufacturer's name and catalog number. Sizes, capacities, colors, etc., specified on the drawings shall be specifically noted or marked on the shop drawings.

2.5.3 Information Not to be included in Submittal

Submittals shall contain only information specific to systems, equipment and materials required by Contract Documents for this Project. Do not submit catalogs that describe products, models, options or accessories, other than those required, unless irrelevant information is marked out or unless relevant information is highlighted clearly. Marks on submittals, whether by Contractor, Subcontractor, manufacturer, etc., shall not be made in red ink. Red is reserved for review process.

2.5.4 Responsibility of Submitted Equipment

The Engineer's review of such drawings shall not relieve the Subcontractor of responsibility for deviations from the Contract, Drawings or Specifications, unless he has in writing called the attention of the Engineer to such deviations at the time of the submission. The Engineer's review shall not relieve the Electrical Subcontractor from responsibility for errors or omissions in such drawings.

2.5.5 Proposal of Other Equipment

If the Electrical Subcontractor proposes an item of equipment other than that specified or detailed on the drawings which requires any redesign of the wiring or any other part of the mechanical, electrical or architectural layout, the required changes shall be made at the expense of the trade furnishing the changed equipment at no cost to the Owner.

2.5.6 Substitution of Equipment of Equal Quality

Manufacturer's names are listed herein and on the drawings to establish a standard for quality and design. Where one manufacturer's name is mentioned, products of other manufacturers will be acceptable if, in the opinion of the Engineer the substitute material is of quality equal to or better than that of the material specified. Where two or more manufacturer's names are specified, material shall be by one of the named manufacturers only.

2.6 Record Drawings

2.6.1 General Requirements

As work progresses, and for duration of the Contract, the Electrical Subcontractor shall maintain a complete and separate set of prints of Contract Drawings at job site at all times and record work completed and all changes from original Contract. Drawings shall clearly and accurately include work installed as a modification or added to the original design. At completion of work and prior to final request for payment, the Electrical Subcontractor shall submit a complete set of reproducible record drawings showing all systems as actually installed.

2.7 Miscellaneous Equipment

2.7.1 Safety Switches

Safety switches shall be 240 VAC NEMA heavy duty, horsepower rated visible blade type. Switches shall be non-fused or fused as indicated on the drawings. Lugs shall be front removable and UL listed for copper conductors. All current carrying parts shall be plated to resist corrosion. The switch operating mechanism shall be spring activated quick make - quick break, such that during the normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening operation of the contacts has been started. The external operating handle shall be an integral part of the box and not the cover. The operating handle shall also indicate the switch position, ON in the up position, OFF in the down position and be capable of being padlocked in the OFF position. An interlock shall be provided to prevent opening the cover when the switch is ON and prevent closing the switch contacts when the cover is opened. This interlock mechanism shall be provided with an externally operated override. Switches shall be provided with a factory supplied ground kit. Fused switches shall be provided with class H or K fuses. Safety switches installed indoors shall be provided with NEMA 1 enclosures. Safety switches installed outdoors or in wet areas shall be provided with NEMA 3R enclosures.

2.7.2 Single Phase Fractional HP Manual Motor Starters

Single phase fractional HP manual motor starters shall be toggle operated, enclosed, one or two pole switches as required by the installation. The enclosure shall be NEMA 1 for indoor locations and NEMA 4 for outdoor, wet and damp locations. A handle guard shall be provided to allow the toggle operator to be padlocked in the OFF position. Starters shall be provided with trip free melting alloy thermal overloads

Part Three: Execution

3.1 Wiring Methods

3.1.1 Requirements

Unless otherwise noted all wiring shall be installed in raceway as follows:

- A. **Service Entrance Conductors:** All service conductors shall be installed in rigid steel, rigid aluminum or intermediate metal conduit except when installed underground.
- B. **Power Distribution Outdoors:** All conduit installed outdoors, all risers between floors and conduit exposed to physical damage (except where installed under the wharf) shall be rigid steel, rigid aluminum or intermediate metal conduit. Wiring installed underground shall be installed in rigid non-metallic, PVC conduit and as per the Contract Drawings.
- C. **Power Distribution Indoors:** Unless otherwise noted, all other power distribution wiring including feeders and branch circuits shall be installed in MC cable assemblies.
- D. **Telephone & Data:** Furnish EMT conduit from jacks to accessible space in the boiler room.
- E. **Cable Television (CATV):** Furnish EMT conduit from jacks to accessible space in the boiler room.
- F. **Underslab Conduits:** Conduit installed under floors (including under the wharf) shall be rigid nonmetallic type.

3.2 Work in Existing Facilities

3.2.1 Requirements

All work shall be accomplished while other portions of the existing facility are in normal operation. All construction activities shall be conducted with minimal disruption to the operation of these spaces. Power outages, bus tie-ins, service change-overs and the like shall be scheduled in writing with the Owner.

3.3 Equipment Arrangement and Access

3.3.1 Location of Equipment

Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Minor deviations from the drawings may be made to allow for better accessibility at no additional cost to the Owner, but changes shall not be made without review by the Engineer. Minimum clearances in front of or around equipment shall conform to the latest applicable code requirements.

3.3.1 Arrangement of Equipment

The size of equipment shown on the drawings is based on the dimensions of a particular manufacturer. Where other manufacturers are acceptable, it is the responsibility of the Electrical Subcontractor to determine if the equipment he proposed to furnish will fit the space available. Layout drawings shall be prepared by the Subcontractor when required by the Engineer or Owner to indicate a suitable arrangement.

3.4 Equipment Labeling

3.4.1 Panelboards and Transformers

All panelboards, indoor transformers, cabinets and other specified equipment shall be labeled with engraved laminated plastic plates, minimum 3/4" high with 3/8" engraved letters. Punch tapes with mastic backings are not acceptable.

3.4.2 Starters and Disconnect Switches

All starters, disconnect switches and other specified equipment shall be marked with engraved laminated plastic plates, minimum 1/2" high with 1/4" engraved letters. Where individual switches or circuit breakers in power or distribution panelboards do not have cardholders, they shall be marked with 1/2" high labels.

3.4.3 Empty Conduits

All empty conduits shall have labels tied to the pull string at each end of each empty conduit, marked as to identification of each end. Junction boxes with circuits provided for future use shall be labeled with appropriate circuit designation.

3.4.4 Panelboard Directories

Cardholders for panelboards shall be filled out with typewritten identification of each circuit, except that the word "spare" shall be written in soft pencil to identify all circuit breakers installed that are not used.

3.5 Temporary Light and Power

3.5.1 Requirements

The Electrical Subcontractor shall maintain the existing service to the space to provide temporary electric light and power while the building is under construction and until the permanent feeders have been installed, tested and accepted by the Owner. The Electrical Subcontractor shall furnish, install and remove the temporary electrical power and lighting systems and pay for all labor, materials, and equipment required therefore. All such temporary electrical work shall meet the requirements of the National Electrical Code, the local utility company, and OSHA.

3.5.2 Utility Coordination

The Electrical Subcontractor shall make all necessary arrangements with the local utility company pertaining to the temporary electric service. The Electrical Subcontractor shall secure and pay for all required permits and back charges for work performed by others, and other expenses incidental to the temporary electric service.

3.5.3 Payment of Electric Bills

The General Contractor shall pay the costs of all energy consumed by himself and by all of his subcontractors until final completion.

3.5.4 Temporary Lighting

The Electrical Subcontractor shall furnish all lamps, both initial and replacement, used for the temporary lighting system.

3.5.5 Equipment Provided by Others

The General Contractor and all subcontractors, individually, shall furnish all extension cords, portable lights and lamps therefore, sockets, motors, and accessories as required for their work.

3.5.6 Reimbursable Items

The General Contractor and all subcontractors shall reimburse the Electrical Subcontractor for the following:

- A. Any temporary wiring of a special nature, other than that specified above, required for their work.
- B. Any temporary wiring of construction offices and buildings used by them, other than the office of the General Contractor and the Clerk of the Works.

3.5.7 Removal of Equipment and Wiring

All temporary wiring, service equipment, and accessories thereto shall be removed by the Electrical Subcontractor when directed by the General Contractor.

End of Section 26 05 00

Section 26 05 19

600 Volt Electrical Power Wire

Part One: General

1.1 General Requirements

1.1.1 Provisions

The provisions of Section 26 05 00, General Requirements for Electrical Work apply to the work of this section.

1.2 Applicable Codes and Standards

1.2.1 Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

ASTM B-3	Soft or Annealed Copper Wire
ASTM B-8	Concentric Lay Stranded Copper Conductors
NEMA WC-5	Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
NEMA WC-7	Cross-Linked Thermosetting Polyethylene Insulated Wire for the Transmission and Distribution of Electrical Energy
UL 44	Rubber Insulated Wires and Cables
UL 62	Flexible Cord and Fixture Wire
UL 83	Thermoplastic Insulated Wires and Cables

1.3 Submittals Required

1.3.1 Data Sheets

Manufacturer's product data sheets.

1.4 Manufacturers

Subject to compliance with the Specification Requirements:

- Anixter
- General Cable
- Rome Cable
- Approved Equal

Part Two: Products

2.1 General

2.1.1 Conductors

All conductors shall be annealed copper in accordance with ASTM B-3.

2.1.2 Jacket

The jacket of all wire shall be printed with the following information:

- Manufacturer
- Size
- Insulation type
- Maximum voltage

- UL label

2.1.3 Insulation

All insulation shall be rated 600 for volts.

2.2 Power Wiring

2.2.1 Service Lateral and Entrance Conductors

Service lateral and service entrance conductors shall be type XHHW.

2.2.2 Feeders and Motor Branch Circuits

Feeders and motor branch circuits shall be type XHHW or THHN/THWN

2.2.3 Description

All power wiring shall be stranded, Class B strand in accordance with ASTM B-8, minimum size #12 AWG.

2.3 Lighting and Receptacle Branch Circuits

2.3.1 Description

All lighting and convenience receptacle branch circuit wiring shall be type THHN/THWN, solid or stranded conductor, minimum size #12 AWG.

2.4 Control Wiring

2.4.1 Description

Wiring for control circuits shall be THHN/THWN stranded, with Class B strand in accordance with ASTM B-8, minimum size #14 AWG.

2.5 Fixture Wire

2.5.1 Description

Where high temperature fixture wire is required it shall be silicone rubber type SF-2.

Part Three: Execution

3.1 General

3.1.1 Installation

All wire shall be installed in accordance with manufacturer's instructions.

End of Section 26 05 19

Section 26 05 26

Grounding Equipment

Part One: General

1.1 General Requirements

1.1.1 Provisions

The provisions of Section 26 05 00, General Requirements for Electrical Work apply to the work of this section.

1.1.2 Installation Compliance

The Contractor shall provide a complete grounding system including: connections to existing grounding electrodes, electrode conductors, bonding jumpers, equipment grounding conductors, connections and other materials as may be required for a complete installation. The completed system provided shall meet the requirements of the National Electrical Code and the interpretation of the Local Authority Having Jurisdiction.

1.2 Applicable Codes and Standards

1.2.1 Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

NFPA 70	National Electrical Code
UL 467	Grounding and Bonding Equipment

1.3 Submittals Required

1.3.1 Equipment Data Sheets

Data sheets for chemical grounding systems, exothermal connection methods, and associated wiring.

1.4 Manufacturers

Products shall be of firms regularly engaged in manufacture of grounding equipment.

Part Two: Products

2.1 General

2.1.1 Requirements

Provide all equipment, components and parts required to for a complete and operable system.

2.2 Conductors

2.3.1 Bare Grounding Conductors

Bare grounding conductors shall be soft drawn stranded copper, sized in accordance with NEC Article 250 unless otherwise noted on the Drawings.

2.3.2 Insulated Grounding Conductors

Insulated grounding conductors shall be stranded copper with Type TW, THW or THHN/THWN insulation. Grounding conductor shall be provided with green insulation for identification purposes.

2.4 Connections

2.4.1 Welded Connections

Welded connections shall be exothermic reaction type, as manufactured by Cadweld, or approved equal. The contractor shall provide all molds, crucibles, weld metal, and any necessary materials or equipment required to make connections using this process.

2.4.2 Compression Connections

Compression lugs shall be short barrel, one-hole compression type for conductors #2/0 AWG and smaller and long barrel, two-hole compression type for conductors #3/0 AWG and larger.

2.5 Grounding Bar

2.5.1 Requirements

Provide a wall-mounted copper grounding bar, mounted 6 inches above finished floor in the Work/Storage Room 102. Grounding bar shall be connected directly to the grounding grid.

Part Three: Execution

3.1 Grounding Electrode System

3.1.1 Requirements

Grounding electrodes of the types required by NEC shall be provided. Additional electrodes shall be provided if required by the local Authority Having Jurisdiction. All electrodes shall be bonded together to form the grounding electrode system.

3.1.2 Connection to Structural Steel

Grounding grid conductors shall be connected to building structural steel and brought back to the existing building grounding grid as required by Code.

3.1.3 Grounding Electrode Conductors

The electrical service and all separately derived systems shall be grounded in accordance with NEC Article 250. The grounding electrode conductor shall be copper, sized in accordance with Article 250 of the NEC or as shown on the Drawings.

3.2 Equipment Grounding Systems

3.2.1 Requirements

A separate, insulated copper conductor, with green colored insulation, shall be provided in all raceways and with every feeder, branch and control circuit, in addition to the grounded metallic conduit system. The equipment grounding conductor shall be grounded at both ends.

3.2.2 Connection of Equipment Grounding Conductors

Connections to equipment grounding busses shall use compression type termination lugs bolted to a clean, dry surface on the bus, free from any contaminants which may hinder the electrical continuity of the connection. The contractor shall provide any additional hardware and all drilling and tapping that may be required for this connection.

3.3 Additional Bonding requirements

3.3.1 Grounding of Raceway Systems

All metallic raceways shall be electrically continuous and bonded to the grounding system.

3.3.2 Bonding of Other Systems

Interior metal water, gas and sprinkler piping shall be bonded as required by Article 250 of the NEC. The points of attachment of these bonding conductors shall be located in readily accessible locations.

End of Section 26 05 26

Section 26 05 33

Raceway and Fittings

Part One: General

1.1 General Requirements

1.1.1 Provisions

Provisions of Section 26 05 00 General Requirements for Electrical Work apply to the work of this Section.

1.2 Applicable Codes and Standards

1.2.1 Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

ANSI C80.1	Standard for Rigid Steel Conduit
ANSI C80.3	Standard for Electrical Metallic Tubing
ANSI C80.6	Standard for Intermediate Metal Conduit
NEMA TC-2	Electrical Plastic Tubing and Conduit
NEMA TC-3	PVC Fittings for use with Rigid PVC Conduit and Tubing
UL 1	Flexible Metal Conduit
UL 6	Rigid Metal Conduit
UL 360	Liquid Tight Flexible Steel Conduit
UL 514B	Fittings for Conduit and Outlet Boxes
UL651	Schedule 40 and 80 Rigid PVC Conduit
UL797	Electrical Metallic Tubing
UL870	Wireways, Auxilliary Gutters and Associated Fittings
UL1242	Intermediate Metal Conduit

1.3 Submittals Required

Manufacturers' product data sheets

1.4 Manufacturers

In compliance with the Specification Requirements:

- Allied Tube and Conduit (Conduit)
- Wheatland (Conduit)
- Thomas and Betts (Fittings)
- Appleton (Fittings)
- Crouse Hinds/Cooper (Fittings)
- OZ Gedney (Fittings)
- Killark (Fittings)
- Carlon (PVC)
- National Pipe and Plastics (PVC)
- AFC Cable Systems (MC/LFMC)
- Southwire (MC/LFMC)
- Other manufacturers listed in the specification descriptions
- Approved equals

Part Two: Products

2.1 Conduit

2.1.1 Galvanized Rigid Steel Conduit (GRS)

Rigid steel conduit shall be manufactured from mild steel tube with a uniform protective coating of hot dipped zinc galvanizing inside and outside, including all threads. The conduit shall be furnished in nominal 10-foot lengths, with both ends threaded and furnished with a galvanized coupling on one end and a plastic thread protector on the other end.

2.1.2 Rigid Aluminium Conduit

Rigid aluminum conduit, couplings and elbows shall be manufactured of a suitable copper-free aluminum alloy. Conduit lengths shall be seamless throughout and shall have hard, smooth and gum-free interior coatings to facilitate the pulling-in of conductors. It shall be furnished in nominal 10-foot lengths, with both ends threaded and a coupling applied to one end of each length. Threads on the coupling end shall be coated with a special lubricant so that the coupling may be removed without difficulty. Threads on the end opposite the coupling shall be protected from damaged by a plastic cap.

2.1.3 Intermediate Metal Conduit (IMC)

Intermediate metal conduit shall be of steel piping with a uniform protective coating of hot dipped zinc galvanizing on the outside of the conduit, including all threads. The conduit shall be furnished in nominal 10-foot lengths, both ends threaded furnished with a galvanized coupling on one end and a plastic thread protector on the other end.

2.1.4 Rigid Nonmetallic Conduit (PVC)

Rigid nonmetallic conduit shall be polyvinyl chloride, rated for use with 90°C conductors and furnished in 10-20-, or 30-foot lengths.

2.1.5 Electrical Metallic Tubing (EMT)

Electrical metallic tubing shall be constructed of zinc coated steel with an interior coating of lacquer or enamel to permit easier wire pulling.

2.1.6 Liquid Tight Flexible Metal Conduit (LFMC)

Liquid tight flexible conduit shall be constructed with a flexible core of galvanized steel and an oil and sunlight resistant PVC jacket to form a liquid tight raceway. The overall jacket shall be wrinklefree and suitable for use in temperatures from -25°C to +80°C.

2.1.7 Flexible Metal Conduit (MC)

Flexible metal conduit shall have an outer armor constructed of be hot dipped galvanized interlocked strip steel.

2.2 Conduit Fittings

2.2.1 Bushings

2.2.1.1 Insulated Bushings

Insulated bushings for conduit sizes 1-1/4 inches and larger shall have metal bodies and threads, with molded-on high impact phenolic thermosetting insulation to prevent conductor insulation damage. Bushings shall be Type "IBC" insulated bushings as manufactured by OZ Gedney or an approved equal. Insulated bushings for conduit sizes 1 inch and smaller may be of plastic, OZ Gedney Type "A", or an approved equal.

2.2.1.2 Insulated Grounding Bushings

Insulated grounding bushings shall be similar to the insulated bushings described above, except they shall have set screws to lock the bushings on the conduits and shall have mechanical type lugs attached. The lugs shall be sized to accept the ground wire sizes as set forth in the latest edition of the National Electrical Code, but in no case smaller than No. 8 AWG wire. Grounding bushings shall be Type "BLG" as manufactured by OZ Gedney or an approved equal.

2.2.1.3 Male Bushings

Male bushings shall be Thomas and Betts Corporation insulated throat chase nipples, or a product of equal construction. Bushings used only to pass conductors through metal partitions, etc. shall be OZ Gedney, Type "ABB".

2.2.1.4 Male Bushings

Bushings for use with EMT shall be OZ Gedney type "SBT" or approved equals.

2.2.2 Conduit Bodies

Conduit bodies for use with aluminum conduit shall be of copper free aluminum alloy. Those for use with steel conduit may be of galvanized, or cadmium plated cast iron, or of copper free aluminum alloy. All conduit fittings shall be provided with neoprene gaskets and sheet metal covers, except that cast covers shall be used for sized 1-1/2 inches and larger. Rigid conduit connections shall be threaded and EMT connections shall be set screw type. Cover screws shall be captive. All conduit fittings shall be as manufactured by Crouse Hinds, Appleton, Killark or approved equal.

2.2.3 Hubs

Water-tight conduit connections are required on all NEMA 3R, 4, and 4X enclosures and all electrical equipment located outdoors or in damp or wet areas. Where hubs or water-tight threaded connections are not provided as part of the enclosure, water-tight hubs shall be Myers "Scrutite", or approved equal. All other terminations shall be double locknut and bushing.

2.2.4 Fittings

Fittings for use with liquid-tight flexible conduit shall be zinc plated malleable iron Crouse Hinds type "CGB" or approved equal.

2.2.5 Locknuts

Locknuts shall be hot dipped galvanized steel or malleable iron. Standard locknuts shall be used for connections to NEMA 1 enclosures. Sealing locknuts with integral gasket shall be used for connections to NEMA 12 enclosures.

2.3 Junction Boxes

2.3.1 Pull and Junction Boxes

Pull and junction boxes shall be of code gauge metal with continuously welded joints or of cast metal if called for on the Drawings. All junction boxes shall have gasketed screw covers. Boxes for use with aluminum conduits shall be of aluminum. Sheet steel boxes shall be galvanized after fabrications. Screws for galvanized steel box covers shall be made of brass. Screws for aluminum box cover shall be stainless steel.

2.3.2 Boxes Installed in Concrete

Boxes installed in concrete shall be cast iron alloy or copper free aluminum.

2.3.3 Rating of Boxes

Unless otherwise shown on drawings, all boxes installed indoors shall be rated NEMA 1 and all boxes installed outdoors shall be rated NEMA 4X.

2.4 Outlet Boxes

2.4.1 Outlet Boxes for Concealed Work

Outlet boxes for concealed work shall be pressed steel boxes, galvanized and not less than #12 gauge. Each ceiling outlet designated for a lighting fixture shall have a fixture support secured in place with bolts and nuts. Ceiling boxes shall be octagonal with lugs and screws for back plates.

2.4.2 Outlet Boxes Installed Outdoors

Outlet boxes installed outdoors, in concrete or exposed, shall be copper free aluminum with gasketed covers.

2.4.3 Outlet Box Accessories

Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and to fulfill installation requirements for individual wiring situations.

2.5 Wireway

2.5.1 Wireway

Wireway shall be lay-in type, code gauge steel with dark gray epoxy paint finish inside and out.

2.5.2 Covers

Covers shall be hinged with captive screw fasteners for NEMA 1 & NEMA 3R wireway and gasketed quick release latch covers for NEMA 12 wireway.

2.6 Supports

2.6.1 Sizing

The Electrical Subcontractor shall size and provide all supports necessary for the installation of all raceway.

2.6.2 Channel Framing

Channel framing shall be manufactured by Unistrut, Kindert, B-Line or approved equal.

2.6.3 Indoor Locations

In dry, non-corrosive areas, channel framing and angle shall be galvanized steel or aluminum and all nuts, bolts and hardware shall be carbon steel, cadmium plated or hot dipped galvanized. Ream clamps shall be galvanized steel or malleable iron.

2.6.4 Outdoor, Wet or Damp Locations

In outdoor, wet or damp areas channel framing and angle shall be 316 stainless steel and nuts, bolts and hardware shall be 316 stainless steel. Beam clamps shall be PVC coated.

2.6.5 Supports

Supports shall be sized with a minimum safety factor of four or 200 lbs. whichever is greater.

Part Three: Execution

3.1 General

3.1.1 Requirements

Unless otherwise noted, all wiring shall be installed in conduit. See Section 16000 for Wiring Methods.

3.2 Installation

3.2.1 Conduit, EMT, Boxes and Enclosures

Conduit, EMT, boxes & enclosures shall be installed so that they are mechanically secure, electrically continuous and neat in appearance.

3.2.2 Exposed Runs

Exposed runs shall be installed to conform to the shape of the surface over which they are run. Where they are run over a plane surface, they shall be straight and true. All exposed conduits shall be run parallel and perpendicular to building column lines and walls. Diagonal runs will not be permitted. Conduit runs in groups shall be supported by means of common members made of channel framing. Group mounting is not required where the group consists of only two conduits. Machine bolts with expansion shields shall be used when fastening to solid masonry or concrete. Toggle bolts shall be used to fasten to hollow masonry.

3.2.3 Spacing

Unless otherwise approved, spacing between conduit supports shall not exceed ten feet. Conduits shall not be supported from structural members marked "Removable" on the structural drawings. Conduit hangers and supports shall be fastened to buildings and structural members only and not to any equipment or piping. Separate conduits a minimum of 6" from flues, steam and hot water lines. Install conduit above mechanical piping wherever possible.

3.2.4 Conduit Supports

All conduit supports other than structural members shall be galvanized. The use of perforated strap or plumber straps will not be permitted.

Conduit up to 1-1/2 inches may be supported by one-hole malleable iron straps with clamp backs.

Conduit 2 inches and larger shall be supported by two-hole straps.

3.2.5 Conduit Run Lengths

Conduit runs shall not exceed 100 feet between boxes, fittings or devices.

PVC conduits run above grade shall be sufficiently supported to prevent sagging.

MC cables shall be neatly bundled and tie wrapped and sufficiently supported.

3.2.6 Use of Expansion Joints

All conduit crossing building or structure expansion joints shall be provided with approved expansion fittings.

3.3 Bends

3.3.1 Field Bends

Field bends shall be made with approved bending tools. All field-formed bends shall be of maximum radius permitted by the design and construction conditions.

3.3.2 Exposed Conduit Changing Direction

Where a group of exposed conduits change direction, the bends shall have a common center in order to maintain the uniformity and neat appearance of the group, having regard for the minimum bending radius of the largest conduit in the group.

3.3.3 General

Bends shall be uniform radius and free from cracks, crimps or other damage to the conduit or its coating and shall not unduly flatten the conduit section.

3.4 Joints and Terminations

3.4.1 Joints in Rigid Conduit

All joints in rigid conduit shall be threaded, using standard couplings. The use of running threads, threadless or split couplings is prohibited. When reaming out of conduit ends to remove burrs and rough edges, care shall be exercised to avoid excessive reaming which results in the weakening of the conduit wall at the end.

3.4.2 Tightening of Joints

All joints shall be made up wrench tight and with a minimum of wrench work in order to avoid wrench cuts.

3.4.3 Cut Threads

All cut threads shall be thoroughly painted with a coating of a rust inhibiting primer.

3.4.4 EMT Couplings and Fittings

EMT couplings and fittings shall be compression type on conduits up to 1-1/4 inch and double set screw type for conduits 1-1/2 inch and larger.

3.4.5 Conduit Terminations

All conduit terminations in panels, enclosures, outlet boxes and equipment shall be provided with bushings.

3.5 Flexible Conduit

3.5.1 Terminations

Flexible conduit shall be used to terminate all, lighting, motors, unit lanterns, transformers, pilot devices and vibrating equipment.

3.5.2 Liquitite Flexible Conduit

Liquitite flexible conduit and fitting shall be used outdoors and in all damp or wet areas, or where exposed to grease or oil.

3.6 Penetrations**3.6.1 Penetrations through Slabs, Walls, Roofs**

All penetrations through concrete slabs, masonry walls or roofs shall be provided with sleeves.

3.6.2 Sleeves

All sleeves shall be sealed to maintain the integrity of the structure. Fire resistant walls and floors shall be sealed with approved material, and shall maintain the original fire rating. All seals below grade shall be watertight, O.Z./Gedney type WSK or approved equal.

End of Section 26 05 33

Section 26 22 13

Interior Transformers

Part One: General

1.1 General Requirements

1.1.1 Provisions

The provisions of Section 26 05 00, General Requirements for Electrical Work apply to the Work of this Section.

1.2 Applicable Codes and Standards

1.2.1 Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

ANSI C89.2	Dry Type Transformer for General Applications
UL 1561	Dry Type General Purpose and Power Transformers

1.3 Submittals Required

1.3.1 Data Sheets

Manufacturer's product data sheets indicating weights, dimensions, voltage, KVA, impedance ratings, efficiency at 25, 50, 75, and 100 percent load, rated temperature rise, sound level rating and insulation system are required.

1.4 Manufacturers

Subject to compliance with the specification requirements:

- Square D
- Cutler Hammer
- General Electric
- Siemens

Part Two: Products

2.1 General

2.1.1 Sizes and Ratings

Interior transformers shall be of the sizes, and ratings shown on the drawings.

2.1.2 Transformers

Transformers shall be general-purpose dry type, self-cooled and ventilated with copper or aluminum windings.

2.1.3 Sound Levels

Transformer sound levels shall meet NEMA/ANSI standard requirements, measured in accordance with ANSI standards. Provide integral vibration and noise dampening supports.

2.1.4 Insulation

Transformers 15 KVA and larger shall have 220°C insulation system with temperature rise not exceeding 150°C under full-rated load in maximum ambient of 40°C.

2.1.5 Voltage Taps

Provide transformers with 6 full capacity taps, 2 at 2-1/2% above rated primary voltage and 4 at 2-1/2% below rated primary voltage.

2.1.6 Energy Efficiency

Energy efficient transformers shall be furnished in ratings 30 KVA and larger and certified to meet NEMA TP-1.

Part Three: Execution**3.1 General****3.1.1 Installation**

Transformers shall be installed in accordance with manufacturer's written instructions.

End of Section 26 22 13

Section 26 24 16

Panelboards

Part One: General

1.1 General Requirements

1.1.1 Provisions

The provisions of Section 26 05 00, General Requirements for Electrical Work apply to the work of this section.

1.2 Applicable Codes and Standards

1.2.1 Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

NEMA 250	Enclosures for Electrical Equipment
NEMA AB-1	Molded Case Circuit Breakers
NEMA KS-1	Enclosed Switches
NEMA PB-1	Panelboards
UL 50	Enclosures for Electrical Equipment
UL 67	Panelboards
UL 98	Enclosed and Deadfront Switches
UL 489	Molded Case Circuit Breakers and Circuit Breaker Enclosures
UL 943	Ground Fault Circuit Interrupters

1.3 Submittals Required

1.3.1 Data Sheets

Manufacturer's product data sheets.

1.3.2 Schedules

Circuit breaker schedules.

1.4 Manufacturers

Subject to compliance with the specification requirements:

- Square D
- Cutler Hammer
- General Electric
- Siemens

Part Two: Products

2.1 General

2.1.1 Panelboards

Panelboards shall be of the sizes, rating and arrangement shown on the drawings.

2.1.2 Overcurrent Devices

Panelboards shall be provided complete with all overcurrent devices, accessories and trim

2.1.3 Safety Barriers

All panelboards shall be provided with safety barriers for dead front construction.

2.1.4 Short Circuit Ratings

The required short circuit ratings of assembled panelboards are shown on the Drawings. The short circuit rating of every overcurrent device in the panel shall meet or exceed the panel rating. Unless otherwise noted on the Drawings, series rated combinations will not be permitted.

2.2 Cabinets

2.2.1 Boxes

Boxes shall be code gauge galvanized sheet steel.

2.2.2 Trim

Trim shall be code gauge steel, ANSI-61 gray finish with stainless steel flush type lock/latch handle. All locks shall be keyed alike.

2.2.3 Surface Mounted Panels

Trim for surface mounted panels shall be door-in-door construction such that the gutter space may be exposed by a hinged door.

2.2.4 Frames

Directory frames shall be metal frame with plastic covers.

2.3 Bus

2.3.1 Bus Work

All bus work shall be 1000 amp/sq.in. copper or 750 amp/sq.in. aluminum.

2.3.2 Neutral Buses

Unless otherwise noted on the drawings, neutral busses shall be 100% rated with adequate connections for all outgoing neutral conductors.

2.3.3 Panelboards

Panelboards shall be provided with [copper][aluminum] ground busses.

2.3.4 Connection

Bus shall be designed for sequence phase connection to allow the installation of one, two or three pole branch circuit breakers in any position.

2.4 Overcurrent Devices

2.4.1 Device Type

Overcurrent devices shall be trip-free molded case, bolt-on, thermal magnetic circuit breakers.

2.4.2 Main Circuit Breakers

Main circuit breakers shall be individually mounted and bolted to bus assembly. Back-fed branch mounted circuit breakers are prohibited.

2.4.3 Circuit Breakers Frontfaces

Front faces of all circuit breakers shall be flush. Trip indication shall be clearly shown by the handle position between the ON and OFF positions.

2.4.4 Ground Fault Circuit Breakers

Ground fault circuit breakers shall be provided as required on the Contract Drawings and shall require no more panel space than standard breakers.

2.4.5 Switching Lighting Circuit Breakers

Where circuit breakers are used for switching of lighting, circuits type "SWD" circuit breakers shall be provided.

2.4.6 Arc Fault Circuit Breakers

Arc fault circuit breakers shall be provided as required on the Contract Drawings and shall require no more space than standard circuit breakers.

2.4.7 Connections

All connections shall be rated for 75°C copper conductors.

Part Three: Execution**3.1 General****3.1.1 Installation**

Panelboards shall be installed in accordance with manufacturer's written instructions.

End of Section 26 24 16

Section 26 31 00

Fire Alarm System

Part One: General

1.1 General Requirements

1.1.1 Definition of Work

This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

1.2 Applicable Codes and Standards

1.2.1 Work

All work shall be in accordance with the laws, rules, codes, and regulations set forth by Local, State, and Federal authorities having jurisdiction. All products and materials shall be manufactured, installed and tested as specified, but not limited to the latest accepted edition of the following codes, standards and regulations:

NFPA 13	Sprinkler Systems
NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
UL 38	Manually Actuated Signaling Boxes
UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 346	Water-flow Indicators for Fire Protective Signaling Systems
UL 464	Audible Signaling Appliances
UL 521	Heat Detectors for Fire Protective Signaling Systems
UL 864	Control Units for Fire Protective Signaling Systems
UL 1971	Visual Notification Appliances

1.2.2 Electrically Supervised System

The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

1.2.3 Field Programmable

Both the fire alarm control panel and the device's address settings must be 100% field programmable without the use of special tools, programmers or software.

1.2.4 UL Listing

The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

1.2.5 Authority Having Jurisdiction

The system and its components shall meet all requirements of the Local Authority Having Jurisdiction.

1.3 Submittals Required

1.3.1 Shop Drawings

Shop Drawings shall include but not be limited to the following:

- Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
- Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
- Show annunciator layout, configurations, and terminations.

1.3.2 Manuals

Manuals shall be submitted simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.

1.3.3 Wiring Diagrams

Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.

1.3.4 Sequence of Operation

Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

1.3.5 Battery Calculation

Provide a complete battery calculation showing that the battery system provided meets the operational requirements as defined by NFPA.

1.4 Manufacturers

Manufacturer shall have factory trained representatives within 4 hours of location of installation.

Subject to compliance with the specification requirements:

- Notifier
- FCI
- Simplex Grinnell
- Approved equal

Part Two: Products

2.1 System Requirements

2.1.1 General

A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.

2.1.2 Basic System Performance

Basic System performance shall meet the following:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
2. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B) as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y) as part of an addressable device connected by the SLC Circuit.
4. On Style 4 (Class B) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

2.1.3 Basic System Functional Operation

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED on the system display shall flash.
2. A local piezo-electric signal in the control panel shall sound.
3. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
5. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs shall be activated.

2.2 System Conduits, Wiring and Grounding

2.2.1 Conduits

Conduits shall be in accordance with other sections of this specification and The National Electrical Code (NEC), local and state requirements.

2.2.2 Wiring

Wiring shall be UL listed and in accordance with local, state and national codes and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG for Notification Appliance Circuits. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).

2.2.3 Terminal Boxes, Junction Boxes and Cabinets

All boxes and cabinets shall be UL listed for their use and purpose.

2.2.4 Arrangement of Circuit Wiring

Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

2.2.5 Grounding of Fire Alarm Control Panel

The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3 Fire Alarm Control Panel (FACP)

Main FACP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal heat detectors, addressable modules, printer, annunciators, and other system controlled devices.

2.3.1 Operator Controls

1. **Acknowledge Switch:** Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel audible signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition. Depression of the Acknowledge switch shall also silence all remote annunciator audible signals.
2. **Alarm Silence Switch:** Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenced by this switch shall

be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. **Alarm Activate (Drill) Switch:** The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
4. **System Reset Switch:** Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
5. **Lamp Test:** The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

2.3.2 FACP System Capacity and General Operation

1. The control panel or each network node shall provide, or be capable of expansion to a minimum of 198 intelligent/addressable modules. The control panel must be fully UL Listed to UL 9th Edition Standards.
2. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance Circuits.
3. The control panel or each network node shall support up to 8 additional output modules (signal, speaker, telephone, or relay), each with 8 circuits for an additional 64 circuits. These circuits shall be either Class A (NFPA Style Z) or Class B (NFPA Style Y) per the project drawings.
4. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
5. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
6. The system shall allow the programming of any input to activate any output or group of outputs.
7. The system shall be provided with Drift Compensation to extend detector accuracy and filter out transient noise signals.
8. The system shall be provided with Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
9. The system shall be able to display or print system reports.
10. The system shall be provided with periodic detector test, conducted automatically by the software.
11. The system shall be provided with self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.
12. The system shall be provided with cross-zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
13. **Smoke Detector Sensitivity Adjust:** A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.

15. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
16. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
17. Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - Device status
 - Device type
 - Custom device label
 - View analog detector values
 - Device zone assignments
 - All program parameters
18. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory.
19. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
20. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
21. Software Zones: The FACP shall provide 50 software zones.
22. Waterflow Detection: An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display; turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.
23. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
24. Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.
25. Non-Alarm Input Operation: Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a

lower priority than fire alarm initiating devices.

26. Combo Zone: A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

2.3.3 Central Microprocessor

The microprocessor communicate with, monitor and control all external interfaces. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall not be lost even if system primary and secondary power failure occurs. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

2.3.4 System Display

The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.

2.3.5 Signaling Line Circuits (SLC)

Each SLC interface shall provide power to and communicate with the intelligent detectors (ionization, photoelectric or thermal) and modules (monitor or control). Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring. The CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

2.3.6 Serial Interfaces

The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

2.3.7 Notification Appliance Circuit (NAC)

1. The Notification Appliance Circuit module shall provide two fully supervised Class A or B (NFPA Style Z or Y) notification circuits. An expansion circuit board shall allow expansion to eight circuits per module.
2. The notification circuit capacity shall be 3.0 amperes maximum per circuit and 6.0 amperes maximum per module.
3. The module shall not affect other module circuits in any way during a short circuit condition.
4. The module shall provide eight green ON/OFF LEDs and eight yellow trouble LEDs.
5. The module shall also provide a momentary switch per circuit that may be used to manually turn the particular circuit on or off or to disable the circuit.
6. Each notification circuit shall include a custom label inserted to identify each circuit's location. Labels shall be created using a standard typewriter or word processor.
7. The notification circuit module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal strips shall be UL listed for use with up to 12 AWG wire.
8. Each circuit shall be capable of, through system programming, deactivating upon depression of the signal silence switch.

2.3.8 Control Relay Module

1. The control relay module shall provide four Form-C auxiliary relay circuits rated at 5 amperes, 28 VDC. An expansion circuit board shall allow expansion to eight Form-C relays per module.
2. Each relay circuit shall be capable of being activated (change in state) by any initiating device or from any combination of initiating devices.
3. The module shall provide a momentary switch per relay circuit that may be used to manually turn the relay ON/OFF or to disable the relay.
4. Each relay circuit shall include a custom label inserted to identify its location. Labels shall be created using a standard typewriter or word processor.
5. The control relay module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal blocks shall be UL listed for use with up to 12 AWG wire.

2.3.9 Enclosure

The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top. The door shall be provided with a key lock and shall include a glass or other transparent opening for viewing of all indicators.

2.3.10 Power Supply

1. A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 3.0 amps of available power for the control panel and peripheral devices.
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 60 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.
4. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:
 - Ground Fault LED
 - AC Power Fail LED
 - NAC on LED (4)
5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
6. The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 25 AH.
7. All circuits shall be power-limited, per UL864 requirements.
8. The batteries are to be completely maintenance free and shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.

2.3.11 Surge Protection

All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.

2.3.12 Universal Digital Alarm Communicator Transmitter (UDACT)

1. The UDACT is an integral interface for communicating digital information between a fire alarm

control panel and an UL-Listed central station and shall be mounted in a standard module position of the fire alarm control cabinet. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status.

2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
3. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
4. Communication shall include vital system status such as:
 - Independent Zone (Alarm, trouble, non-alarm, supervisory)
 - Independent Addressable Device Status
 - AC (Mains) Power Loss
 - Low Battery and Earth Fault
 - System Off Normal
 - 12 and 24 Hour Test Signal
 - Abnormal Test Signal (per UL requirements)
 - EIA-485 Communications Failure
 - Phone Line Failure
5. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

2.4 Visual Strobe Notification Devices

Notification strobes shall be 24V xenon type, meet the requirements of the ADA, UL Standard 1971, and be fully synchronized. Minimum intensity is 15/75cd unless otherwise shown on the Drawings.

2.5 Combination Horn/Strobe Notification Devices

Electronic horns shall be 24V, field programmable without the use of special tools, at a sound level of at least 90dBA measured at 10 feet from the device. Strobes shall meet the requirements for Visual Strobe Notification Devices.

2.6 Manual Pull Stations

Manual fire alarm stations shall be analog addressable type, non-breakglass type, equipped with key lock so that they may be tested without operating the handle. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset. An operated station shall be visually detected as operated at a minimum distance of 100 feet front or side. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters ½-inch in size or larger.

2.7 Photoelectric Area Smoke Detectors

Photoelectric smoke detectors shall be a 24 VDC, two wire, analog addressable type, ceiling-mounted, light scattering type using an LED light source. Each detector shall contain a remote LED output and a built-in test switch. Detector shall be provided on a twist-lock base. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall flash at least every 10 seconds, indicating that power is applied to the detector. The detector shall not go into alarm when exposed to air velocities of up to 3000 feet (914.4 m) per minute. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber. All field wire connections shall be made to the base through the use of a clamping plate and screw.

2.8 Duct Smoke Detectors

Duct smoke detectors shall be a 24 VDC, analog addressable type with integral communications and device identification, and provided with a remote test indicator. Each detector shall be furnished and wired by the electrical contractor and installed by the mechanical contractor in the supply/return air ducts as shown on the Drawings. Duct smoke detectors shall be provided with properly sized air sampling tubes.

2.8.1 Operation of Duct Smoke Detectors

Duct smoke detectors shall be provided with 120V rated, form C contacts that open/close upon sensing of smoke or detector failure. Contacts will be used to shut down the associated air handler when detectors are installed in the supply ducts of the air handler.

2.9 Heat Detectors

Automatic heat detectors shall be analog addressable type, and be of combination rate of rise and fixed temperature construction, rated at 135 degrees Fahrenheit for areas where ambient temperatures do not exceed 100 degrees, and 200 degrees for other areas. Heat detectors shall be low profile, ceiling mount type with positive indication of activation, and have smooth ceiling rating of 2500 square feet.

2.9.1 Rate of Rise Element

The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15 degrees F (9.4 degrees C) per minute.

2.9.2 Fixed Temperature Element

The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.

2.10 Waterflow Indicators

Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type, with alarm transmission delay time adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.

2.10.1 Installation Requirements

Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

2.11 Sprinkler and Standpipe Valve Supervisory Switches

2.11.1 Where Used

Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.

2.11.2 Post Indicator Valve (PIV) Switch

PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves. The switch housing shall be finished in red baked enamel. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.

2.11.2 Valve Supervisory Switches

Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor. This unit shall provide for each zone: alarm indications using red LED for alarm and yellow LED for trouble and control switches for the control of fire alarm control panel functions. The annunciator will also have an ON-LINE LED, local electric alarm signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels. Switches shall be available for remote annunciation and control of output points in the system, system acknowledge, telephone zone select, speaker select, global signal silence, and global system reset

within the confines of all applicable standards.

2.12 Non-System Smoke and CO Detectors

Non-system combination smoke and CO detectors shall be operable by 120VAC and 9VDC (battery). Units shall be as manufactured by Gentex, or approved equal.

Part Three: Execution

3.1 Installation

3.1.1 Installation Requirements

1. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
2. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
3. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.
4. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.
5. Smoke detectors shall be provided with dust covers to remain in place during construction to protect smoke detectors from contamination and physical damage. Dust covers shall be removed prior to final acceptance.
6. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
7. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 Testing

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system.

3.2.1 Testing Requirements

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
3. Verify activation of all waterflow switches.
4. Open initiating device circuits and verify that the trouble signal actuates.
5. Open and short signaling line circuits and verify that the trouble signal actuates.
6. Open and short notification appliance circuits and verify that trouble signal actuates.
7. Ground all circuits and verify response of trouble signals.
8. Check presence and audibility of tone at all alarm notification devices.

9. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
11. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 Final Inspection and Certification

At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect. Upon completion of testing submit a certification from the major equipment manufacturer indicating that the supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

3.4 Instruction

Instruction shall be provided 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. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3.5 Guarantee

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

End of Section 26 31 00

Section 26 51 00

Lighting Fixtures

Part One: General

1.1 General Requirements

1.1.1 Provisions

The provisions of Section 26 05 00, General Requirements for Electrical Work, and section 26 05 33, Raceway and Fittings, apply to the work of this section.

1.2 Applicable Codes and Standards

1.2.1 Products

Products shall comply with the following codes and standards and shall be UL-listed and labeled:

CBM Labels	Certified Ballast Manufacturers Assoc.
NEC Art. 410	National Electrical Code
FCC, Part 18	RFI and EMI
ANSI C62.41	Line Transient Protection
UL 1570	Fluorescent Lighting Fixtures
UL 924	Emergency Lighting and Power Equipment
UL 1088	Temporary Lighting

1.3 Submittals Required

1.3.1 Data Sheets, Photometrics and Installation Instructions

Submit manufacturer's product data, photometrics, and installation instructions for each type of light fixture specified. Fixture submittals will be in booklet form with separate sheet for each fixture assembled in "luminaire type" alphabetical order, with proposed fixture and accessories clearly indicated on each sheet.

1.3.2 Ballast Requirements

Submit on a separate sheet for each HID and fluorescent fixture type specified, the ballast manufacturer, type and technical data for that ballast.

1.3.3 Lamp Requirements

Submit on a separate sheet for each light fixture specified, the proposed lamp and manufacturer's data for that lamp.

1.4 Manufacturers

1.4.1 General

The fixture types, manufacturers and model numbers are shown on the lighting schedule in the Contract Drawings. These fixtures and manufacturers are listed to establish a baseline type, style and quality of fixture to be provided. Although one manufacturer may be listed on this lighting schedule, other manufacturers' representatives may submit fixtures for consideration as "equal" fixtures to facilitate the "packaging" of the lighting fixtures within the representative's product lines. The architect and engineer however reserve the right to require certain individual fixtures be provided of the model and manufacturer specified in order to meet specific design intent by the architect or engineer.

Part Two: Products

2.1 General

2.1.1 Light Fixtures

Light fixtures shall be provided with housings, trims, ballasts, lamp holders, sockets, reflectors, wiring and other components required, as a factory-assembled unit for a complete installation.

2.1.2 Electrical Wiring

Provide electrical wiring within light fixtures suitable for connecting to branch circuit wiring in accordance with N.E.C. Article 410, Paragraph 25.

2.1.3 Packaging

Deliver interior lighting fixtures shall be delivered in factory fabricated containers and wrapping, in order to properly protect fixtures from damage.

2.1.4 Storage

Interior lighting fixtures shall be stored in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, humidity, extreme temperatures, laid flat and on skids to keep off floors and ground.

2.1.5 Ceiling Fixtures

Fixtures installed in ceilings, suspended from ceilings or on walls shall be installed with a plastic film covering protecting the lens, louver and lamps from dust, dirt and debris during construction. Plastic film shall be removed upon the completion of construction.

2.2 Fluorescent Fixtures

2.2.1 General

Provide fluorescent fixtures of sizes, types and ratings indicated and specified in the Lighting Fixture Schedule on the Contract Drawings.

2.2.2 Fluorescent-Lamp Ballasts

Provide low-energy solid state fluorescent lamp ballasts, capable of operating lamp types indicated, with a minimum power factor of 0.90 and Class A sound rating. Ballasts shall have lamp current crest factor of 1.7 or less and total harmonic distortion less than 20%. Ballast factor shall be 0.88-0.90 or as specified in the lighting fixture schedule. Ballast shall be instant start for maximum efficiency and parallel wired such that if one lamp fails the remaining lamps stay lit.

2.2.2.1 Manufacturers

Subject to compliance with the requirements, provide ballasts by one of the following:

- Osram Sylvania
- General Electric
- Magnetek
- Advance

2.2.2 Compact Fluorescent Ballasts

Provide solid-state electronic ballasts capable of operating lamp types specified. Ballasts shall have a total harmonic distortion not to exceed 20%. Ballasts shall have an end of lamp life sensing circuit capable of shutting the lamp down to prevent lamp glass from cracking and preventing lamp base and sockets from melting. Ballasts shall have a ballast factor of 0.90-1.00.

2.2.4.1 Manufacturers

Subject to compliance with requirements provide dimming ballasts by one of the following:

- Osram Sylvania
- Magnetek
- Advance

2.3 Lamps

2.3.1 Lamp Requirements

Provide fluorescent lamps of types as indicated on the contract drawings. Acceptable lamp manufacturers are Osram Sylvania, Inc. and Philips Lighting Co.

2.4 Exterior Lighting Controls

2.4.1 General

Operation of exterior lighting is to be provided with a combination of photocell (ON), time clock (ON or OFF), and automatic control override switch (ON) through a UL listed lighting contactor. These controls shall be provided with all components required for a fully-operable system.

2.4.2 Lighting Contactors

Lighting contactors shall be provided in a NEMA 1 enclosure sufficiently sized to also house the time clock. Lighting contactors shall be listed for operation with the voltages shown on the Contract Drawings. Lighting contactors shall be multi-pole type sized sufficiently for the number of circuits shown on the contract drawings and a minimum of one spare circuit. Contactors shall be [electrically] [mechanically] held with Normally Open (N.O.) contacts which are convertible to Normally Closed (N.C.) type.

2.4.3 Photocells

Photocells shall be provided as shown on the Contract Drawings. Mounting location and height shall be as shown on the Drawings and further coordinated with the architect and engineer prior to installation for exact location of box. Photocell shall be provided with NEMA 4 enclosure to be mounted on standard 2"x4" exterior junction box.

2.4.4 Time Clocks

Time clocks shall be 24-hour type with mechanical rotary dial operator.

Part Three: Execution

3.1 General

3.1.1 Prior Examination

Examine all areas and conditions under which lighting fixtures are to be installed and structure which will support lighting fixtures. Notify the Contractor in writing of any conditions detrimental to proper installation and completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.1.2 Coordinate Installation

Coordinate light fixture installations with other trades. Fluorescent light fixtures should be installed at least two feet away from smoke detectors. Coordinate all lighting fixtures with mechanical piping and ductwork to allow for proper clearance.

3.2 Installation

3.2.1 Locations and Heights

Install all lighting fixtures at locations and heights indicated, in accordance with the architectural reflected ceiling plans.

3.2.2 Recessed Lighting Fixtures

All recessed lighting fixtures installed in ceiling which require a fire resistance rating shall be installed in accordance with the 1996 BOCA National Building Code Section 713.

3.2.3 Fastening and Supporting Fixtures

Provide fixtures and/or fixture outlet boxes with hangers, channel or other method of fastening and supporting fixtures required for proper installation.

3.2.4 Pendant Mounted Fixtures

All pendant mounted fixtures shall be installed plumb and level or as detailed on the Contract Drawings. Pendant mounted fixtures longer than 18" shall have twin hangers of type specified.

3.2.5 Tightening Values

Tighten connectors and terminals, including screws and bolts in accordance with equipment manufacturer's published torque tightening values for equipment connectors. All screws and bolts shall have washers.

3.3 Splices and Terminations

3.3.1 General

Twist on wire connectors shall be installed which utilize square-wire spring grips and thermo plastic shells. Install connectors to meet the manufacturer's torquing requirements. Install wire connectors of size required as not to exceed the manufacturers UL-listed CSA recognized wire combinations

3.4 Field Quality Control

3.4.1 Replacement of Lamps

At date of substantial completion, all lamps that are not functioning, have color deficiencies, or are noticeably dimmed shall be replaced with new lamps as determined by the Engineer.

3.4.2 Temporary Lighting Replacement

All lamps used for temporary lighting in new light fixtures shall be replaced with new lamps.

3.4.3 Cleaning Light Fixtures

All light fixtures shall be cleaned of dirt and debris upon completion of construction. All finger prints and smudges shall be cleaned.

3.4.4 Protection During Construction

All installed fixtures during remainder of construction shall be protected in accordance with section 2.1.5 of this specification section.

3.4.5 Grounding of Fixtures

All light fixtures shall be grounded in accordance with article 250 and 410 of the NEC. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

3.4.6 Damaged Light Fixtures

All light fixtures damaged in shipping or during installation shall be replaced with new fixtures at no cost to the owner.

End of Section 26 51 00



LT Series

Designer Combination Emergency Lighting Unit/LED Exit Sign

FEATURES

Application

The LT Series provides bright, even LED exit illumination and emergency lighting, offering a flexible solution for emergency path of egress illumination. Four long life LEDs illuminate the exit sign, and two, semi-recessed "eyeball" shaped lamp-heads with halogen or LED based MR16 lamps provide emergency unit illumination. Remote capacity and damp location options are available.

Construction

The precision-molded thermoplastic housing is impact and scratch resistant, corrosion proof and UV stabilized to resist discoloration. Available in white or black. Innovative snap-together design. Includes additional face-plate for single or double-face applications. Snap-in directional chevrons. Designed for ceiling or wall mounting; can be end-mounted with end-mount accessory kit. Red or green polystyrene .030" diffuser is frequency matched to the LEDs providing optimum exit sign illumination.

Installation

Product mounts to 3½", 4" octagon or 4" square outlet boxes. Housing back-plate includes universal knock-out pattern for outlet box mounting. Keyholes provided for securing housing to wall surface. Pre-stripped pigtail leads provided.

Illumination

Four long-life LEDs provide exit illumination. Exceeds the 2009 UL 924 requirements for brightness and uniformity. Unit illumination by halogen or optional high-performance LED based MR16 lamps.

Compliances

UL 924 Listed (optional damp location listed)
 NFPA 70
 NFPA 101
 U.S. Patent Nos. D406,279, D400,991, 6,280,042, and 6,019,477.

Catalog Number	
Comments	Type



Matching indoor remote heads for use with LTUXX3 models (sold separately)



LZRSW0605 (5W HAL)
 LZRSW0603L (3W LED)



LZRSB0605 (5W HAL)
 LZRSB0603L (3W LED)

ORDERING GUIDE

LT	U						
Model	Faces	Letter Color	Housing Finish	Application	Self-Diagnostics	Options	
LT	U Universal Single/ Double Face	R Red G Green	W White B Black	Blank Standard Model 3 Remote Capacity Model D Damp Location Model ⁵	Blank None I Spectron® Self-test/ Self-diagnostic Electronics ¹	Blank 5W Halogen lamps -03L 3W LED Lamp ⁶ -0 Unit supplied without lampheads ² -FAP Fire alarm panel interface ^{3, 4, 7} -FM Flasher module ^{4, 7} -AF Alarm/Flasher module ^{4, 7} -24K 220-240VAC, 60 Hz operation	

¹ Available only with remote capacity and damp location models
² Available with remote capacity (LTUXX3) models without Spectron only
³ Operates with 24-volt AC or DC fire alarm panels
⁴ -FAP, -FM or -AF options may not be specified together
⁵ Not available with -03L(LED) option
⁶ Not available with Spectron Self-Diagnostics
⁷ Only available with Spectron Self-Diagnostics

ACCESSORIES (order separately)

WGTW	Wireguard (wall mount)
WGTC	Wireguard (ceiling or end mount)
FTSMKW	Side mount field kit (white)
FTSMKB	Side mount field kit (black)
PMLZTW	12½" Pendant mounting kit (white)
PMLZTB	12½" Pendant mounting kit (black)

LT Series

Designer Combination Emergency Lighting Unit/LED Exit Sign

Output Voltage	Battery	Lamp	Unit Capacity	Runtime	Extended Runtime	Remote Watts	Number of Remotes: 5W HAL	Number of Remotes: 3W LED
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Standard Models

LTURW	6VDC	Lead-Calcium	5W HAL	10 watts	90 min.	No	--	--
LTUGW	6VDC	Lead-Calcium	5W HAL	10 watts	90 min.	No	--	--

Damp Location Models

LTURWD	6VDC	Lead-Calcium	5W HAL	10 watts	90 min.	No	--	--
LTUGWD	6VDC	Lead-Calcium	5W HAL	10 watts	90 min.	No	--	--

Remote Capacity Models

LTURW3	6VDC	Lead-Calcium	5W HAL	15 watts	90 min.	Yes	5	1
LTUGW3	6VDC	Lead-Calcium	5W HAL	15 watts	90 min.	Yes	5	1

Spectron® Models

LTURW3I	6VDC	Lead-Calcium	5W HAL	15 watts	90 min.	Yes	5	1
LTUGW3I	6VDC	Lead-Calcium	5W HAL	15 watts	90 min.	Yes	5	1

LED Models

LTURW-03L	6VDC	Lead-Calcium	3W LED	10 watts	90 min.	Yes	--	--
LTURW3-03L	6VDC	Lead-Calcium	3W LED	15 watts	90 min.	Yes	9	3
LTURW3I-03L	6VDC	Lead-Calcium	3W LED	15 Watts	90 min.	Yes	9	3

SPECIFICATIONS

Standard Features:

- External push-to-test switch and AC-ON indicator
- Exit Sign Letters: 6" height, 3/4" stroke
- Snap-in directional chevrons in Exit Sign
- Low voltage disconnect
- Transformer isolation
- AC lockout
- Temperature compensated charger circuitry
- MR16 Halogen lamp with rated 200 hour life
- Battery recharge time within UL specifications

Optional Features:

- Spectron® self-test/self-diagnostic circuitry monitors lamp status, lamp load transfer circuitry and battery capacity; displays any fault detected via a flashing code. Automatically runs periodic diagnostic routines to ensure unit readiness. Multicolor LED indicates fault condition and charging status.
- LED MR16 lamps rated at 50,000 hour life expectancy.
- Available without integral lamp heads for added run time or remote capacity operation.

Operating Temperature Range:

Standard models: 20°C to 30°C (68°F to 86°F)
 Damp location models: 10°C to 40°C (50°F to 104°F)

AC Input Voltage

120VAC or 277VAC: 60 Hz. operation standard **Optional 220-240VAC:** 50/60 Hz.

Power Consumption

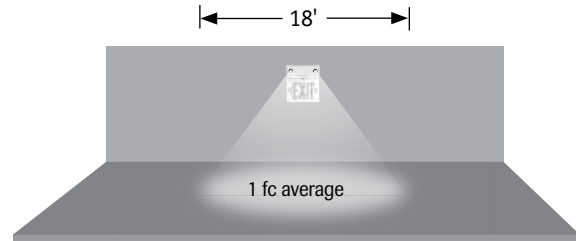
Maximum: 5.0W at 120VAC or 277VAC (all models)

Normal: 4.2W at 120VAC or 277VAC (all models)

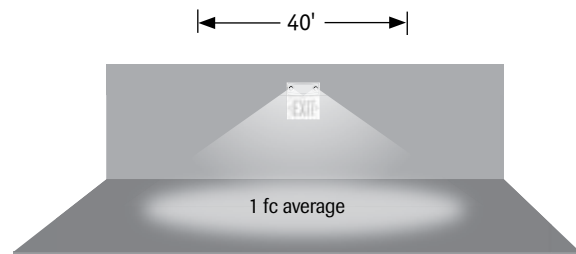
Power Factor, Average: .9 (lagging)

APPLICATION DATA

Coverage for 5W HAL MR16 lamp

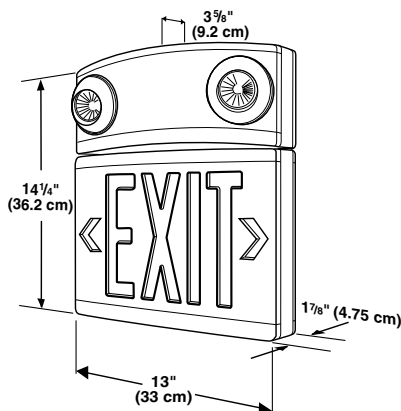


Coverage for optional 3W LED MR16 lamp



Meets Life Safety Code minimum illuminance of 0.1 fc and average illuminance of 1.0 fc. Assumes open space with no obstructions, mounting height of 7.5', ceiling height of 9' and reflectances of 80/50/20. Photometry files available on the Dual-Lite web site (www.dual-lite.com).

DIMENSIONS



Dual-Lite • www.dual-lite.com

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0601470 C 2/12



LZ Series

Designer Emergency Lighting Unit

Catalog Number	
Comments	Type

FEATURES

Application

The LZ Series is an indoor emergency lighting unit with 10 - 65W capacity utilizing a sealed lead-calcium or nickel-cadmium battery in 6 or 12 VDC. Supplied standard with two halogen MR16 lamps. High-output LED based MR16 option provides increased spacing, additional run-time and/or increased remote capacity. Matching remote heads are also offered. The integrated lamp design offers greater protection from vandalism.

Construction

Available in two housing sizes, one for standard capacity models (LZ2, LZ15) and increased depth for higher capacity models (LZ15 through LZ65). Made from UV stabilized thermoplastic with a snap-together design in white or black finish. Includes test switch and AC-ON indicator.

Installation

Unit mounts to 3½", 4" octagon or 4" square boxes. Back-plate provides a universal knockout pattern for mounting to outlet box. Keyholes provided for securing housing to wall surface. LZ2 and LZ15 can be ceiling mounted. All AC connections made inside unit housing.

Illumination

The LZ Series provides illumination with two halogen MR16 lamps positioned inside an adjustable "eyeball" style housing. Optional lamps for greater light output include 10W MR16 and maximum coverage high-output LED based MR16.

Compliances

UL 924 Listed (optional damp location listed)
 NFPA 70
 NFPA 101
 ADA compliant (LZ standard models only)
 U.S. Patent Nos. D400,991, D419,708, D400,995, 6,280,042 and 6,019,477.



Standard Size



High Capacity



Optional black finish



LZR remote heads
(sold separately)

ORDERING GUIDE

LZ

Model	Capacity	Battery Type	Rating	Output Volts	Self-Diagnostics	Options
LZ	2 10 Watts ² 15 15 Watts 20 20 Watts ⁵ 25 25 Watts ⁵ 30 30 Watts ² 35 35 Watts ^{2,6} 55 55 Watts ² 65 65 Watts ^{2,6}	Blank N Lead-Calcium Nickel-Cadmium ^{3,4}	Blank D Standard Model Damp Location Listing ⁹	Blank -12V 6 Volts 12 Volts ¹⁰	Blank I None Spectron® Self-test/ Self-diagnostic Electronics ⁷	Blank 5W Halogen lamps 10W 10W Halogen lamps ¹ 03L 3W LED Lamps ⁸ B Black finish V Voltmeter 0 Unit supplied without lampheads ¹¹ 24K 220-240VAC, 60 Hz operation ² A21 Aux. 2-conductor, line cord, 120VAC only ¹² A31 Auxiliary 3-conductor line cord, 120VAC only ¹³

¹ Available on units with capacities of 20 watts or more

² Not available with Nickel-Cadmium battery models

³ Available only on 15, 20 or 25 Watt models

⁴ Must order with damp location on LZ15 in 6 VDC only

⁵ Not available with Lead-Calcium battery models

⁶ Not available with damp location models

⁷ Must order with damp location listing on LZ2 model

⁸ Not available with LZ21 and LZ15I Spectron® equipped unit

⁹ Not available with -03L (LED) option

¹⁰ Limited to LZ20ND-12V, LZ25N-12V, LZ30D-12V, LZ35-12V, LZ55D-12V and LZ65-12V

¹¹ Not available on LZ2 and LZ15 models

¹² Available on LZ2 only

¹³ Available on all models except LZ2



LZ Series

Designer Emergency Lighting Unit

	Voltage	Battery	Lamp	Capacity	Runtime	Extended Runtime	Remote Watts	Number of Remotes: 5W HAL	Number of Remotes: 10W HAL	Number of Remotes: 3W LED
STANDARD	LZ2	6VDC	Lead Calcium	5W HAL	10 watts	90 min.	No	0	0	0
	LZ15	6VDC	Lead Calcium	5W HAL	15 watts	90 min.	Yes	5	1	1
	LZ30	6VDC	Lead Calcium	5W HAL	30 watts	90 min.	Yes	20	4	6
	LZ35-12V	12VDC	Lead Calcium	5W HAL	35 watts	90 min.	Yes	25	5	8
	LZ65	6VDC	Lead Calcium	5W HAL	65 watts	90 min.	Yes	55	11	18
	LZ65-12V	12VDC	Lead Calcium	5W HAL	65 watts	90 min.	Yes	55	11	18
DAMP	LZ20N	6VDC	Nickel Cadmium	5W HAL	20 watts	90 min.	Yes	10	2	3
	LZ25N-12V	12VDC	Nickel Cadmium	5W HAL	25 watts	90 min.	Yes	15	3	5
	LZ2D	6VDC	Lead Calcium	5W HAL	10 watts	90 min.	No	0	0	-
	LZ25D	6VDC	Lead Calcium	5W HAL	25 watts	90 min.	Yes	15	3	-
	LZ30D-12V	12VDC	Lead Calcium	5W HAL	30 watts	90 min.	Yes	20	4	-
	LZ55D	6VDC	Lead Calcium	5W HAL	55 watts	90 min.	Yes	45	9	-
LED	LZ55D-12V	12VDC	Lead Calcium	5W HAL	55 watts	90 min.	Yes	45	9	-
	LZ15ND	6VDC	Nickel Cadmium	5W HAL	15 watts	90 min.	Yes	5	1	-
	LZ20ND-12V	12VDC	Nickel Cadmium	5W HAL	20 watts	90 min.	Yes	10	2	3
	LZ2-03L	6VDC	Lead Calcium	3W LED	10 watts	90 min.	No	0	0	0
	LZ15-03L	6VDC	Lead Calcium	3W LED	15 watts	90 min.	Yes	9	1	3
	LZ30-03L	6VDC	Lead Calcium	3W LED	30 watts	90 min.	Yes	24	4	8
	LZ35-12V-03L	12VDC	Lead Calcium	3W LED	35 watts	90 min.	Yes	29	5	9
	LZ65-03L	6VDC	Lead Calcium	3W LED	65 watts	90 min.	Yes	59	11	19
	LZ65-12V-03L	12VDC	Lead Calcium	3W LED	65 watts	90 min.	Yes	59	11	19
LZ20N-03L	6VDC	Nickel Cadmium	3W LED	20 watts	90 min.	Yes	14	2	4	
LZ25N-12V-03L	12VDC	Nickel Cadmium	3W LED	25 watts	90 min.	Yes	19	3	6	

SPECIFICATIONS

Standard Features:

- External push-to-test switch and AC-ON indicator
- Low voltage disconnect
- Transformer isolation
- Temperature compensated charger circuitry
- MR16 Halogen lamp with rated 200 hour life

Optional Features:

- Spectron® self-test/self-diagnostic circuitry monitors lamp status, lamp load transfer circuitry and battery capacity; displays any fault detected via a flashing code. Automatically runs periodic diagnostic routines to ensure unit readiness. Multicolor LED indicates fault condition and charging status.
- LED MR16 lamps rated at 50,000 hour life expectancy
- Available without integral lamp heads for added run time or remote capacity operation.

Operating Temperature Range:

Standard models: 20°C to 30°C (68°F to 86°F)
Damp location models: 10°C to 40°C (50°F to 104°F)

Weight: 4 - 12 lbs. depending on capacity

AC Input Voltage

120VAC or 277VAC: 60 Hz. operation standard **Optional 220-240VAC:** 50/60 Hz.

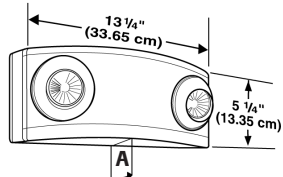
Power consumption for LZ2 and LZ15

Maximum: 4.0W, 120VAC or 277VAC **Normal:** 1.3W, 120VAC or 277VAC

Power consumption for LZ15N and larger

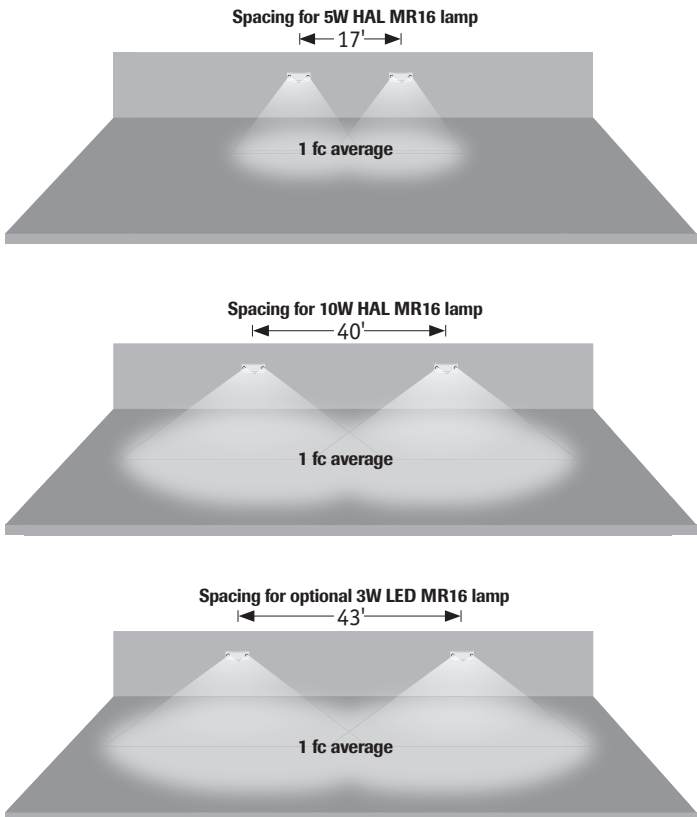
	Lead-Acid Battery		Nickel-Cadmium Battery	
	6 Volt	12 Volt	6 Volt	12 Volt
Maximum	14W	14.0W	11.1W	11.1W
Normal	1.8W	2.0W	8.4W	8.1W

DIMENSIONS



A
Standard size (LZ2, LZ15) depth is 3.625" (9.2cm).
High capacity model depth is 5.125" (13cm).

APPLICATION DATA



Meets Life Safety Code minimum illuminance of 0.1 fc and average illuminance of 1.0 fc. Assumes open space with no obstructions, mounting height of 75', ceiling height of 9' and reflectances of 80/50/20 on a 3' path. Photometry files available on the Dual-Lite web site (www.dual-lite.com).

Dual-Lite • www.dual-lite.com

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0601469 C 6/11



EVR Series

Architectural LED Emergency Light

FEATURES

The EVR LED remote offers compact architectural design which matches the EV LED unit in size and performance. The use of a EVR2 remote doubles the multiple unit spacing, cuts down on AC wiring requirements and can be installed up to 50' from the EV unit. The EVR LED remote is designed to run on DC input provided from a EV4 remote capacity emergency light. The EVR2 is illuminated by 2 LED lamp-heads which are fully adjustable. The housing is made of UV stable thermoplastic with a light texture. The EVR matches the EV unit in color and texture. Available in White or Black finish. The EVR remote can be wall or ceiling mounted by use of a molded-in template and wired through the back-plate or conduit entry.

Input Power Requirements

4.8 Vdc at 2 watts provided from the EV4D or EV4DI emergency light with remote capacity

Specific LED information

Lamp Color: Cool White

Total Lamp Output: 88 Lumens per LED

System Efficacy: 80lm/W

Rated LED Lamplife: Greater than 100,000 hrs.

Warranty

LED Lifetime Warranty

EVR Full 3 year warranty

Remote Lighting Heads

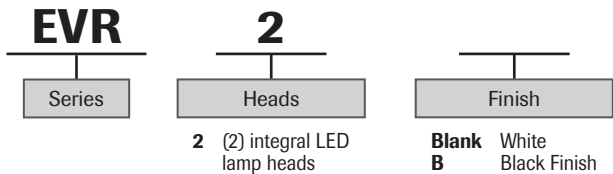
Catalog Number	
Comments	Type



Patents Pending

Caution: The EVR2 remote can only accept input power from the EV4D with remote capacity. The EVR2 will not work with any other emergency units.

ORDERING GUIDE



EVO Series

Outdoor LED Remote

FEATURES

The EVO outdoor LED remote is a single or double head LED based remote which accepts DC input from an EV emergency light with remote capacity (EV4 model). The EVO is best utilized as an over the door path of egress light for emergency operation. The EVO uses a single 3 watt rated LED per lamp-head and can be located up to 50' from the external power source. Available in white or black corrosion resistant finish. Lamp housing and mounting plate are made of durable die-cast aluminum.

Input Power Requirements

4.8Vdc at 1 watt per head provided exclusively from an EV4D or EV4DI emergency light with remote capacity

Specific LED information

Lamp Color: Cool White

Total Lamp Output: 88 Lumens per head

System Efficacy: 80 Lumens per LED

Rated LED Lamplife: Greater than 100,000 hrs.

Warranty

LED Lifetime Warranty

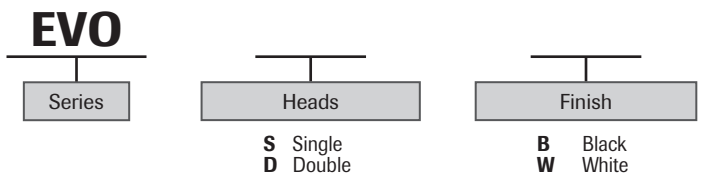
EVO Full 3 year warranty

Catalog Number	
Comments	Type



Caution: The EVO remote can only accept input power from the EV4D or EV4DI emergency light. The EVO will not work with any other emergency units.

ORDERING GUIDE



Hubbell Lighting, Inc.



Remote Lighting Heads

PGR *PGR High Performance LED Remote*

Catalog Number	
Comments	Type

FEATURES

The PGR offers LED performance in a remote fixture. Architectural style for indoor or outdoor application. The unit is illuminated by 4 high power LED's arranged so that in the event of 1 or 2 LED failures the unit will continue to operate. The PGN accepts DC voltage which must be supplied from an external 6-12V DC emergency lighting unit. Housing and mounting plate are constructed of 1/8" die-cast aluminum and sealed with a 1/8" closed-cell silicone gasket. Housing finish is powder coated electro-deposition paint available in four colors: dark bronze, white, platinum silver and black. Remote can be wall-mounted by use of a universal molded-in template. Wired from the j-box through the back or through a conduit entry at the top.

Input Power Requirements

12 watts at 6vDC, 13 watts at 12vDC

Specific LED information

Lamp Color: neutral White, 4000K

Color Rendering Index(CRI): 75

Total Lamp Output: 445 Lumens min. Initial

LED Lamplife: 48,000 hrs. at 70% of Initial

U.S. Patent No. D627,916



White



Black

ORDERING GUIDE

PGR

Series

W

Finish

- W** White
- Z** Dark Bronze
- P** Platinum Silver
- B** Black

LZ Series

Matching Remote Lighting Heads

Catalog Number	
Comments	Type

FEATURES

Architectural/commercial design. High performance MR-16 halogen lamps standard. Mounts to standard electrical boxes using universal mounting plate provided. Fixture housing mounts to back plate in a choice of four mounting positions. Housings secured using locking screws provided.

ORDERING GUIDE

LZR

Series

S

Heads

- S** Single
- D** Double

W

Finish

- W** White
- B** Black

06

Volts

- 06** 6VDC
- 12** 12VDC

03L

Watts

- 05** 5 watt halogen
- 10** 10 watt Halogen
- 03L** 3 watt LED



Hubbell Lighting, Inc.

Replacement lamp part numbers and photometrics are available on the web at www.dual-lite.com.



CPR Series

Decorative Indoor Remote Lighting Heads

FEATURES

Injection molded thermoplastic decorative lamphead and mounting plate assembly. Mounts to 3½" octagonal or single gang boxes. Single and twin lamp fixtures with MR16 lamp included. Standard finish is available in white or black.

ORDERING GUIDE

CPR	S	W	O3L
Series	Heads	Finish	Lamp
	S Single D Double	W White B Black	0605 6 Volt, 5 Watt Halogen 0603L 6 Volt, 3 Watt LED 1203L 12 Volt, 3 Watt LED

Remote Lighting Heads

Catalog Number	
Comments	Type



OCR Series

Decorative Outdoor Remote Lighting Heads

FEATURES

Outdoor UL Wet Location Listed die cast aluminum lamp head and mounting plate assembly complete with MR 16 lamp. Single or twin lamp fixtures available in dark bronze, black or white polyester powder coat finish. Mounts to 3½" octagonal or single gang boxes. Available with 5 watt lamps. Housing rated up to 50 watts. Lamps higher than 5 watts supplied by others.

ORDERING GUIDE

OCR	S	W	O3L
Series	Heads	Finish	Lamp
	S Single D Double	W White B Black Z Dark Bronze	0605 6 Volt, 5 Watt Halogen 0603L 6 Volt, 3 Watt LED 1203L 12 Volt, 3 Watt LED

Catalog Number	
Comments	Type





Remote Lighting Heads

SRH Series

Standard Remote Lighting Heads

FEATURES

Injection molded thermoplastic lamphead/round mounting plate assemblies. Mounts to 3 1/2" octagonal or single gang boxes. For use with most commercial or industrial emergency fixtures. Standard finish is available in white or black. Single and twin lamp fixtures with a choice of incandescent or halogen PAR 36 lamps.

ORDERING GUIDE

SRH	S	W	0620
Series	Heads	Finish	Lamp
	S Single D Double	W White B Black	0605 6 volt, 5.4 watts Incandescent ¹ 0607 6 volt, 7.2 watts Incandescent ¹ 0608 6 volt, 8 watts Halogen 0612 6 volt, 12 watts Halogen 0618 6 volt, 18 watts Incandescent 0620 6 volt, 20 watts Halogen 0625 6 volt, 25 watts Incandescent 1207 12 volt, 7.2 watts Incandescent ¹ 1208 12 volt, 8 watts Halogen 1212 12 volt, 12 watts Halogen 1218 12 volt, 18 watts Incandescent 1225 12 volt, 25 watts Incandescent 1235 12 volt, 35 watts Incandescent 2409 24 volt, 9 watts Incandescent ¹

¹Sealed Beam Type Lamp

Catalog Number	
Comments	Type



OMS Series

Outdoor Remote Lighting Heads

FEATURES

Outdoor aluminum spot with sealed lamp and swivel assembly. Furnished with round gasketed aluminum mounting plate. Mounts to 3 1/2" octagonal boxes.

ORDERING GUIDE

OMS	S	W	0620
Series	Heads	Finish	Lamp
	S Single D Double	W White B Black	0605 6 volt, 5.4 watts Incandescent ¹ 0607 6 volt, 7.2 watts Incandescent ¹ 0608 6 volt, 8 watts Halogen 0612 6 volt, 12 watts Halogen 0618 6 volt, 18 watts Incandescent 0620 6 volt, 20 watts Halogen 0625 6 volt, 25 watts Incandescent 1207 12 volt, 7.2 watts Incandescent ¹ 1208 12 volt, 8 watts Halogen 1212 12 volt, 12 watts Halogen 1218 12 volt, 18 watts Incandescent 1225 12 volt, 25 watts Incandescent 1235 12 volt, 35 watts Incandescent 1250 12 volt, 50 watts Incandescent

¹Sealed Beam Type Lamp

Catalog Number	
Comments	Type





Remote Lighting Heads

AHD

All Metal Remote Lighting Heads

FEATURES

Stamped aluminum housing with metal swivel. Standard finish available in white or black. Choice of incandescent or halogen PAR 36 lamps.

ORDERING GUIDE

AHD	S	W	0620	
Series	Style	Finish	Lamp	
	S Single D Double	W White B Black	0605	6 volt, 5.4 watts Incandescent ¹
			0607	6 volt, 7.2 watts Incandescent ¹
			0608	6 volt, 8 watts Halogen
			0612	6 volt, 12 watts Halogen
			0618	6 volt, 18 watts Incandescent
			0620	6 volt, 20 watts Halogen
			0625	6 volt, 25 watts Incandescent
			1207	12 volt, 7.2 watts Incandescent ¹
			1208	12 volt, 8 watts Halogen
			1212	12 volt, 12 watts Halogen
			1218	12 volt, 18 watts Incandescent
2407	24 volt, 7.2 watts Incandescent ¹		1225	12 volt, 25 watts Incandescent
2413	24 volt, 13 watts Incandescent ¹		1235	12 volt, 35 watts Incandescent
2418	24 volt, 18 watts Incandescent ¹		1250	12 volt, 50 watts Halogen
2428	24 volt, 28 watts Incandescent ¹			

¹Sealed Beam Type Lamp

Catalog Number	
Comments	Type



GNX Series

Environmental Lighting Heads

FEATURES

Moisture resistant thermoplastic head in black finish with coated lamp terminals and sealed swivel assembly. Furnished with mounting plate. Available with a choice of incandescent or halogen PAR 36 lamps. Matches N4X series units.

ORDERING GUIDE

GNX	S	B	0620		W
Series	Style	Finish	Lamp		Options
	S Single D Double	B Black	0607	6 volt, 7.2 watts Incandescent ¹	L Shatter Containment ²
			0608	6 volt, 8 watts Halogen	
			0612	6 volt, 12 watts Halogen	
			0618	6 volt, 18 watts Incandescent	
			0620	6 volt, 20 watts Halogen	
			0625	6 volt, 25 watts Incandescent	
			1208	12 volt, 8 watts Halogen	
			1209	12 volt, 9 watts Incandescent ¹	
			1212	12 volt, 12 watts Halogen	
			1218	12 volt, 18 watts Incandescent	
			1225	12 volt, 25 watts Incandescent	
			1235	12 volt, 35 watts Incandescent	

¹Sealed Beam Type Lamp

²Not available on Sealed Beam Type Lamps

Available with shatter containment option. Add "-L" to model number for Sealed Beam Lamps PAR36 only. Example: GNXSB0625-L

Catalog Number	
Comments	Type



Replacement lamp part numbers and photometrics are available on the web at www.dual-lite.com.



Hubbell Lighting, Inc.



C1D2R/C1D2TR

FEATURES

Suitable for wet and damp location applications. Rated for NEC Class I, Division 2, Groups B, C and D as well as Class I, Zone 2, Group IIB + H2 environments. Black housing and head assemblies. Single (C1D2R) and twin (C1D2TR) head models.

ORDERING GUIDE

MODEL NUMBERS		LAMPS*	
SINGLE HEAD HUB LEFT SIDE ^{1,2}	TWIN HEAD HUB LEFT SIDE ^{1,2}	VOLTS	WATTS
C1D2R-6V8W	C1D2TR-6V8W	6	8
C1D2R-6V12W	C1D2TR-6V12W	6	12
C1D2R-12V8W	C1D2TR-12V8W	12	8
C1D2R-12V12W	C1D2TR-12V12W	12	12

* PAR 36 Halogen sealed beam lamps.

¹Hub Right Side — add "R" to end of model number. Example C1D2R-6V8WR.

²Hubs Both Sides — add "F" to end of model number. Example C1D2R-6V8WF.

Remote Lighting Heads

Catalog Number	
Comments	Type



3R Listed

124R

Recessed Rectangle

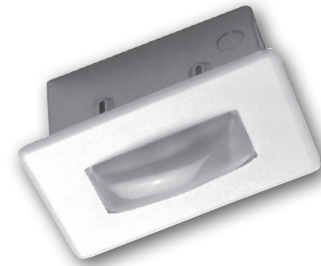
FEATURES

Recessed mounted fixture with frosted lens. White trim. Dimensions: 8 3/16" x 4 1/2" x 4"

ORDERING GUIDE

DC BAYONET BASE		
MODEL NUMBERS	LAMP VOLTS	LAMP WATTS
124R-0628	6	28
124R-1228	12	28

Catalog Number	
Comments	Type



122

Gimbal

FEATURES

Adjustable (60° max.) recessed mounted fixture. Matte white trim. Dimensions: 8 1/2" dia. x 4 1/2"

ORDERING GUIDE

INCANDESCENT PAR 36 SEALED BEAM		
MODEL NUMBERS	LAMP VOLTS	LAMP WATTS
122SB-0625	6	25

Catalog Number	
Comments	Type



Replacement lamp part numbers and photometrics are available on the web at www.dual-lite.com.

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0602008 E 5/12



FEATURES & SPECIFICATIONS

INTENDED USE

Low-profile static luminaire provides general illumination for recessed applications; ideal for restricted plenum spaces.

ATTRIBUTES

Designed exclusively for use with T8 lamps, electronic ballasts and sockets.

CONSTRUCTION

Smooth hemmed sides and smooth, inward formed end flanges for safe handling. Lighter weight fixture allows for safe, easy installation.

Standard steel door frame has superior structural integrity with premium extruded appearance and precision flush mitered corners. Steel door allows easy lens replacement without frame disassembly (for lenses up to .156" thick). Powder painted, steel latches provide easy, secure door closure.

Superior mechanical light seal requires no foam gasketing. Integral T-bar clips secure fixture to T-bar system. Housing formed from cold-rolled steel. Acrylic shielding material 100% UV stabilized. No asbestos is used in this product.

FINISH

Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with high-gloss, baked white enamel.

ELECTRICAL SYSTEM

Standard ballast is electronic, thermally protected, resetting, Class P, HPF, non-PCB, UL Listed, CSA certified ballast, universal voltage and sound rated A.

Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

LISTING

Standard: UL. Optional: Canada — CSA or cUL; Mexico — NOM.

WARRANTY

Guaranteed for one year against mechanical defects in manufacture.

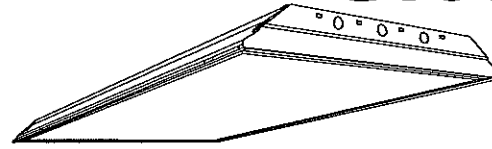
US patents: 6,210,025; 6,231,213; 2,288,471.

Specifications subject to change without notice.

Catalog Number	
2GT8232A12MVOLTADOLP	
Notes	Type
CITY OF PORTLAND	

General Purpose T8 Troffer

GT8 2'x4'

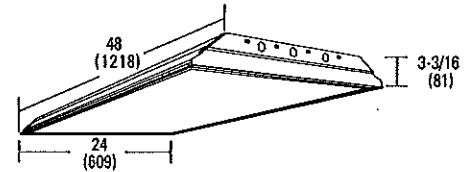


2, 3 or 4 Lamps



Specifications

Length: 48 (1218)
 Width: 24 (609)
 Depth: 3-3/16 (81)
 Weight: 22 lbs (9.9 kg)



All dimensions are inches (millimeters).

ORDERING INFORMATION

For shortest lead times, configure product using standard options (shown in bold).

Example: 2GT8 4 32 A12 MVOLT 1/4 GEB10IS

2GT8	2	32		MVOLT	ADOLP
Series	Number of lamps		Door frame	Voltage	Options ²
2GT8 2' wide	2 3 4 Not included.		(blank) Flush steel, white FN Flush aluminum, natural FM Flush aluminum, matte black FW Flush aluminum, white RN Regressed aluminum, natural RM Regressed aluminum, matte black RW Regressed aluminum, white	120 277 347 MVOLT Others available.	1/4 One 4-lamp ballast 1/3 One 3-lamp ballast GEB10IS Electronic ballast, ≤10% THD, instant start GEB10RS Electronic ballast, ≤10% THD, rapid start EL Emergency battery pack (nominal 300 lumens) EL14 Emergency battery pack (nominal 1400 lumens) GLR Internal fast-blow fuse GMF Internal slow-blow fuse LST Tandem-wired fixture pairs (shared ballasts) PWS1836 6' prewire, 3/8" dia., 18-gauge, 1 circuit
Trim type	Lamp type		Diffuser type		LP_ Lamped, specify lamp type and color LP735 Lamped; 700-series, 3500K LP741 Lamped; 700-series, 4100K JP Palletized and stretch-wrapped without individual cartons; grid trim
(blank) Grid F Overlapping flanged	32 32W T8 (48")		A12 #12 pattern acrylic A12125 #12 pattern acrylic, .125" thick A19 #19 pattern acrylic, .156" thick A15 #15 pattern acrylic, .2" thick PC1S 1/2" x 1/2" x 1/2" plastic cube louver, silver PC2S 1-1/2" x 1-1/2" x 1" plastic cube louver, silver w/ flange ¹ PC3S 3/4" x 3/4" x 1/2" plastic cube louver, silver		CSA CSA Certified NOM NOM Certified

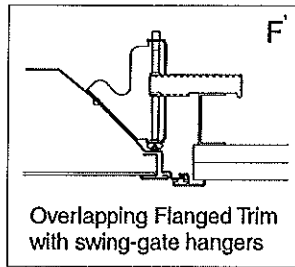
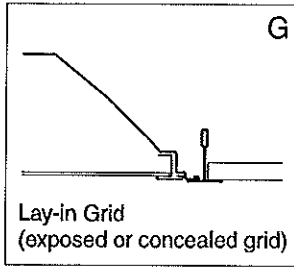
NOTES:

- Available with flush door frames only.
- MVOLT standard for 120-277V applications, 50-60 hz operation. Some options require voltage specified.

GT8 2'x4' Static T8 Troffer

MOUNTING DATA

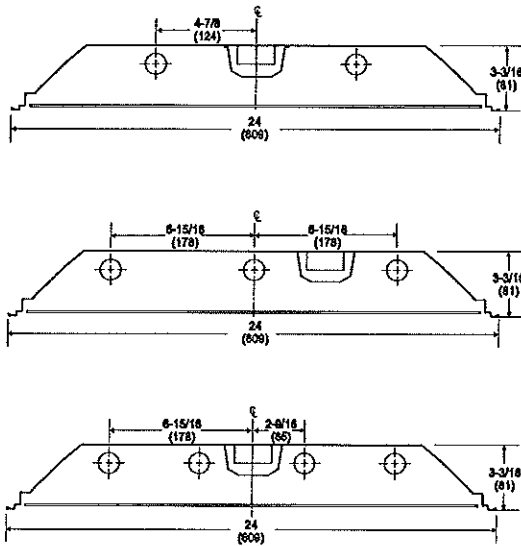
Continuous row mounting of flanged units requires CRE and CRM trim options (see Options).



NOTE:

1 Recommended rough-in dimensions for F-trim fixtures 24"x48". (Tolerance is +1/4"-0"). Swing-gate range 1-3/16" to 3-15/16". Swing-gate span 23-3/8" to 26-11/16". Fixture swing-gate points require additional 1-1/16" over nominal fixture height.

DIMENSIONS



PHOTOMETRICS

Calculated using the zonal cavity method in accordance with IESNA LM41 procedure. Floor reflectances are 20%. Lamp configurations shown are typical. Full photometric data on these and other configurations available upon request.

2GT8 2 32 A12

Report LTL 7424
Lumens per lamp - 2850 - Lum. eff. - 81.7%
S/MH (along) 1.2 (across) 1.4
Coefficient of Utilization

Ceiling	80%			70%			50%		
	70%	50%	30%	70%	50%	30%	50%	30%	10%
0	97	97	97	95	95	95	91	91	91
1	89	86	82	87	84	81	80	78	76
2	82	75	70	80	74	69	71	67	63
3	75	67	60	73	65	59	63	58	54
4	69	59	52	67	58	52	56	51	46
5	63	53	46	62	52	46	51	45	40
6	59	48	41	47	47	40	46	40	35
7	54	44	37	53	43	36	42	36	31
8	51	40	33	49	39	33	38	32	28
9	47	37	30	46	36	30	35	29	25
10	44	34	27	43	33	27	32	27	23

2GT8 3 32 A12 1/3

Report LTL 7421
Lumens per lamp - 2850 - Lum. eff. - 80.1%
S/MH (along) 1.2 (across) 1.4
Coefficient of Utilization

Ceiling	80%			70%			50%		
	70%	50%	30%	70%	50%	30%	50%	30%	10%
0	95	95	95	93	93	93	89	89	89
1	88	84	81	85	82	79	79	76	74
2	80	74	69	78	72	68	70	66	62
3	74	66	59	72	64	58	62	57	53
4	68	58	52	66	57	51	55	50	46
5	62	52	45	61	52	45	50	44	40
6	58	47	40	56	47	40	45	39	35
7	54	43	36	52	42	36	41	35	31
8	50	39	33	49	39	32	38	32	28
9	47	36	30	45	36	29	35	29	25
10	44	33	27	43	33	27	32	27	23

2GT8 4 32 A12 1/4

Report LTL 7425
Lumens per lamp - 2850 - Lum. eff. - 78.6%
S/MH (along) 1.2 (across) 1.4
Coefficient of Utilization

Ceiling	80%			70%			50%		
	70%	50%	30%	70%	50%	30%	50%	30%	10%
0	94	94	94	91	91	91	87	87	87
1	86	82	79	84	81	78	77	75	73
2	79	73	68	77	71	67	68	64	61
3	72	64	58	70	63	57	61	56	52
4	66	57	51	65	56	50	54	49	45
5	61	51	45	60	51	44	49	43	39
6	57	47	40	55	46	39	44	39	34
7	53	42	36	51	42	35	40	35	31
8	49	39	32	48	38	32	37	31	27
9	46	35	29	45	35	29	34	29	25
10	43	33	27	42	32	27	32	26	22

Zonal Lumens Summary

Zone	Lumens%	Lamp%	Fixture
0-30	1372	24.1	29.4
0-40	2277	39.9	48.9
0-60	3907	68.5	83.9
0-90	4658	81.7	100.0
90-180	0	0	0
0-180	4658	81.7	100.0

Zonal Lumens Summary

Zone	Lumens%	Lamp%	Fixture
0-30	2066	24.2	30.2
0-40	3412	39.9	49.8
0-60	5768	67.5	84.2
0-90	6851	80.1	100.0
90-180	0	0	0
0-180	6851	80.1	100.0

Zonal Lumens Summary

Zone	Lumens%	Lamp%	Fixture
0-30	2718	23.8	30.3
0-40	4481	39.3	50.0
0-60	7553	66.3	84.2
0-90	8965	78.6	100.0
90-180	0	0	0
0-180	8965	78.6	100.0

Energy (Calculated in accordance with NEMA standard LE-5)

LER,FL	ANNUAL ENERGY COST*	LAMP DESCRIPTION	LAMP LUMENS	BALLAST FACTOR	WATTS
73	\$3.29	(2) 32WT8	2850	.90	58
70	\$3.43	(3) 32WT8	2850	.87	85
73	\$3.29	(4) 32WT8	2850	.88	109

* Comparative yearly lighting energy cost per 1000 lumens



An Acuity Brands Company



FEATURES & SPECIFICATIONS

INTENDED USE

Low-profile static luminaire provides general illumination for recessed applications; ideal for restricted plenum spaces.

ATTRIBUTES

Designed exclusively for use with T8 lamps, electronic ballasts and sockets.

CONSTRUCTION

Smooth hemmed sides and smooth, inward formed end flanges for safe handling. Lighter weight fixture allows for safe, easy installation.

Standard steel door frame has superior structural integrity with premium extruded appearance and precision flush mitered corners. Steel door allows easy lens replacement without frame disassembly (for lenses up to .156" thick). Powder painted, steel latches provide easy, secure door closure.

Superior mechanical light seal requires no foam gasketing. Integral T-bar clips secure fixture to T-bar system. Housing formed from cold-rolled steel. Acrylic shielding material 100% UV stabilized. No asbestos is used in this product.

FINISH

Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with high-gloss, baked white enamel.

ELECTRICAL SYSTEM

Standard ballast is electronic, thermally protected, resetting, Class P, HPF, non-PCB, UL Listed, CSA certified ballast, universal voltage and sound rated A.

Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

LISTING

UL Listed (standard). CSA Certified or NOM Certified (see Options).

WARRANTY

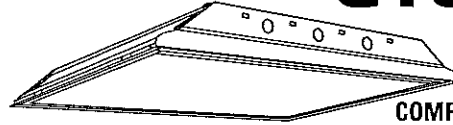
Guaranteed for one year against mechanical defects in manufacture.

US patents: 6,210,025; 6,231,213; 2,288,471.

Catalog Number	
2GT82U316MVOLTADOLP	
Notes	Type
CITY OF PORTLAND	

General Purpose T8 Troffer

GT8 2'x2'



**COMPACT FLUORESCENT,
STRAIGHT AND U LAMPS**
2, 3 or 4 Lamps
CF or T8 only



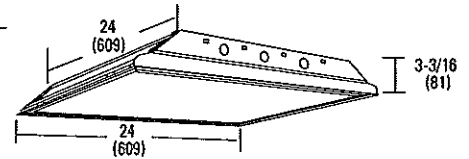
Specifications

Length: 24 (609)

Width: 24 (609)

Depth: 3-3/16 (81)

Weight: 19 lbs (8.6 kg)



All dimensions are inches (millimeters).

ORDERING INFORMATION

For shortest lead times, configure product using standard options (shown in bold).

Example: 2GT8 2 U316 A12 MVOLT GEB10IS

2GT8	2	U316	MVOLT	ADOLP
Series	Number of lamps	Door frame	Voltage	Options⁴
2GT8 2' wide	2 3 4 ¹ Not included.	(blank) Flush steel, white FN Flush aluminum, natural FM Flush aluminum, matte black FW Flush aluminum, white RN Regressed aluminum, natural RM Regressed aluminum, matte black RW Regressed aluminum, white	120 277 347 MVOLT Others available.	1/4 One 4-lamp ballast 1/3 One 3-lamp ballast GEB10IS Electronic ballast, ≤10% THD, instantstart GEB10RS Electronic ballast, ≤10% THD, rapid start EL Emergency battery pack (nominal 300 lumens) GLR Internal fast-blow fuse GMF Internal slow-blow fuse LST Tandem-wired fixture pairs (shared ballasts) PWS1836 6' prewire, 3/8" dia., 18-gauge, 1 circuit LP_ Lamped, specify lamp type and color LP735 Lamped, 700-series, 3500K JP Palletized and stretch-wrapped without individual cartons; grid trim only CSA CSA Certified NOM NOM Certified
Trim type	Lamp type	Diffuser type		
(blank) Grid F Overlapping flanged	17 17W T8 (24") U31 31W T8 (24") U316 31W T8 U (6" leg, 24")² CF40 40W TT5 (24")²	A12 #12 pattern acrylic A12125 #12 pattern acrylic, .125" thick A19 #19 pattern acrylic, .156" thick A15 #15 pattern acrylic, .2" thick PC1S 1/2" x 1/2" x 1/2" plastic cube louver, silver PC2S 1-1/2" x 1-1/2" x 1" plastic cube louver, silver w/ flange ³ PC3S 3/4" x 3/4" x 1/2" plastic cube louver, silver		

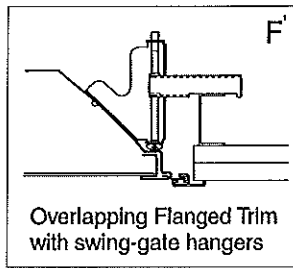
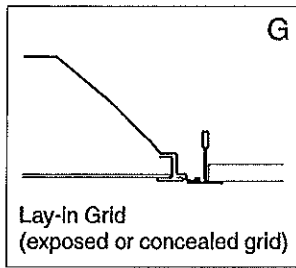
NOTES:

- 4-lamp models available with 17-watt straight tubes only.
- Not available on 3-lamp models. Use U31.
- Available with flush door frames only.
- MVOLT standard for 120-277V applications, 50-60 hz operation. Some options require voltage specified.

GT8 2'x2' Static T8 Troffer

MOUNTING DATA

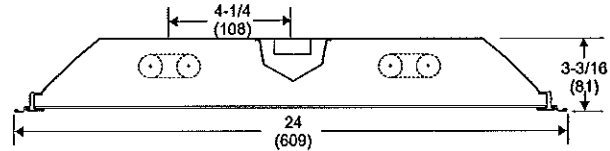
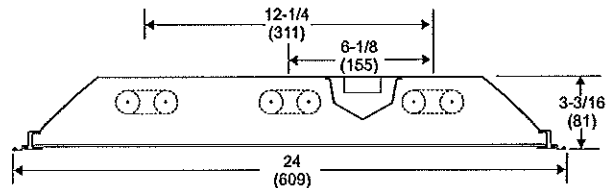
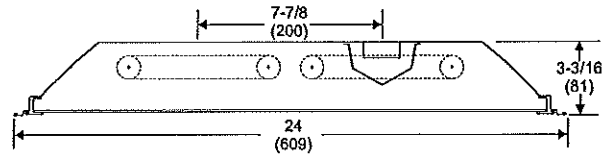
Continuous row mounting of flanged units requires CRE and CRM trim options (see Options).



NOTE:

1 Recommended rough-in dimensions for F-trim fixtures 24"x24". (Tolerance is +/-1/4" 0")
Swing-gate range 1-3/16" to 3-15/16". Swing-gate span 23-3/8" to 26-11/16". Fixture swing-gate points require additional 1-1/16" over nominal fixture height.

DIMENSIONS



PHOTOMETRICS

Calculated using the zonal cavity method in accordance with IESNA LM41 procedure. Floor reflectances are 20%. Lamp configurations shown are typical. Full photometric data on these and other configurations available upon request.

2GT8 2CF40 A12

Report LTL 7533

Lumens per lamp - 3150 - Lum. eff. - 84.3%

S/MH (along) 1.2 (across) 1.4

Coefficient of Utilization

Ceiling Wall	80%		70%			50%			
	70%	50%	30%	70%	50%	30%	50%	30%	10%
0	100	100	100	98	98	98	94	94	94
1	92	89	85	90	87	84	83	81	78
2	85	78	73	82	77	72	74	70	66
3	78	69	63	76	68	62	66	60	56
4	71	62	55	70	61	54	59	53	49
5	66	56	48	64	55	48	53	47	42
6	61	50	43	60	50	43	48	42	38
7	57	46	39	55	45	38	44	38	33
8	53	42	35	52	41	35	40	34	30
9	49	39	32	48	38	32	37	31	27
10	46	36	29	45	35	29	34	29	25

Zonal Lumens Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1664	26.4	31.3
0-40	2736	43.4	51.5
0-60	4514	71.6	85.0
0-90	5309	84.3	100.0
90-180	0	0	0
0-180	5309	84.3	100.0

2GT8 2U316 A12

Report LTL 7534

Lumens per lamp - 2600 - Lum. eff. - 72.9%

S/MH (along) 1.2 (across) 1.4

Coefficient of Utilization

Ceiling Wall	80%		70%			50%			
	70%	50%	30%	70%	50%	30%	50%	30%	10%
0	87	87	87	85	85	85	81	81	81
1	80	77	74	78	75	72	72	70	68
2	73	68	63	71	66	62	64	60	57
3	67	60	54	65	59	54	57	52	49
4	62	54	48	60	53	47	51	46	42
5	57	48	42	56	47	42	46	41	37
6	53	44	37	52	43	37	42	36	32
7	49	40	34	48	39	33	38	33	29
8	46	36	30	45	36	30	35	30	26
9	43	33	28	42	33	27	32	27	23
10	40	31	25	39	30	25	30	25	21

Zonal Lumens Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1191	22.9	31.4
0-40	1950	37.5	51.4
0-60	3220	61.9	84.9
0-90	3793	72.9	100.0
90-180	0	0	0
0-180	3793	72.9	100.0

2GT8 3U31 A12 1/3

Report LTL 7537

Lumens per lamp - 2800 - Lum. eff. - 70.9%

S/MH (along) 1.2 (across) 1.3

Coefficient of Utilization

Ceiling Wall	80%		70%			50%			
	70%	50%	30%	70%	50%	30%	50%	30%	10%
0	84	84	84	82	82	82	79	79	79
1	78	74	72	76	73	70	70	68	66
2	71	66	61	69	64	60	62	58	55
3	65	58	53	64	57	52	55	51	47
4	60	52	46	59	51	46	49	45	41
5	56	47	41	54	46	40	45	40	36
6	51	42	36	50	42	36	41	35	32
7	48	39	33	47	38	32	37	32	28
8	45	35	30	43	35	29	34	29	25
9	42	32	27	41	32	27	31	26	23
10	39	30	25	38	30	24	29	24	21

Zonal Lumens Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1876	22.3	31.5
0-40	3070	36.5	51.5
0-60	5058	60.2	84.9
0-90	5956	70.9	100.0
90-180	0	0	0
0-180	5956	70.9	100.0

Energy (Calculated in accordance with NEMA standard LE-5)

LER,FL	ANNUAL ENERGY COST*	LAMP DESCRIPTION	LAMP LUMENS	BALLAST FACTOR	WATTS
61	\$3.93	(2) 40W T15	3150	.88	76
56	\$4.29	(2) 31W T8 U6	2600	.88	60
66	\$3.64	(3) 31W T8 U	2800	.88	79

* Comparative yearly lighting energy cost per 1000 lumens



An AcuityBrands Company



FEATURES & SPECIFICATIONS

INTENDED USE

Ideal where high brightness and good illumination levels are required such as retail, light industrial and warehouses.

ATTRIBUTES

Fixture can be assembled with snap together components and requires no tools. Available in one lamp or two lamp configuration.

CONSTRUCTION

Heavy-duty channel, die-formed from code-gauge steel.

Sturdy channel cover secured by captive quarter-turn latch for easy access to wireway.

Combination endplate/channel connector furnished with each fixture.

FINISH

Five-stage iron phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with high-gloss, baked white enamel.

ELECTRICAL SYSTEM

Thermally protected, resetting, Class P, UL Listed and CSA Certified ballast is standard. Sound rating depends on lamp/ballast combination.

AWM, TFN, THHN wire throughout, rated for required temperatures.

INSTALLATION

For unit or row installations, surface or suspended mounting.

LISTING

UL listed to US and Canadian safety standards. Optional: Mexico NOM.

WARRANTY

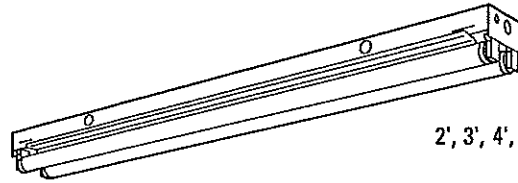
Guaranteed for one year against mechanical defects in manufacture.

Specifications subject to change without notice.

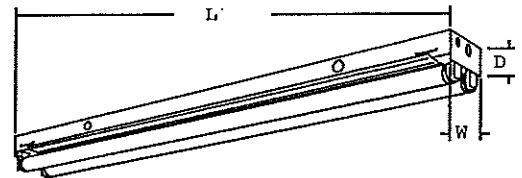
Catalog Number	TC232MVOLTADOPL	<i>S</i>
Notes	CITY OF PORTLAND	Type

General-Purpose Strip

C



2', 3', 4', 6' or 8' length
1 or 2 lamps



Specifications

Length:	24" (610)
	36" (914)
	48" (1219)
	72" (1829)
	96" (2438)
Width:	4-3/8" (111)
Fixture Depth:	2-1/16" (52)

All dimensions are inches (millimeters).

ORDERING INFORMATION

For shortest lead times, configure product using standard options (shown in bold).

Example: C 2 32 MVOLT GEB10IS

C			
Series	Lamp type	Voltage	Options
C General-purpose strip For tandem double-length unit, add prefix T. Example: TC	T8 17 17W T8 (24") 25 25W T8 (36") 32 32W T8 (48") 96T8 59W T8 slimline (96")	MVOLT^{1,2} 120 277 347 Others available.	GEB Electronic ballasts, $\leq 20\%$ THD ³ GEB10IS Electronic ballasts, $\leq 10\%$ THD instant start ^{1,2} GEB10RS T8 electronic ballast, $\leq 10\%$ THD, rapid start BILP High-efficiency ballast, .78bf (low), instant start BINP T8 high-performance ballast, .88 bf (normal), instant start BIHP T8 high-performance ballast, 1.20 bf (high), instant start ⁴ 1/4 One four-lamp ballast ⁵ EL Emergency battery pack (nominal 300 lumens) GLR Internal fast-blow fuse (add X for external) ⁶ GMF Internal slow-blow fuse (add X for external) ⁶ PLR_ Plug-in wiring; specify 1, 2 or 3 branch circuits and hot wires (A = Black, B = Red, C = Blue, AB or AC) TILW Tandem in-line wiring CW Cold-weather ballast; 0°F starting temp CSA CSA Certified (only required for 347V) NOM NOM Certified
Number of lamps	T12 Slimline 36 30W slimline (36") 48 38W slimline (48") 72 55W slimline (72") 96 75W slimline (96")		
1 2 Not included.			

Accessories

Order as separate catalog numbers.

SQ_	Swivel-stem hanger (specify length in 2' increments).
1B	Ceiling spacer (adjusts from 1-1/2" to 2-1/2" from ceiling).
CONLGC	12" screw-on channel connector.
WGCUN	Wireguard, 4' white. ⁵
HC36	Chain hangers (1 pair, 36" long).
HRC	Hooker® T-bar hanger (flush to ceiling).
HRC1	Hooker® T-bar hanger (1-1/2" from ceiling).
WGCMSR	Wireguard, 4' white for symmetric reflector. ³
WGCASR	Wireguard, 4' white for asymmetric reflector. ³
CSMR48	Symmetric reflector, 4' white, 7" aperture. ³
CASR48	Asymmetric reflector, 4' white, 5-3/4" wide. ³

NOTES:

- 1 MVOLT standard for 120-277V applications, 50-60 mhz operation. Some options require voltage specified.
- 2 T8 lamps only.
- 3 Slimline lamps only.
- 4 Not available in 347V.
- 5 Not available in slimline.
- 6 Specify voltage.
- 7 Order two for 8' fixtures.

C General-Purpose Strip

MOUNTING DATA

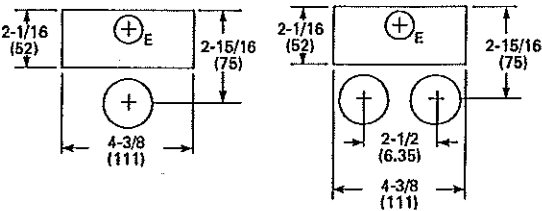
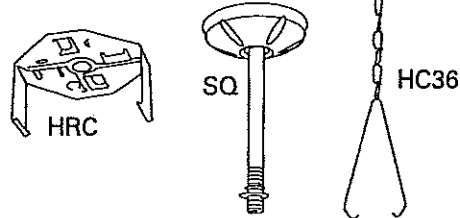
For unit or row installation, surface or suspended mounting.

Unit installation — Minimum of two hangers required.

Row installation — Two hangers per channel required. One per fixture plus one per row if CONLGC installed.

Hooker® (HRC) and HC Hangers — Minimum two per channel (unit and row)

See ACCESSORIES below for hanging devices.



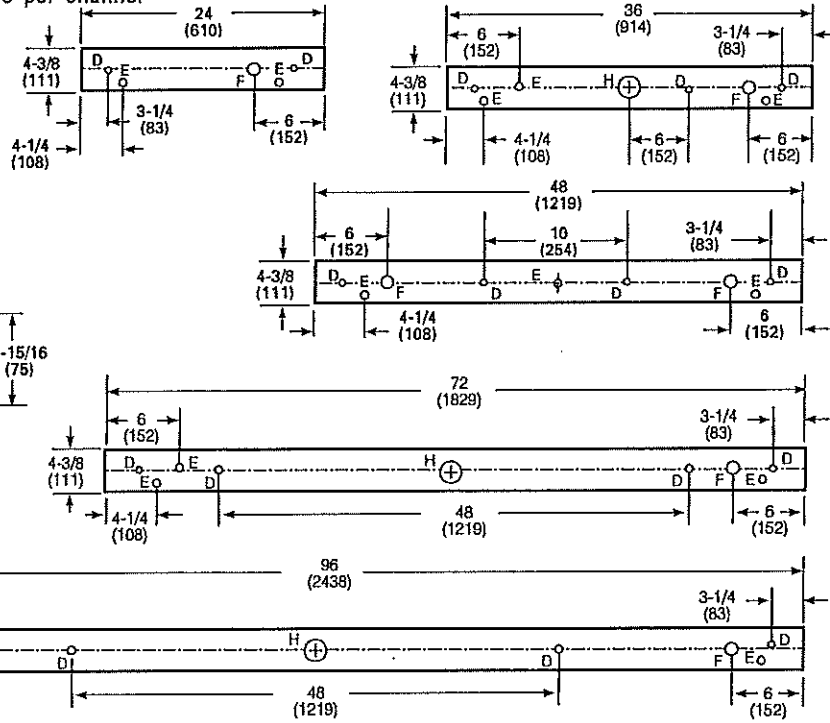
D = 11/16 (17) Dia.K.O.
 E = 7/8 (22) Dia.K.O.
 F = 1-1/4 (32) Dia.K.O.
 H = 2 (51) Dia.K.O.

DIMENSIONS

Inches (millimeters). Subject to change without notice.

48", 72" and 96" have only two 7/8" K.O.'s 6" from each end

24" and 36" have only two 7/8" K.O.'s 3-1/4" from each end



PHOTOMETRICS

Calculated using the zonal cavity method in accordance with IESNA LM41 procedure. Floor reflectances are 20%. Lamp configurations shown are typical. All data based on 25°C. Full photometric data on these and other configurations available upon request.

C 2 32

TEST NO: LTL 18310

LUMENS PER LAMP: 6300

C 2 32

TEST NO: LTL 5181

LUMENS PER LAMP: 2900

ROR	pc	Coefficients of Utilization								
		80%			70%			50%		
		50%	30%	10%	50%	30%	10%	50%	30%	10%
0		103	103	103	98	98	98	90	90	90
1		86	82	78	82	78	74	75	72	69
2		74	67	61	70	64	59	64	59	55
3		64	56	49	61	54	48	56	49	44
4		56	47	41	53	48	40	49	42	37
5		49	41	35	47	39	34	43	37	31
6		44	36	30	42	34	29	39	32	27
7		40	32	26	38	30	25	35	28	24
8		36	28	23	35	27	22	32	25	21
9		33	25	20	32	25	20	29	23	19
10		30	23	18	29	22	18	27	21	17

ROR	pc	Coefficients of Utilization								
		80%			70%			50%		
		50%	30%	10%	50%	30%	10%	50%	30%	10%
0		106	106	106	102	102	102	93	93	93
1		89	84	79	85	80	76	78	74	71
2		76	68	62	72	66	60	66	61	56
3		65	57	50	62	55	49	57	51	45
4		57	48	42	55	47	40	50	43	38
5		51	42	35	48	40	34	44	37	32
6		45	36	30	43	35	29	40	33	28
7		41	32	26	39	31	25	36	29	24
8		37	29	23	35	28	22	33	26	21
9		34	26	20	32	25	20	30	23	19
10		31	23	18	30	23	18	28	21	17

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1785.8	14.2	15.7
0° - 40°	3042.4	24.1	26.8
0° - 60°	5944.0	47.2	52.3
0° - 90°	9027.5	71.6	79.4
90° - 180°	2341.8	18.6	20.6
0° - 180°	11369.4	90.2	100.0

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	842.1	14.5	15.6
0° - 40°	1435.8	24.8	26.7
0° - 60°	2810.1	48.4	52.2
0° - 90°	4362.5	75.2	81.0
90° - 180°	1021.0	17.6	19.0
0° - 180°	5383.6	92.8	100.0

Energy (Calculated in accordance with NEMA standard LE-5)

LER.FL	ANNUAL ENERGY COST*	LAMP DESCRIPTION	LAMP LUMENS	BALLAST FACTOR	WATTS
86.2	\$2.79	(2)T8 F32	2900	.88	55

* Comparative yearly lighting energy cost per 1000 lumens

Energy (Calculated in accordance with NEMA standard LE-5)

ORDERING INFORMATION	LER.FL	ANNUAL ENERGY COST*	LAMP DESCRIPTION	LAMP LUMENS	BALLAST FACTOR	WATTS
C 2 32 MVOLT GEB10IS	77.6	\$3.09	F32T8/735	2800	.88	59
C 2 32 MVOLT BILP	93.6	\$2.56	F32T8/835/HT8	3100	.78	48

* Comparative yearly lighting energy cost per 1000 lumens



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Sheet #: C

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Lithonia Lighting

Fluorescent

One Lithonia Way, Conyers, GA 30012

Phone: 770-922-9000, 800-315-4963, Fax: 770-602-1531

www.lithonia.com

FEATURES & SPECIFICATIONS

INTENDED USE — For applications that require the clean appearance of a flat-bottom diffuser. Provides high light levels for storage rooms, offices or retail applications. **Certain airborne contaminants can diminish integrity of acrylic.** [Click here for Acrylic Environmental Compatibility table for suitable uses.](#)

CONSTRUCTION — Linear side prisms control brightness, pyramidal bottom prisms minimize lamp image. Continuous side flanges on fixture body provide light trap and continuous diffuser support to prevent accidental opening and simplify maintenance. Full depth, white enamel end plates.

Die-formed from code gauge cold-rolled steel. Channel cover snaps into place without the use of tools. Full end cap factory installed to reduce job site labor. Diffuser is extruded clear acrylic.

Finish: Five-stage iron-phosphate pretreatment ensures superior paint adhesion and rust resistance. Finished with high-gloss, baked white enamel.

ELECTRICAL — Thermally protected, resetting, Class P, HPF, UL listed, CSA Certified ballast is standard. Energy saving and electronic ballasts are sound rated A.

Luminaire is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures.

INSTALLATION — For surface or stem mounting, individual or row installation.

LISTINGS — UL listed to U.S. and Canadian Safety Standards. Optional: Canada CSA or Mexico NOM

WARRANTY — 1-year limited warranty. Complete warranty terms located at

www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Note: Specifications subject to change without notice.

Catalog Number
Notes
Type

Square-Basket Wraparound

SB

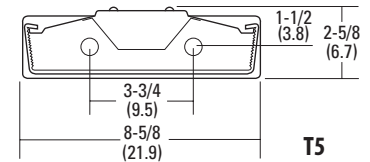
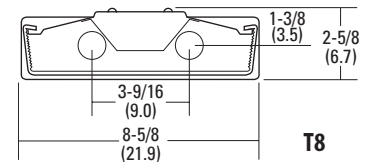
T8/T5
NARROW BODY
2', 4' or 8' lengths
2 lamps



Specifications

T8 Length:	24 (61.0)
	48 (122.0)
	96 (243.9)
T5 Length:	22-1/2 (57.2)
	46-1/2 (118.1)
	92-1/2 (235.0)
Width:	8-3/8 (21.2)
Depth:	2-5/8 (6.7)

All dimensions are inches (centimeters) unless specified otherwise.



ORDERING INFORMATION

For shortest lead times, configure products using standard options (**shown in bold.**)

Example: SB 2 32 MVOLT GEB10IS

Series	Lamp type	Voltage	Options
SB 2			
SB 2 2 lamps, 8-3/8" wide	17 17W T8 (24")	120	<u>Shipped installed in fixture</u>
For tandem double-length unit, add prefix T. Example: TSB	32 32W T8 (48")	277	GEB10IS Electronic ballast, ≤10% THD, instant start
	14T5 14W T5 (22-1/2")	347 ¹	GEB10RS Electronic ballast, ≤10% THD, program rapid start
	24T5HO 24W T5 HO (22-1/2")	MVOLT²	GEB10PS Electronic ballast, ≤10% THD, program start
	28T5 28W T5 (46-1/2")		GEB95 .95 ballast factor T5 ³
	54T5HO 54W T5 HO (46-1/2")		GEB95S .95 ballast factor T5 step dimming ³
			EL Emergency battery pack (nominal 300 lumens, see Life Safety Section) ⁴
			EL14 Emergency battery pack (nominal 1400 lumens, see Life Safety Section) ⁴
			GLR Internal fast-blow fuse ⁵
			GMF Internal slow-blow fuse ⁵
			RE 120V residential electronic ballast ⁶
			CSA Listed and labeled to comply with Canadian Standards
			NOM NOM certified
			SSR Specular silver interior finish (95% reflective)

Accessories: Order as separate catalog number.	
SQ_	Swivel-stem hanger (specify length in 2" increments)
1B	Ceiling spacer (1-1/2" to 2-1/2" from ceiling)

Notes

- Not available in GEB10PS.
- Electronic ballast 120 through 277V only.
- Only available with 14T5 or 28T5.
- Not available with T5 2' configuration.
- Must specify voltage.
- Must specify voltage, 120V. Energy Star[®] qualified.

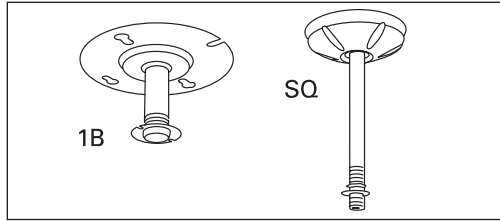
SB Square Basket Wraparound, Narrow Body

MOUNTING DATA

For unit or row installation. Surface or stem mounting. Stem mounting is not available with TSB.

UNIT INSTALLATION — Minimum of two hangers required.

ROW INSTALLATION — One hanger per fixture plus one per row required.



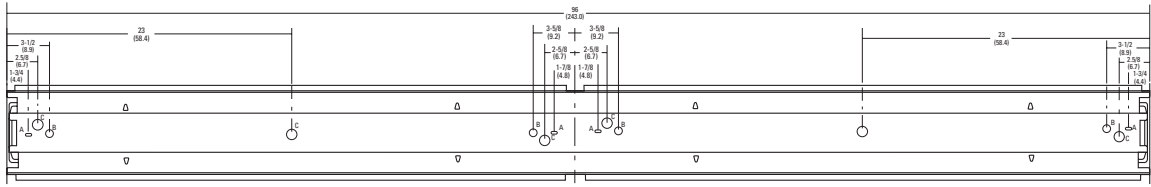
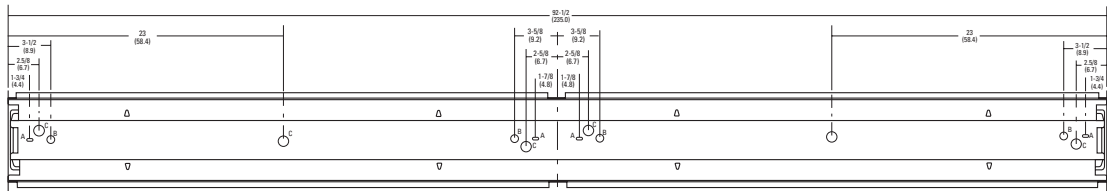
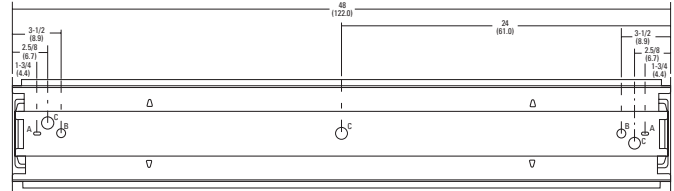
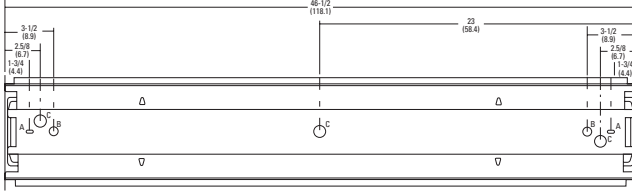
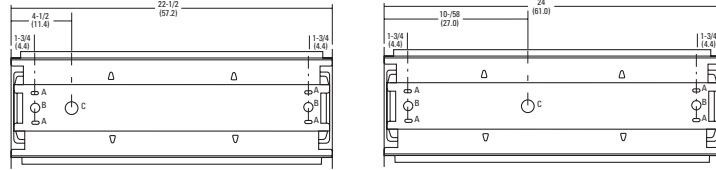
DIMENSIONS

All dimensions are inches (centimeters). Specifications subject to change without notice.

A = 1/4 x 1/2 (64 x 13) Oval Hole

B = 11/16 (17) Dia. K.O.

C = 7/8 (22) Dia. K.O.



PHOTOMETRICS

Calculated using the zonal cavity method in accordance with IESNA LM41 procedure. Floor reflectances are 20%. Lamp configurations shown are typical. All data based on 25°C. Full photometric data on these and other configurations available upon request.

Test # BAL16519 - SB 2 32 MVOLT GEB1015

Test # LTL 19931 - SB 2 28 T5 GEB95

Coefficient of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCR	pf	pc	pw	Coefficients of Utilization											
				80%				50%				20%			
				50%	30%	10%	0%	50%	30%	10%	0%	50%	30%	10%	0%
0	107	107	107	97	97	97	90	90	90	84	84	84	82		
1	93	90	86	85	82	79	79	77	75	74	73	71	68		
2	82	76	71	75	70	66	70	66	63	66	63	60	58		
3	73	65	60	66	61	56	62	58	54	59	55	52	49		
4	65	57	51	59	53	48	56	51	47	53	48	45	43		
5	58	50	44	53	47	42	50	45	41	48	43	39	37		
6	52	44	39	48	42	37	46	40	36	43	39	35	33		
7	47	40	34	44	38	33	42	36	32	40	35	31	29		
8	43	36	31	40	34	29	38	33	29	37	32	28	26		
9	40	32	28	37	31	27	35	30	26	34	29	25	24		
10	37	30	25	34	28	24	33	27	24	31	26	23	21		

RCC%	Effective Floor Cavity Reflectance: 20%																						
	80%				70%				50%				30%				10%				0%		
0	1.03	1.03	1.03	1.03	1.00	1.00	1.00	.79	.93	.93	.93	.87	.87	.87	.82	.82	.82	.79					
1	.94	.90	.86	.83	.91	.87	.84	.67	.82	.79	.77	.77	.75	.73	.72	.71	.69	.67					
2	.86	.79	.74	.69	.83	.77	.72	.57	.72	.68	.64	.68	.65	.61	.64	.61	.59	.56					
3	.79	.70	.63	.58	.76	.68	.62	.50	.64	.59	.55	.61	.56	.53	.57	.54	.51	.48					
4	.73	.63	.55	.50	.70	.61	.54	.43	.58	.52	.47	.54	.50	.46	.52	.47	.44	.42					
5	.67	.56	.49	.43	.65	.55	.48	.38	.52	.46	.41	.49	.44	.40	.47	.42	.39	.37					
6	.62	.51	.43	.38	.60	.50	.42	.34	.47	.41	.36	.45	.39	.35	.48	.38	.34	.32					
7	.58	.46	.39	.34	.56	.45	.38	.30	.43	.37	.32	.41	.36	.31	.39	.34	.31	.29					
8	.54	.42	.35	.30	.52	.41	.34	.27	.39	.33	.29	.38	.32	.28	.36	.31	.28	.26					
9	.50	.39	.32	.27	.49	.38	.31	.25	.36	.30	.26	.35	.29	.26	.33	.28	.25	.23					
10	.47	.36	.29	.25	.46	.35	.29	.23	.34	.28	.24	.32	.27	.23	.31	.26	.23	.21					

Zonal Lumens Summary

Zone	Lumens	%Lamp	%Fixture
0-30	1,274.4	24.5	27.7
0-40	2,085.0	40.1	45.3
0-60	3,401.4	65.4	73.9
60-90	726.3	14.0	15.3
70-100	483.1	9.3	10.5
90-120	350.6	6.7	7.6
0-90	4,127.8	79.4	89.6
90-180	476.6	9.2	10.4
0-180	5,604.4	88.5	100

Zonal Lumen Summary			
Zone	Lumens	% Lamp	% Fixture
0° - 30°	1444.3	24.5	26.6
0° - 40°	2374.5	40.2	43.7
0° - 60°	3953.3	67.0	72.8
0° - 90°	4821.6	81.7	88.8
90° - 180°	610.2	10.3	11.2
0° - 180°	5431.9	92.1	100.0

FEATURES & SPECIFICATIONS

INTENDED USE

Ideal for a wide variety of low- to medium-height ceiling applications including commercial, retail and hospitality spaces where an open or damp location lensed fixture is required.

CONSTRUCTION

Utilizes an extruded socket housing that attaches to the reflector via keyhole mount, which provides superior heat dissipation and extended lamp life. Socket housing also adjusts to accommodate varying lamp lengths. Galvanized steel mounting frame with mechanical trim retention (clips) ensures secure and flush reflector mounting to ceiling. Mounting frame has cutout section for remodel applications when installation from below is necessary.

Galvanized bar hangers span up to 24" o.c. and feature built-in T-bar clips and nailers for T-bar or wood joist installation.

Frames equipped with galvanized junction box UL Listed for through wire applications.

Maximum 1-1/2" ceiling thickness.

OPTICS

Aluminum full reflectors are optically designed to maximize lumen output and to provide superior glare control. Anodized finishes for open reflectors are semi-specular or diffuse in a variety of colors. Polyester powder coat finishes also are available in white.

Lenses are available in clear flat glass, tempered prismatic glass or polycarbonate to provide optimal visual comfort and improved aesthetics. Lens is recessed 7/8 (2.2) from flange.

ELECTRICAL

Electronic ballast with end of lamp life protection standard. Class P thermally protected ballast protects against improper contact with insulation. Minimum starting temperature is 0°F/-18°C.

Rated for #12 AWG conductor thru-branch wiring. Minimum 90° supply wire. Ground wire provided.

Lamp Socket Base:

DTT 4-pin lamps – 13W (G24Q-1); 18W (G24Q-2); 26W (G24Q-3)

TRT 4-pin lamps – 13W (GX24Q-1); 18W (GX24Q-2); 26W & 32W (GX24Q-3); 42W (GX24Q-4)

LISTINGS

Fixtures are UL Listed for thru-branch wiring, Non-IC recessed mounting, damp location, and to U.S. and Canadian Safety Standards.

Catalog Number
Notes
Type

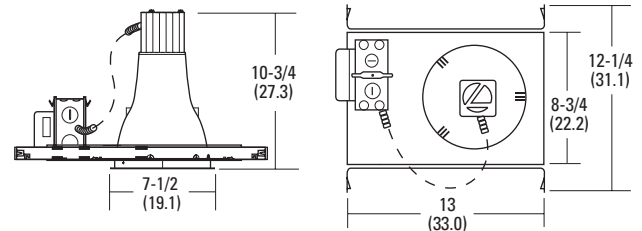
Compact Fluorescent Downlighting

6" 6VF



OPEN REFLECTOR

Vertical 1-Lamp, Double Twin-Tube (DTT) or Triple-Tube (TRT)



Specifications

Max. height: 10-3/4 (27.3)

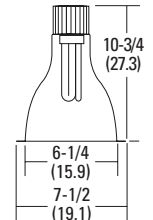
Ceiling opening: 7 (17.8)

Overlap trim: 7-1/2 (19.1)

Length: 13 (33.0)

Width: 12-1/4 (31.1)

All dimensions are inches (centimeters).



ORDERING INFORMATION

For shortest lead times, configure products using **bolded options**.

Example: 6VF 26-42TRT 609A MVOLT

6VF Series	Wattage/Lamp	Reflector/Color	Lens type	Voltage	Options ⁵
6VF	13DTT ¹	609 White open	(blank) No lens	MVOLT³	ADEZ Advance Mark 10™ electronic dimming ballast, 120V or 277V. Minimum dimming level 5%. Must be voltage specific.
	18DTT	609A Clear diffuse open	CGL Clear glass lens	120	ECOS Lutron EcoSystem electronic dimming ballast, 120V-277V. Must be wattage specific. Minimum dimming level 5%.
	26DTT	609AZ Clear semi-specular open	T73 Tempered glass prismatic lens	277	EL Emergency PSDL3 DL battery pack with integral test switch⁶
	13TRT ¹	609G Gold diffuse open	PCL Clear polycarbonate lens	347 ⁴	ELR Emergency PSDL3 DL battery pack with remote test switch⁶
	18TRT	609GZ Gold semi-specular open			ELHL IOTA I-420-R high lumen output emergency battery pack. Integral test switch provided. Maximum average lumen output 1300 (42W). ⁷
	26-42TRT²	609PR Pewter diffuse open			ELRHL IOTA I-420-EM-B high lumen output emergency battery pack. Remote test switch provided. Maximum average lumen output 1300 (42W). ⁷
	26TRT	609WTZ Wheat semi-specular open			GMF Single slow-blow fuse, must specify voltage
	32TRT				BDP Ballast disconnect plug (meets codes that require in-fixture disconnect) ⁴
	42TRT				RIF1 Radio interference filter
					WLP 35K lamp (shipped separately)
				TRW White flange	

Accessories: Order as separate catalog number.	
SCA6	Sloped ceiling adaptor. Degree of slope must be specified (10D, 15D, 20D, 25D, 30D) Ex: SCA6 10D.
CTE6	Ceiling thickness extender is used when ceiling thickness is greater than 1-1/2 (3.8). Maximum thickness 2 (5.1).

Notes

- Not available with ADEZ or ECOS.
- Not available with ECOS or WLP.
- Electronic multi-volt ballast capable of operating any line voltage from 120-277V, 50 or 60Hz.
- Not available with EL or ELR.

- For [additional options](#), see www.lithonia.com.
- Add 3" (7.6) to width and 4-1/2" (11.4) to length.
- Not recommended for field installation.

6" 6VF Vertical 1-Lamp, Double Twin-Tube (DTT) or Triple Tube (TRT), Open

Distribution Curve	Distribution Data	Output Data	Coefficient of Utilization	Illuminance Data at 30" Above Floor for a Single Luminaire
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6VF 32TRT 609A MVOLT, (1) 32W TRT lamp, 2400 rated lumens, 1.0 s/mh, test no. LTL11603

cp	Lumens	Zone	Lumens % Lamp	pf	20%						Task Height: 2.5ft.						
					pc	80%		70%		50%							
						pw	50%	30%	50%	30%		50%	30%				
0	912	0° - 30°	623.0	26.0	0	61	61	59	59	57	57	Initial FC					
5	943	0° - 40°	956.6	39.9	1	56	55	55	54	53	52	Mounting	Center	50% beam - 55.0'		10% beam - 92.0'	
15	782	0° - 60°	1214.7	50.6	2	51	49	50	48	49	47	Height	Beam	Diameter	fc	Diameter	FC
25	684	0° - 90°	1225.4	51.1	3	47	44	46	44	45	43	8.0	30.1	5.7	15.1	11.4	3.0
35	538	90° - 180°	0.0	0.0	4	43	40	43	40	42	39	10.0	16.2	7.8	8.1	15.5	1.6
45	311	0° - 180°	1225.4	*51.1	5	40	36	39	36	38	36	12.0	10.1	9.9	5.1	19.7	1.0
55	23			*Total Efficiency	6	37	33	36	33	36	33	14.0	6.9	12.0	3.4	23.8	0.7
65	7				7	34	31	34	30	33	30	16.0	5.0	14.0	2.5	28.0	0.5
75	2				8	32	28	31	28	31	28						
85	1				9	30	26	29	26	29	26						
90	0				10	28	24	27	24	27	24						

6VF 32TRT 609AZ MVOLT, (1) 32W TRT lamp, 2400 rated lumens, 1.0 s/mh, test no. LTL11604

cp	Lumens	Zone	Lumens % Lamp	pf	20%						Task Height: 2.5ft.						
					pc	80%		70%		50%							
						pw	50%	30%	50%	30%		50%	30%				
0	1032	0° - 30°	673.9	28.1	0	64	64	62	62	59	59	Initial FC					
5	1060	0° - 40°	1022.7	42.6	1	59	57	58	56	55	54	Mounting	Center	50% beam - 52.0'		10% beam - 91.4'	
15	857	0° - 60°	1281.7	53.4	2	54	52	53	51	51	50	Height	Beam	Diameter	fc	Diameter	FC
25	727	0° - 90°	1285.0	53.5	3	50	47	49	46	48	45	8.0	34.1	5.4	17.1	11.3	3.4
35	560	90° - 180°	0.0	0.0	4	46	42	45	42	44	41	10.0	18.3	7.3	9.2	15.4	1.8
45	333	0° - 180°	1285.0	*53.5	5	42	39	42	38	41	38	12.0	11.4	9.3	5.7	19.5	1.1
55	9			*Total Efficiency	6	39	36	39	35	38	35	14.0	7.8	11.2	3.9	23.6	0.8
65	2				7	36	33	36	32	35	32	16.0	5.7	13.2	2.8	27.7	0.6
75	1				8	34	30	33	30	33	30						
85	0				9	31	28	31	28	31	28						
90	0				10	29	26	29	26	29	26						

6VF 32TRT 609AZ CGL MVOLT, (1) 32W TRT lamp, 2400 rated lumens, 1.1 s/mh, test no. LTL15104

cp	Lumens	Zone	Lumens % Lamp	pf	20%						Task Height: 2.5ft.						
					pc	80%		70%		50%							
						pw	50%	30%	50%	30%		50%	30%				
0°	685	0° - 30°	478	19.9	0	48	48	47	47	45	45	50% beam - 10% beam					
5°	693	0° - 40°	746	31.1	1	44	43	44	43	42	41	57.4' - 92.5'					
15°	624	0° - 60°	962	40.1	2	41	39	40	38	39	37	Initial fc					
25°	566	0° - 90°	975	40.6	3	37	35	37	34	36	34	Mtg	Center	Diameter fc		Diameterfc	
35°	464	90° - 180°	0	0.0	4	34	32	34	31	33	31	Ht	Beam	Diameter	fc	Diameter	fc
45°	278	0° - 180°	975	40.6	5	31	29	31	28	30	28	8	22.6	6	11	11	2
55°	35			Efficiency: 40.6%	6	29	26	29	26	28	26	10	12.2	8	6	16	1
65°	9				7	27	24	26	24	26	23	12	7.6	10	4	20	1
75°	3				8	25	22	25	22	24	22	14	5.2	13	3	24	1
85°	1				9	23	20	23	20	22	20	16	3.8	15	2	28	0
90°	0				10	21	19	21	19	21	19						

6VF 32TRT 609AZ T73 MVOLT, (1) 32W TRT lamp, 2400 rated lumens, 1.1 s/mh, test no. LTL15105

cp	Lumens	Zone	Lumens % Lamp	pf	20%						Task Height: 2.5ft.						
					pc	80%		70%		50%							
						pw	50%	30%	50%	30%		50%	30%				
0°	1107	0° - 30°	665	27.7	0	61	61	59	59	57	57	50% beam - 10% beam					
5°	1144	0° - 40°	990	41.2	1	56	55	55	54	53	52	46.0' - 88.4'					
15°	994	0° - 60°	1218	50.8	2	52	49	51	49	49	47	Initial fc					
25°	739	0° - 90°	1227	51.1	3	48	45	47	44	46	43	Mtg	Center	Diameter fc		Diameterfc	
35°	577	90° - 180°	0	0.0	4	44	41	43	40	42	40	Ht	Beam	Diameter	fc	Diameter	fc
45°	357	0° - 180°	1227	51.1	5	41	37	40	37	39	36	8	36.6	5	18	11	4
55°	27			Efficiency: 51.1%	6	38	34	37	34	36	34	10	19.7	6	10	15	2
65°	8				7	35	32	35	31	34	31	12	12.3	8	6	18	1
75°	2				8	33	29	32	29	32	29	14	8.4	10	4	22	1
85°	0				9	30	27	30	27	30	27	16	6.1	11	3	26	1
90°	0				10	29	25	28	25	28	25						

FEATURES & SPECIFICATIONS

INTENDED USE

Ideal for a wide variety of low- to medium-height ceiling applications including commercial, retail and hospitality spaces where a wet location lensed fixture is required. Ideal for shower and outdoor applications.

CONSTRUCTION

Utilizes an extruded socket housing that attaches to the reflector via keyhole mount, which provides superior heat dissipation and extended lamp life. Socket housing also adjusts to accommodate varying lamp lengths. Galvanized steel mounting frame with mechanical trim retention (clips) ensures secure and flush reflector mounting to ceiling. Mounting frame has cutout section for remodel applications when installation from below is necessary.

Galvanized bar hangers span up to 24" o.c. and feature built-in T-bar clips and nailers for T-bar or wood joist installation.

Frames equipped with galvanized junction box UL Listed for through wire applications.

Maximum 1-1/2" ceiling thickness.

OPTICS

Aluminum full reflectors are optically designed to maximize lumen output and to provide superior glare control. Glass lenses are available in clear flat glass, tempered prismatic, drop opal or fresnel glass lenses to provide optimal visual comfort and improved aesthetics.

ELECTRICAL

Electronic ballast with end of lamp life protection standard. Class P thermally protected ballast protects against improper contact with insulation. Minimum starting temperature is 0°F/-18°C.

Rated for #12 AWG conductor thru-branch wiring. Minimum 90° supply wire. Ground wire provided.

Lamp Socket Base:

DTT 4-pin lamps – 13W (G24Q-1); 18W (G24Q-2); 26W (G24Q-3)

TRT 4-pin lamps – 13W (GX24Q-1); 18W (GX24Q-2); 26W & 32W (GX24Q-3); 42W (GX24Q-4)

LISTINGS

Fixtures are UL Listed for thru-branch wiring, Non-IC recessed mounting, wet location, and to U.S. and Canadian Safety Standards.

Catalog Number
Notes
Type

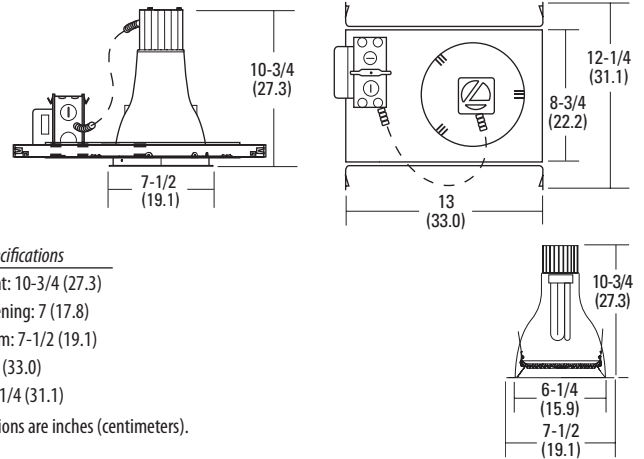
Compact Fluorescent Downlighting

6" 6VF



WET LENS

Vertical 1-Lamp, Double Twin-Tube (DTT) or Triple-Tube (TRT)



Specifications

Max. height: 10-3/4 (27.3)
 Ceiling opening: 7 (17.8)
 Overlap trim: 7-1/2 (19.1)
 Length: 13 (33.0)
 Width: 12-1/4 (31.1)
 All dimensions are inches (centimeters).

ORDERING INFORMATION

For shortest lead times, configure products using **bolded options**.

Example: 6VF 26-42TRT 6LR4 MVOLT

6VF Series	Wattage/Lamp	Reflector/Lens ³	Voltage	Options ⁶
6VF	13DTT ¹	6LRF1 White splay, clear lens	MVOLT⁴	ADEZ Advance Mark 10™ electronic dimming ballast, 120V or 277V. Minimum dimming level 5%. Must be voltage specific.
	18DTT	6LRFB1 Black baffle, clear lens	120	ECOS Lutron EcoSystem electronic dimming ballast, 120V-277V. Must be wattage specific. Minimum dimming level 5%.
	26DTT	6LR4 White splay, fresnel lens	277	EL Emergency PSDL3 DL battery pack with integral test switch. Lens removal required before EL testing.⁷
	13TRT ¹	6LRB4 Black baffle, fresnel lens	347 ⁵	ELR Emergency PSDL3 DL battery pack with remote test switch⁷
	18TRT	6LRF73 White splay, tempered prismatic lens		ELHL IOTA I-420-R high lumen output emergency battery pack. Integral test switch provided. Maximum average lumen output 1300 (42W). ⁸
	26-42TRT²	6LRFB73 Black baffle, tempered prismatic lens		ELRHL IOTA I-420-EM-B high lumen output emergency battery pack. Remote test switch provided. Maximum average lumen output 1300 (42W). ⁸
	26TRT	6LRD3 White splay, drop opal lens		GMF Single slow-blow fuse, must specify voltage
	32TRT	6LRDB3 Black baffle, drop opal lens		BDP Ballast disconnect plug (meets codes that require in-fixture disconnect) ⁵
	42TRT			RIF1 Radio interference filter

Accessories: Order as separate catalog number.

SCA6	Sloped ceiling adaptor. Degree of slope must be specified (10D, 15D, 20D, 25D, 30D) Ex: SCA6 10D.
CTE6	Ceiling thickness extender is used when ceiling thickness is greater than 1-1/2 (3.8). Maximum thickness 2 (5.1).

Notes

- Not available with ADEZ or ECOS.
- Not available with ECOS or WLP.
- White painted flange standard.
- Electronic multi-volt ballast capable of operating any line voltage from 120-277V, 50 or 60Hz.
- Not available with EL or ELR.

- For **additional options**, see www.lithonia.com.
- Add 3" (7.6) to width and 4-1/2" (11.4) to length.
- Not recommended for field installation.

6" 6VF Vertical 1-Lamp, Double Twin-Tube (DTT) or Triple Tube (TRT), Wet Lens

Distribution Curve	Distribution Data	Output Data	Coefficient of Utilization
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6VF 1/18TRT 6LR4 MVOLT, (1) 18W TRT lamp, 1200 rated lumens, 1.0 s/mh, test no. LTL9929

Polar Plot

Vertical Angle	Intensity Distribution		Zonal Lumen Summary		ROR	Coefficients of Utilization						
	Horizontal Angle	0	Zone	Lumens % Lamp		pf	80%		70%		50%	
	0					pc	50%	30%	50%	30%	50%	30%
0	229	0° - 30°	197.9	16.5	0	50	50	48	48	46	46	
5	231	0° - 40°	312.5	26.0	1	45	43	44	42	42	41	
15	237	0° - 60°	448.8	37.4	2	40	38	39	37	38	36	
25	238	0° - 90°	500.0	41.7	3	36	33	35	33	34	32	
35	185	90° - 180°	0.0	0.0	4	32	29	32	29	31	28	
45	107	0° - 180°	500.0	*41.7	5	29	26	29	26	28	25	
55	58	*Total Efficiency				6	27	23	26	23	26	23
65	33				7	25	21	24	21	24	21	
75	15				8	23	19	22	19	22	19	
85	2				9	21	18	21	18	20	17	
90	0				10	19	16	19	16	19	16	

6VF 1/26TRT 6LR4 MVOLT, (1) 26W TRT lamp, 1800 rated lumens, 1.0 s/mh, test no. LTL10759

Polar Plot

Vertical Angle	Intensity Distribution		Zonal Lumen Summary		ROR	Coefficients of Utilization						
	Horizontal Angle	0	Zone	Lumens % Lamp		pf	80%		70%		50%	
	0					pc	50%	30%	50%	30%	50%	30%
0	340	0° - 30°	311.2	17.3	0	56	56	55	55	52	52	
5	350	0° - 40°	507.9	28.2	1	50	49	49	48	47	46	
15	370	0° - 60°	761.8	42.3	2	45	42	44	42	42	40	
25	380	0° - 90°	847.5	47.1	3	40	37	40	37	38	36	
35	317	90° - 180°	0.0	0.0	4	36	33	36	32	35	32	
45	213	0° - 180°	847.5	*47.1	5	33	29	32	29	31	28	
55	100	*Total Efficiency				6	30	26	29	26	29	25
65	56				7	27	23	27	23	26	23	
75	25				8	25	21	25	21	24	21	
85	3				9	23	19	23	19	22	19	
90	0				10	21	18	21	18	21	18	

FEATURES & SPECIFICATIONS

INTENDED USE — Ideal where high brightness and good illumination levels are required such as retail, light industrial and warehouses.

Attributes: Available in one lamp or two lamp configuration.

CONSTRUCTION — Heavy-duty channel, die-formed from code-gauge steel.

Sturdy channel cover secured by captive quarter-turn latch for easy access to wireway.

Combination endplate/channel connector furnished with each fixture.

Finish: Five-stage iron phosphate pretreatment ensures superior paint adhesion and rust resistance. Painted parts finished with high-gloss, baked white enamel.

ELECTRICAL — Thermally protected, resetting, Class P, UL Listed and CSA Certified ballast is standard. Sound rating depends on lamp/ballast combination.

AWM, TFN, THHN wire throughout, rated for required temperatures.

INSTALLATION — For unit or row installations, surface or suspended mounting.

LISTINGS — UL listed to US and Canadian safety standards. Optional: Mexico NOM.

Damp location listed.

Listed for 25 degree C ambient temperature.

WARRANTY — 1-year limited warranty. Complete warranty terms located at www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx.

Note: Specifications subject to change without notice.

Actual performance may differ as a result of end-user environment and application.

Catalog Number
Notes
Type

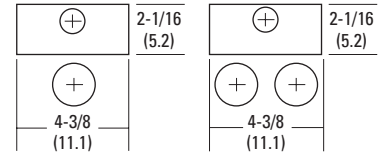


General-Purpose Strip

2', 3', 4', 6' and 8' length
1 or 2 lamps

Specifications

Length:	24" (61.0)
	36" (91.4)
	48" (121.9)
	72" (182.9)
	96" (243.8)
Width:	4-3/8" (11.1)
	Fixture Depth: 2-1/16" (5.2)



All dimensions are inches (centimeters) unless otherwise specified.

ORDERING INFORMATION

Lead times will vary depending on options selected. Consult with your sales representative.

Example: C 2 32 MVOLT GEB10IS

Series	Number of lamps	Lamp type	Voltage																																										
C General-purpose strip	1	T8	MVOLT ²																																										
For tandem double length unit, add prefix T. Example: TC	2 lamp not included	<table border="1"> <tr> <td>17</td> <td>17W T8 (24")</td> <td>36</td> <td>30W slimline (36")</td> <td>HO</td> <td>24HO</td> <td>35W T12 800mA (24")¹</td> </tr> <tr> <td>25</td> <td>25W T8 (36")</td> <td>48</td> <td>38W slimline (48")</td> <td>36HO</td> <td>45W T12 800mA (36")¹</td> <td>277</td> </tr> <tr> <td>32</td> <td>32W T8 (48")</td> <td>72</td> <td>55W slimline (72")</td> <td>48HO</td> <td>60W 800mA (48")</td> <td>347</td> </tr> <tr> <td>96T8</td> <td>59W T8 slimline (96")</td> <td>96</td> <td>75W slimline (96")</td> <td>72HO</td> <td>85W 800mA (72")</td> <td>Others available</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>96HO</td> <td>110W 800mA (96")</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>96T8HO</td> <td>86W 380mA (96")</td> <td></td> </tr> </table>	17	17W T8 (24")	36	30W slimline (36")	HO	24HO	35W T12 800mA (24") ¹	25	25W T8 (36")	48	38W slimline (48")	36HO	45W T12 800mA (36") ¹	277	32	32W T8 (48")	72	55W slimline (72")	48HO	60W 800mA (48")	347	96T8	59W T8 slimline (96")	96	75W slimline (96")	72HO	85W 800mA (72")	Others available					96HO	110W 800mA (96")						96T8HO	86W 380mA (96")		
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Options			
GEB	Electronic ballasts, ≤20%THD ⁴	EL	Emergency battery pack (nominal 300 lumens) ⁶
GEB10IS	Electronic ballasts, ≤10%THD, instant start ²	GLR	Internal fast-blow fuse (add X for external) ⁶
GEB10RS	Electronic ballast, ≤10%THD, rapid start ³	GMF	Internal slow-blow fuse (add X for external) ⁶
GEB10PS	Electronic ballast, ≤10%THD, programmed start	PLR_	Plug-in wiring; specify 1, 2, or 3 branch circuits and hot wires (A = Black, B = Red, C = Blue, AB or AC)
BILP	High-efficiency ballast, .78bf (low), instant start	TILW	Tandem in-line wiring
BINP	T8 high-performance ballast, .88bf (normal), instant start	CSA	CSA Certified (only required for 347V)
BIHP	T8 high-performance ballast, 1.20bf (high), instant start	NOM	NOM Certified
1/4	One four-lamp ballast ⁵	AL	Aluminum housing; white enamel finish

Accessories: Order as separate catalog number.			
SQ_	Swivel stem hanger (specify length in 2" increments)	HRC1°	Hooker T-bar hanger (1-1/2" from ceiling)
1B	Ceiling spacer (adjusts from 1-1/2" to 2-1/2" from ceiling)	WGCSMR48	Wireguard, 4' white for symmetric reflector ⁷
CONLGC	12" screw-on channel connector	WGCASR48	Wireguard, 4' white for asymmetric reflector ⁷
WGCUN NST	Wireguard, 4' white ⁷	CSMR 48	Symmetric reflector, 4' white, 7" aperture ⁷
HC36	Chain hangers (1 pair, 36" long)	CASR 48	Asymmetric reflector, 4' white, 5-3/4" wide ⁷
HRC°	Hooker T-bar hanger (flush to ceiling)		

Notes

1. Only available with AL option.
2. MVOLT standard for 120-277V applications, 50-60 mhz operation. Some options require voltage specified.
3. 347V, slimline lamps only.
4. Slimline and HO lamps only.
5. Not available in slimline.
6. Specify voltage.
7. Order two for 8' fixtures.

C General-Purpose Strip

MOUNTING DATA

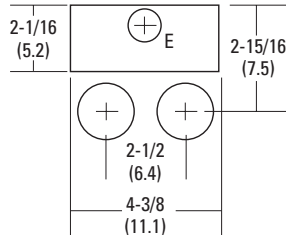
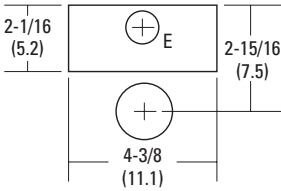
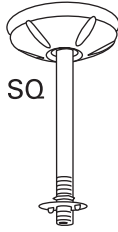
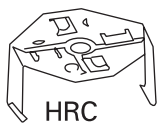
For unit or row installation, surface or suspended mounting.

Unit installation — Minimum of two hangers required.

Row installation — Two hangers per channel required one per fixture plus one per row of CONLGC installed.

Hooker® (HRC) and (HC) Hangers - minimum two per channel (unit and row).

See ACCESSORIES below for hanging devices.



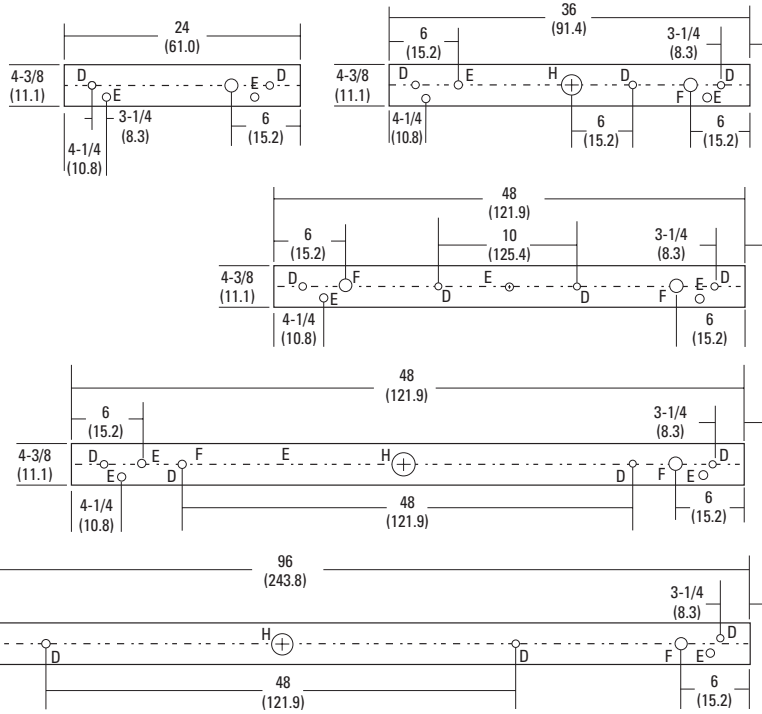
D = 11/16 (17) Dia.K.O.
E = 7/8 (22) Dia.K.O.
F = 1-1/4 (32) Dia.K.O.
H = 2 (51) Dia.K.O.

DIMENSIONS

All dimensions in inches (centimeters) unless otherwise specified. Subject to change without notice.

48", 72", and 96" have only two 7/8" K.O.'s 6" from each end.

24" and 36" have only two 7/8" K.O.'s 3-1/4" from each end.



PHOTOMETRICS

Calculated using the zonal cavity method in accordance with IESNA LM41 procedure. Floor reflectances are 20%. Lamp configurations shown are typical.

All data based on 25°C. Full photometric data on these and other configurations available upon request.

C 2 32

TEST NO: LTL 5181

LUMENS PER LAMP: 2900

C 2 96

TEST NO: LTL 18310

LUMENS PER LAMP: 6300

RCR	Coefficients of Utilization								
	20%			50%			80%		
	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	106	106	106	102	102	102	93	93	93
1	89	84	79	85	80	76	78	74	71
2	76	68	62	72	66	60	66	61	56
3	65	57	50	62	55	49	57	51	45
4	57	48	42	55	47	40	50	43	38
5	51	42	35	48	40	34	44	37	32
6	45	36	30	43	35	29	40	33	28
7	41	32	26	39	31	25	36	29	24
8	37	29	23	35	28	22	33	26	21
9	34	26	20	32	25	20	30	23	19
10	31	23	18	30	23	18	28	21	17

RCR	Coefficients of Utilization								
	20%			50%			80%		
	50%	30%	10%	50%	30%	10%	50%	30%	10%
0	103	103	103	98	98	98	90	90	90
1	86	82	78	82	78	74	75	72	69
2	74	67	61	70	64	59	64	59	55
3	64	56	49	61	54	48	56	49	44
4	56	47	41	53	46	40	49	42	37
5	49	41	35	47	39	34	43	37	31
6	44	36	30	42	34	29	39	32	27
7	40	32	26	38	30	25	35	28	24
8	36	28	23	35	27	22	32	25	21
9	33	25	20	32	25	20	29	23	19
10	30	23	18	29	22	18	27	21	17

Zonal Lumen Summary		
Zone	Lumens % Lamp	% Fixture
0° - 30°	842.1	14.5
0° - 40°	1435.8	24.8
0° - 60°	2810.1	48.4
0° - 90°	4362.5	75.2
90° - 180°	1021.0	17.6
0° - 180°	5383.6	92.8

Zonal Lumen Summary		
Zone	Lumens % Lamp	% Fixture
0° - 30°	1785.8	14.2
0° - 40°	3042.4	24.1
0° - 60°	5944.0	47.2
0° - 90°	9027.5	71.6
90° - 180°	2341.8	18.6
0° - 180°	11369.4	90.2

Energy (Calculated in accordance with NEMA standard LE-5)					
LER.FL	ANNUAL ENERGY COST*	LAMP DESCRIPTION	LAMP LUMENS	BALLST FACTOR	WATTS
86.2	\$2.79	(2) T8 F32	2900	.88	55

*Comparative yearly lighting energy cost per 1000 lumens.

Energy (Calculated in accordance with NEMA standard LE-5)						
ORDERING INFORMATION	LER.FL	ANNUAL ENERGY COST*	LAMP DESCRIPTION	LAMP LUMENS	BALLAST FACTOR	WATTS
C 2 32 MVOLT GEB10IS	77.6	\$3.09	F32T8/735	2800	.88	59
C 2 32 MVOLT BILP	93.6	\$2.56	F32T8/835/HT8	3100	.78	48

*Comparative yearly lighting energy cost per 1000 lumens.