PROJECT MANUAL
BIDDING SPECIFICATION

VOLUME 1

FOR

WYOCENA FIRE DEPARTMENT ADDITION

284 S Columbus Street
Wyocena, WI 53969

Project # 26057

August 12, 2026

ARCHITECTURAL
Lien & Peterson Architects, Inc.
4675 Royal Drive
P O Box 925
Eau Claire, WI 54701
(715) 835 7500

PLUMBING / MECHANICAL / ELECTRICAL
Apex Engineering, Inc.
110A East Grand Ave
Eau Claire, WI 54701
(715) 835 7736

Page Intentionally Left Blank

WYOCENA FIRE DEPARTMENT ADDITION
TABLE OF CONTENTS

Division	Section Title	Pages
DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS		
	Project Title Page	1
	Table Of Contents	4
00 01 15	List Of Drawing Sheets	2
00 11 16	Invitation To Bid	2
00 21 00	Instructions To Bidders	4
00 26 00	Procurement Substitution Procedures	1
00 31 32	Geotechnical Data	1
	Geotechnical Exploration and Evaluation Report	13
	Field Exploration	2
	Soil Boring Location Exhibit	7
	Document Qualifications	3
	Recommended Compacted Fill Specifications	3
00 31 43	Permit Application	1
00 41 13	Bid Form - Stipulated Sum (single-prime Contract)	2
00 43 13	Bid Security Forms	1
00 43 22	Unit Prices Form	1
00 43 93	Bid Submittal Checklist	1
00 60 00	Project Forms	1
DIVISION 01 - GENERAL REQUIREMENTS		
01 10 00	Summary	2
01 25 00	Substitution Procedures	3
01 26 00	Contract Modification Procedures	2
01 29 00	Payment Procedures	3
01 31 00	Project Management And Coordination	5
01 33 00	Submittal Procedures	5
01 35 16	Alteration Project Procedures	4
01 60 00	Product Requirements	4
01 73 00	Execution	7
01 74 19	Construction Waste Management And Disposal	4
01 77 00	Closeout Procedures	4
01 78 23	Operation And Maintenance Data	4
01 78 39	Project Record Documents	2
01 79 00	Demonstration And Training	1
DIVISION 02 - EXISTING CONDITIONS		
02 41 19	Selective Demolition	4
DIVISION 03 - CONCRETE		
03 10 00	Concrete Forming and Accessories	4
03 20 00	Concrete Reinforcing	3
03 30 00	Cast-in-place Concrete	13

DIVISION 04 - MASONRY

04 20 00 Unit Masonry 9

DIVISION 05 - METALS

05 12 00 Structural Steel Framing 4
05 40 00 Cold-Formed Metal Framing 6
05 50 00 Metal Fabrications 6

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 53 Miscellaneous Rough Carpentry 3
06 16 00 Sheathing 2
06 17 53 Shop-Fabricated Wood Trusses 3
06 20 13 Exterior Finish Rough Carpentry 3
06 46 00 Wood Trim 2

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 21 00 Thermal Insulation 2
07 25 00 Weather Barriers 2
07 26 00 Vapor Retarders 1
07 31 13 Asphalt Shingles 5
07 42 13.13 Formed Metal Wall Panels 4
07 42 93 Soffit Panels 4
07 53 23 Ethylene-Propylene-Diene-Monomer (EPDM) Roofing 7
07 62 00 Sheet Metal Flashing and Trim 8
07 92 00 Joint Sealants 3

DIVISION 08 - OPENINGS

08 11 13 Hollow Metal Doors and Frames 4
08 33 13 Coiling Counter Doors 3
08 36 13 Sectional Doors 5
08 52 00 Wood Windows 3
08 71 00 Door Hardware 3
08 80 00 Glazing 4

DIVISION 09 - FINISHES

09 29 00 Gypsum Board 3
09 30 13 Ceramic Tiling 4
09 51 23 Acoustical Tile Ceilings 2
09 65 13 Resilient Base and Accessories 2
09 68 13 Tile Carpeting 3
09 91 23 Interior Painting 2

DIVISION 10 - SPECIALTIES

10 14 23.16 Room-identification Panel Signage 2
10 28 00 Toilet, Bath, And Laundry Accessories 3
10 44 13 Fire Protection Cabinets 2
10 44 16 Fire Extinguishers 1

DIVISION 12 - FURNISHINGS

12 32 16 Plastic-Laminate-Clad Casework 4
12 36 26 Plastic-Laminate-Clad Countertops 3

DIVISION 22 - PLUMBING

22 05 00 Common Work Results for Plumbing 16
22 05 19 Meters and Gauges for Plumbing Piping 3
22 05 53 Identification for Plumbing Piping and Equipment 4
22 07 19 Plumbing Piping Insulation 7
22 10 05 Plumbing Piping 16
22 10 06 Plumbing Piping Specialties 8
22 30 00 Plumbing Equipment 11
22 40 00 Plumbing Fixtures 11

DIVISION 23 – HEATING, VENTILATING, & AIR CONDITIONING

23 05 00 Common Work Results for HVAC 13
23 05 13 Common Motor Requirements for HVAC Equipment 4
23 05 23 General Duty Valves for HVAC Piping 3
23 05 29 Hangers and Supports for HVAC Piping and Equipment 7
23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment 3
23 05 93 Testing, Adjusting, and Balancing for HVAC 6
23 07 00 HVAC Insulation 11
23 11 00 Facility Fuel Piping 8
23 23 00 Refrigerant Piping 5
23 31 00 HVAC Ducts and Casings 9
23 33 00 Air Duct Accessories 8
23 34 00 HVAC Fans 6
23 37 13 Diffusers, Registers & Grilles 3
23 41 00 Particulate Air Filtration 4
23 55 00 Fuel-Fired Heaters 3
23 72 00 Air-to-Air Energy Recovery Ventilator 5
23 81 26 Split-System Ductless Air Conditioners 6
23 82 00 Heating and Cooling Terminal Units 3

DIVISION 26 - ELECTRICAL

26 01 00 Basic Electrical Requirements 9
26 01 10 Basic Electrical Materials and Methods 8
26 01 15 Temporary Service 2
26 05 19 Low-Voltage Electrical Power Conductors and Cables 5
26 05 26 Grounding and Bonding for Electrical Systems 5
26 05 29 Hangers and Supports for Electrical Systems 2
26 05 34 Conduit 6
26 05 37 Boxes 4
26 05 53 Identification for Electrical Systems 3
26 05 73 Overcurrent Protective Device Coordination Study 4
26 09 18 Remote Control Switching Devices 5
26 09 43 Distributed Digital Lighting Controls 12
26 24 16 Panelboards 4
26 27 01 Electrical Service Entrance 2
26 27 17 Equipment Wiring 3

26 27 26 Wiring Devices 5
26 28 18 Enclosed Switches 3
26 32 13 Engine Generators..... 17
26 36 00 Transfer Switches 7
26 43 05 Surge Suppression..... 4
26 51 00 Interior Lighting..... 9
26 56 00 Exterior Lighting..... 3

DIVISION 30 – COMMON WORK RESULTS FOR ALL EXTERIOR WORK
30 05 00 Common Work Results for All Exterior Work..... 5

DIVISION 32 – EXTERIOR IMPROVEMENTS
32 11 23.33 Dense Graded Base..... 4
32 12 16.13 Plant Mix Asphalt Paving..... 2
32 13 13 Concrete Paving..... 5

END OF TABLE OF CONTENTS

SECTION 00 01 15
LIST OF DRAWING SHEETS

LIST OF DRAWINGS

Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Wyocena Fire Department Addition, dated August 12, 2026, as modified by subsequent Addenda and Contract modifications.

List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

GENERAL

Title Sheet, Sheet Index, Project Location Maps G101
Egress Plan, Code Analysis, FFE Plans G102
Building Components G103

CIVIL

Civil Title Sheet C0.0
Civil General Notes C1.0
Civil Existing Conditions and Demolition Plan C2.0
Civil Proposed Site Layout C3.0
Civil Proposed Grading and Wet Utility Plan C4.0
Civil Proposed Erosion Control Plan C5.0
Civil Construction Details C6.0
Civil Construction Details C6.1
Civil Construction Details C6.2

ARCHITECTURAL

Demolition Floor Plan A201
Proposed Floor Plan A301
Enlarged Floor Plans A302
Enlarged Toilet Room Plans, Interior Elevations A303
Roof Plan A304
Wall Types, Door Types, Window Types, Frame Types, Schedules A305
Exterior Elevations A401
Building Sections, Details A501
Details A502
Door Details A503
Window Details A504
Proposed Reflected Ceiling Plan A701

STRUCTURAL

Structural Design Notes S101
Foundation Plan S201
Enlarged Framing Plans, Structural Details S301
Structural Details S501

PLUMBING

Plumbing General Info Sheet P101
Plumbing Main Floor Plan – Demolition - Phase I P201
Plumbing Main Floor Plan – Demolition - Below Floor - Phase II P202
Plumbing Main Floor Plan – Demolition - Above Floor - Phase II P203
Plumbing Main Floor Plan – Remodel - Phase I P301
Plumbing Main Floor Plan – Addition - Below Floor - Phase 1 ..... P302

Plumbing Main Floor Plan – Addition - Lower Level - Phase I P303
Plumbing Main Floor Plan – Addition - Upper Level - Phase I P304
Plumbing Main Floor Plan – Remodel - Below Floor - Phase II P305
Plumbing Main Floor Plan – Remodel - Above Floor - Phase II P306
Plumbing Waste and Vent Schematic P401
Plumbing Water Piping Schematic P402
Plumbing Schedules P501
Plumbing Details P502

MECHANICAL
Mechanical General Info Sheet M101
Mechanical Floor Plans – Demolition Phase 1 & 2 ..... M201
Mechanical Floor Plan - Remodel M301
Mechanical Floor Plan - Addition M302
Mechanical Floor Plan – Gas Piping M303
Mechanical Schedules M401
Mechanical Details M402
Mechanical Gas Schematic M403

ELECTRICAL
Electrical Symbol Legend E101
Electrical Demolition Floor Plans – Phase 1 & 2 ..... E201
Electrical Floor Plan – Remodel – Lighting Phase 2 ..... E301
Electrical Floor Plan – Addition – Lighting Phase 1 ..... E302
Electrical Floor Plan Remodel – Power Phase 2 ..... E303
Electrical Floor Plan Addition – Power Phase 1 ..... E304
Electrical Power Riser Diagram, Panels & Details E401
Electrical Lighting & Equipment Schedules E402

END OF DOCUMENT

SECTION 00 11 16
INVITATION TO BID

PROJECT INFORMATION

Notice to Bidders: Qualified bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.

Project Identification: Wyocena Fire Department Addition
Project Number: 26057
Project Location: 284 S Columbus Street, Wyocena, WI 53969
Owner: City of Wyocena
Architect: Lien & Peterson Architects, Inc.
Supervising Professional: William Boettcher, PE

This building addition will be constructed of concrete masonry unit walls and wood roof trusses. This addition includes three offices, a laundry room, one restroom, and an apparatus bay. There will be a precast mechanical platform above the new office portion. In addition, the existing pre-engineered metal building will be reworked to consist of an equipment bay, a conference room, a police office with a secured storage closet for evidence, and a break room. All associated plumbing, electrical, and mechanical rework will be necessary, see plans.

Construction Contract: Bids will be received for the following Work:

General Contract (all trades).

BID SUBMITTAL AND OPENING

Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:

Bid Date: September 10, 2026.
Bid Time: 2:00 p.m., local time.
Location: 165 E Dodge Street, Wyocena, WI 53969

Bids will be thereafter publicly opened and read aloud.

BID SECURITY

Bid security shall be submitted with each bid in the amount of 5 percent of the bid amount. No bids may be withdrawn for a period of 60 days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

PREBID CONFERENCE

A prebid conference for all bidders will be held at 284 S Columbus Street, Wyocena, WI 53969 on August 27, 2026 at 10:00 a.m., local time. Prospective bidders are requested to attend, but not required.

DOCUMENTS

Printed Procurement and Contracting Documents: Obtain after August 13, 2026 on our website at www.lienandpetersonarchitects.com and at the following builders exchanges, Northwest Regional Builders Exchange, La Crosse Builders Exchange, Builders Exchange of Wisconsin and Wausau Builders Exchange.

TIME OF COMPLETION

The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within an estimated 365 calendar days.

BIDDER'S QUALIFICATIONS

Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.

INTERPRETATION

No verbal explanation or instructions will be given in regard to the meaning of the drawings or specifications during the bid period. Bidders shall bring inadequacies, omissions, or conflicts to the Architect/Engineer's attention at least nine (9) business days before the date set for bid opening. Prompt clarification will be supplied to all bidders of record by addendum.

Failure to so request clarification or interpretation of the drawings and specifications will not relieve the successful Bidder of responsibility. Signing of the contract will be considered as implicitly denoting that the Contractor has thorough understanding of the scope of work and comprehension of the contract documents.

The Architect/Engineer will be responsible for verbal instructions.

END OF DOCUMENT

SECTION 00 21 00
INSTRUCTIONS TO BIDDERS

PROJECT INFORMATION
Project Identification: Wyocena Fire Department Addition
Project Number: 26057
Project Location: 284 S Columbus Street, Wyocena, WI 53969
Owner: City of Wyocena
Architect: Lien & Peterson Architects, Inc.
Supervising Professional: William Boettcher, PE

DEFINITIONS
Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the invitation to bid, Instructions to Bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, and all Addenda.

Addenda are written or graphic instruments issued prior to Bid Deadline which modify or interpret the bidding documents, including Drawings and Specifications, by addition, deletion, clarification and/or correction. Addenda become part of the Contract Documents.

A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

The terms, Architect and A/E shall mean Lien & Peterson Architects, Inc.

BIDDERS REPRESENTATION
Each bidder by making his bid represents that he has read and understands the bidding documents and that he has visited the site and familiarized himself with the local conditions under which the Work is to be performed.

BIDDING PROCEDURES
All bids must be prepared on the form provided in this Project Manual and submitted in accordance with the Instructions to Bidders. **REMOVE FORM FROM PROJECT MANUAL**. Do not submit entire project manual. Submit only one Bid Form. Bid shall be completed in accordance with the requirements stated in this section. Place bid in an opaque envelope and seal. No other information shall be included with the Bid Form except any required bond or information requested herein or by Addendum. Mark the exterior of the envelope as follows:

CONTRACTORS PROPOSAL
(Give Project Name)
(State Portion of the Work Bid Upon)
(Contractor's Name and Address)

No bidder shall modify, withdraw, or cancel his bid or any part thereof for thirty (30) days after the Bid Deadline.

A bid is invalid if it has not been deposited at the designated location prior to the Bid Deadline. Such a bid will not be opened and will be returned to the bidder.

Bids will be received for contracts as provided in the Bid/Proposal form.

ADDENDA

Addenda will be made available through the same online platform as the Bid Documents. Questions regarding plans and specifications are due by August 31, 2026. An addendum will be issued on September 1, 2026.

BIDDING DOCUMENTS

Contracting Documents: Obtain digital copies after August 13, 2026 on our website at www.lienandpetersonarchitects.com and at the following builders exchanges; Northwest Regional Builders Exchange, La Crosse Builders Exchange, Builders Exchange of Wisconsin and Wausau Builders Exchange.

Refer to section 00 43 93 “Bid Submittal Checklist” to ensue all documents are submitted with bid.

Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

EXAMINATION OF BIDDING DOCUMENTS

The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation.

No verbal explanation or instructions will be given in regard to the meaning of the drawings or specifications during the bid period. Bidders shall bring inadequacies, omissions, or conflicts to the Architect/Engineer's attention, in writing, at least nine (9) days prior to the bid date.

Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

Failure to so request clarification or interpretation of the drawings and specifications will not relieve the successful Bidder of responsibility. Signing of the contract will be considered as implicitly denoting that the Contractor has thorough understanding of the scope of work and comprehension of the contract documents.

INSURANCE REQUIREMENTS

The Contractor shall purchase and maintain property insurance upon the entire Work at the site to the full insurable value thereof. This insurance shall include the interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Work and shall insure against the perils of fire and extended coverage and shall include "all risk" insurance for physical loss or damage including, without duplication coverage, theft, vandalism and malicious mischief.

SUBSTITUTIONS

Each bidder represents that his bid is based upon the materials and equipment described in the bidding documents.

No substitution will be considered unless written request has been submitted to the A/E for approval at least ten (10) days prior to the date for receipt of bids. Each such request shall include a complete description of the proposed substituted, drawings, cuts, performance and test data and any other data or information necessary for a complete evaluation. Approval of substitutions will be set forth by Addendum.

Approval by the A/E of a manufacturer for specified items shall not be deemed as approval of all products or models that the manufacturer can furnish but only the single product which most closely duplicates the item originally specified.

The responsibility for all revisions to the work required by substitutions shall be borne solely by the Contractor who utilizes the substitution, including the following:

- Additional work by other Contractors.
- Changes to the building structure or room sizes.
- Additional associated devices, connections, wiring, etc.
- Properly notifying other contractors as to the effect of such substitutions on their contract.

PRODUCT OR MATERIAL AVAILABILITY

Prior to the receipt of bids, verify that all specified items, products, materials, etc., will be available for timely inclusion in the work. Should any item not be available, notify the A/E. Extra costs resulting from delays caused by failure to determine availability of specified items shall be borne by the Contractor.

QUALIFICATION OF BIDDERS

Before the award of any contract, the owner shall be satisfied that the bidder, (1) maintains a permanent place of business, (2) has adequate equipment to do the work properly, (3) has a suitable financial status to meet obligations incident to the work, (4) has appropriate technical experience, and (5) has satisfactorily completed contracts of similar nature and magnitude.

SUBMISSION OF BIDS

All bids shall be submitted on the standard Bid Forms enclosed in the specifications and only bids that are made on the Bid Forms will be considered. The entire Bid Form including the Addendum Receipt/Signature page, the Bid Bond Form, and other supporting documents (if any), shall be filled out and submitted in the manner specified hereinafter. SPECIFICATIONS SHALL NOT ACCOMPANY BID.

Bidders shall submit a Single Base Bid for all the work. No bids for any subdivision or any sub-classification of this work will be accepted. Any conditional bid, amendment to the Bid Form or appendant thereto, the inclusion of any correspondence, written or printed matter, unsolicited material or data, or details of any nature other than the information specifically called for, will disqualify the Bid. Telecommunication alterations to the bid will not be accepted.

Any addendum issued during the time of bidding shall become a part of the Contract Documents. Bidders shall acknowledge receipt of such addendum in the appropriate space provided on the Bid Form. Bid will be rejected if receipt of an addendum applicable to the award of contract has not been acknowledged on the Bid Form.

Bidder shall be responsible for the sealed bid being delivered to the place designated for the bid opening before the time specified. Bids received after the time indicated in the Advertisement for Bids will be rejected.

Bid will be considered invalid and will be rejected if it has not been signed by the Bidder.

AWARD OR REJECTION OF BIDS

Review the Bid Form for procedures to be followed should the bid be accepted by the Owner. Notice that prompt delivery of the required documents is required. The bidder acknowledges the right of the Owner to reject any or all bids and to waive any informality or irregularity in any bid received. In addition, the bidder recognizes the right of the Owner to reject a bid if the bidder failed to furnish any required bid security, or to submit the data required by the bidding documents, or if the bid is in any way incomplete or irregular.

SUBMISSION OF POST-BID INFORMATION

Upon request by the A/E, the selected bidder shall within seven (7) days thereafter submit the following:

A statement of costs for each major item of Work included in the bid.

A designation of the Work to be performed by the bidder with his own forces.

A list of names of the Subcontractors or other persons or organizations (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

PERFORMANCE BOND AND PAYMENT BOND

The Bidder who is awarded the work shall furnish and pay for bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder in such form as the Owner may prescribe and with such sureties secured through the bidder's usual sources as may be agreeable to the parties. The amount of each bond shall be 100% of the Contract Amount. Bonds shall be dated not later than the date of execution of the Contract. The attorney-in-fact who executes the required bonds on behalf of the surety shall affix thereto a certified and current copy of his power-of-attorney indicating the limit of such power.

Bond form shall be AIA Document WIS. A311, latest edition, "Private Improvement Performance Bond" and "Private Improvement Labor and Material Payment Bond."

RETAINAGE

Retainage will be accumulated at 10% of the amount due until 50% completion. Upon substantial completion, payments shall be increased to 98% of the amount due, less allowance for incomplete and unsatisfactory work.

END OF SECTION

SECTION 00 26 00
PROCUREMENT SUBSTITUTION PROCEDURES

DEFINITIONS

Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.

Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 01 25 00 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

QUALITY ASSURANCE

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

PROCUREMENT SUBSTITUTIONS

Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:

- Extensive revisions to the Contract Documents are not required.
- Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
- The request is fully documented and properly submitted.

SUBMITTALS

Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing in compliance with the following requirements:

- Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
- Submittal Format: Submit copies of each written Procurement Substitution Request, using CSI Substitution Request Form 1.5C.
  - Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.
  - Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

Architect's Action:

- Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT

Page Intentionally Left Blank

SECTION 00 31 32
GEOTECHNICAL DATA

GEOTECHNICAL DATA

This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.

Soil-boring data for Project, obtained by Construction Geotechnical Consulting, dated June 9, 2026, is available for viewing as appended to this Document.

A geotechnical investigation report for Project, prepared by Construction Geotechnical Consulting, dated June 9, 2026, is available for viewing as appended to this Document.

The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.

Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

END OF DOCUMENT

Page Intentionally Left Blank

CGC, Inc.
Construction • Geotechnical
Consulting Engineering/Testing

June 9, 2026
C26232

Mr. Owen Landsverk
Village of Wyocena
165 E Dodge St, PO Box 913
Wyocena, WI 53969

Re: Geotechnical Exploration
Wyocena Fire Station Addition
284 South Columbus Street
Wyocena, Wisconsin

Dear Mr. Landsverk:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the subsurface exploration program for the above-referenced project. The purpose of this program was to evaluate the subsurface conditions within the proposed construction area and to provide geotechnical recommendations regarding site preparation, foundation, floor slab, retaining wall, and pavement design/construction. A determination of the site class for seismic design is also included. We are sending you an electronic copy of this report, and we can provide a paper copy upon request. A copy is also being sent to Mr. William Boettcher at Lien & Peterson Architects, Inc.

PROJECT AND SITE DESCRIPTION

We understand that a single-story, slab-on-grade addition is planned for the vacant parcel immediately north of the above-referenced address. Our understanding of the project is based on the provided Site Plans (Sheet C201; dated March 3, 2026) by Lien & Peterson Architects, Inc. and Drawing 226-76A by Grothman & Associates S.C. Professional Services.

The proposed building area is an undeveloped lot on the west side of South Columbus Street, between West Dodge Street and West Franklin Street, located immediately north of the existing Wyocena Village Fire Station. The majority of the parcel is mowed lawn and greenspace, with isolated bushes and mature trees near or just over the property lines on the north and east sides. Additionally, there is a utility pole and pedestal in the northwest portion of the lot and a utility pedestal (and possibly still a fire pit and small shed) in the east. According to 1-ft contour lines shown on the provided site plans, site grades generally slope from the southeast down toward the northwest, with existing ground surface elevations ranging from about EL 811 to 805 ft.

The planned improvements for the site are for a single-story, slab-on-grade addition on the north side of the existing fire station. Based on information verbally provided by Grothman & Associates, the existing fire station has a finished first floor elevation (FFE) of about EL 811 ft. It is planned that the addition will have an FFE that is 3 ft lower than the existing fire station's floor grade. Therefore, FFE

2921 Perry Street, Madison WI 53713
Telephone: 608/288-4100
FAX: 608/288-7887

for the proposed building addition will be established at about EL 808 ft. Based on the sloping site topography and the provided grading plan, we anticipate that FFE will be about 3 ft above (west side) to about 2.5 ft below (east side) existing site grades. It is expected there will be a heavy-duty concrete approach slab on the west side entering the addition from South Columbus Street with a finished elevation from about EL 804 ft to the slab grade of about EL 808 ft.

SUBSURFACE CONDITIONS

Subsurface conditions for this study were explored by drilling three Standard Penetration Test (SPT) soil borings (labeled B-1 through B-3) to planned depths of 20 ft at locations selected by CGC and field-staked by PTS. The borings were conducted by PTS (under subcontract to CGC) on May 29, 2026 using a track-mounted (ATV) Geoprobe 7822DT rotary drill rig equipped with 2.25" hollow stem augers and an automatic SPT hammer. The specific procedures used for drilling and sampling are described in Appendix A, and the boring locations are shown in plan on the Soil Boring Location Exhibit presented in Appendix B. Ground surface elevations were estimated by CGC based on 1-ft contour lines shown on the provided topographic site plan, and elevations should therefore be considered approximate.

The subsurface profiles at the boring locations were fairly consistent, and the following strata were typically encountered (in descending order):

- About 6 in. of ***topsoil***; underlain by
- Generally, very loose to medium dense ***sand*** deposits with trace to little silt and variable amounts of gravel, to the maximum depths explored.

It should be noted that the sand deposits generally coarsen with depth, and the amounts of fines (P200 content) within the sand strata generally decrease with depth. B-2 encountered a surficial sand layer with significant amounts of silt (designated SM on the boring log) to a depth of 1.5 ft and scattered silt seams within the sand layers between a depth of 5.5 to 8 ft.

Groundwater was encountered during or shortly after drilling in all three borings generally at about 14 to 17 ft below current site grades, corresponding to approximately EL 792 to 794 ft. It should be noted that Boring 1 encountered groundwater at only 7 ft depth (approximately EL 799 ft) indicating a probable localized and temporary perched water condition in that area. Observed groundwater conditions reflect those present at the time of exploration only, and groundwater levels are expected to fluctuate with seasonal variations in precipitation, infiltration, evapotranspiration, the level in the nearby Wyona Lake, and other factors. However, given our observations, we generally do not anticipate groundwater to be encountered during construction. A more detailed description of the site soil and groundwater conditions is presented on the individual soil boring logs attached in Appendix B.

DISCUSSION AND RECOMMENDATIONS

Subject to the limitations discussed below and based on the subsurface exploration, it is our opinion that the site is generally suitable for the planned development and that the structure can be supported by a conventional reinforced concrete spread footing foundation system. *However, based on the anticipated foundation loads and in order to limit settlement to within tolerable levels and prevent stability issues, fairly widespread and systematic undercutting of unsuitable very loose to loose sand soils should generally be expected below the bottom of footings to utilize even a low allowable bearing pressure for foundation design*. Therefore, it is our opinion that an intermediate foundation system, such as aggregate piers, stone columns, or similar, could be considered to improve the soils in-place to limit settlement and create stable conditions without the need for undercutting. With the use of intermediate foundations, a higher allowable design soil bearing pressure can likely be utilized to reduce foundation sizes. Our recommendations for site preparation, foundation, floor slab, retaining wall, and pavement design/construction, along with our assessment of the site class for seismic design, are presented in the following subsections. Additional information regarding the conclusions and recommendations presented in this report is discussed in Appendix C.

1. Site Preparation

To prepare the site for construction, we recommend that northern portions of the existing building be demolished in accordance with the planned demolition plan. Utilities related to the demolition or other utilities associated with or crossing through the vacant lot should also be appropriately abandoned and removed or rerouted, as necessary. The small shed and the fire pit should be removed (if not already).

We further recommend that topsoil and vegetation should be completely removed and stripped at least 10 ft beyond the proposed construction area, including areas requiring fill beyond the building footprint and pavement limits. The topsoil can be stockpiled on-site and later re-used as fill in landscaped areas. As mentioned earlier, topsoil was about 6 in. thick in the borings, but variable topsoil thicknesses may be encountered between and beyond boring locations due to previous grading activities and site usage. Trees and root zones should be completely removed prior to, or in conjunction with, topsoil stripping.

After partial demolition, vegetation removal, and topsoil stripping, subgrades are largely anticipated to consist of very loose sand soils with moderate to significant silt content. In slab or pavement areas remaining at-grade or where grades need to be raised, we recommend cohesive and fine-grained subgrades (i.e., clay, silt, and clayey sand), if any, be statically recompacted (i.e., without vibration) and subsequently proof-rolled with a piece of heavy rubber-tire construction equipment, such as a loaded tri-axle dump truck, to check for soft/yielding areas. If soft/yielding areas are observed, these soils should be undercut and replaced with granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557) in accordance with our Recommended Compacted Fill Specifications presented in Appendix D. Alternatively, 3-in. DGB that is placed in loose 10-in. lifts and compacted until deflection ceases can also be used to restore grades in undercut areas. Granular subgrades (i.e., sand and gravel) should be thoroughly recompacted with a vibratory smooth-drum roller, and zones that remain loose after recompaction should be undercut and replaced or

stabilized as described above. Areas subsequently receiving fill should be checked for their pavement support suitability prior to fill placement, as applicable. *Some undercutting/replacement or stabilization should generally be expected to create firm and stable subgrades in new pavement areas (where near existing site grades), and to facilitate structural fill placement, as the anticipated subgrade soils (very loose, fine sands with moderate to significant silt) are generally considered moisture sensitive, especially when subjected to repetitive construction traffic. We therefore recommend that the project budget contain a contingency for subgrade improvements in planned floor slab and pavement areas.*

Following the development of a firm and stable subgrade, fill placement to establish site, pavement, and building grades can proceed, as required. To the extent possible, we recommend using granular soils (i.e., sands/gravels, including native granular soils if selectively excavated and stockpiled) as fill within the building envelope and at least in the upper 2 ft below the base course in pavement areas, because these soils are relatively easy to place and compact in most weather conditions compared to clay/silt soils. Clay and silt soils excavated on-site, if any, are generally not recommended as structural fill because moisture conditioning by discing and drying (aeration) will likely be required to achieve desired compaction levels, which is highly weather-dependent (i.e., dry, warm and windy conditions) and could delay construction progress. In our opinion, clay/silt soils are best used as fill in landscaping or potentially as lower lifts in pavement areas provided the moisture contents can be sufficiently lowered from the natural states to facilitate compaction efforts. We recommend that structural fill be compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557) following Appendix D guidelines. Periodic field density tests should be taken by CGC staff within the fill to document the adequacy of the compaction effort.

Note that, due to the generally low to moderate P200 content in the native sand soils, which typically correlates to natural moisture contents below the optimum moisture content for compaction, the addition of water will likely be required to facilitate adequate compaction of structural fill comprised of on-site sand soils, or recompaction of native sand subgrades.

We anticipate that the excavations to establish slab and footing grades for the proposed building can generally be sloped back according to OSHA requirements. It is our opinion that the sand soils with low to moderate amounts of fines (denoted as SP-SM on the boring logs), typically classified as OSHA "Type C" soils, will control excavation side slopes, with slopes of 1.5H:1.0V expected to be at least temporarily stable. Note that flatter side slopes may be required where perched or seeping water is present that destabilizes the side slopes. Surface runoff should be diverted away from sloped excavations as it can also increase the risk of sidewall instability. The appropriate excavation side slopes should be determined by a competent person completing the earthwork in accordance with OSHA slope guidelines.

2. Foundation Design

A. *Shallow Spread Footing Foundations with Undercutting/Replacement*

We understand the finished first floor elevation of the proposed building is planned to be established at about EL 808 ft, which is approximately 3 ft above to 2.5 ft below existing site grades, from west to east. Interior footings, if any, are generally expected to bear about 2 to 3 ft below finished floor slab elevation, and we recommend that perimeter footings extend at least 4 ft below finished exterior grades for frost protection. Accordingly, we expect footing subgrades to largely consist of very loose to loose sandy soils with low to moderate amounts of fines (P200 content) and trace amounts of gravel (denoted as SP-SM on the boring logs).

The very loose to loose granular soils encountered at and below anticipated foundation elevations in all three soil borings are considered unsuitable for direct building support from a settlement and bearing capacity perspective. Therefore, to provide stable subgrades and limit settlement to within tolerable limits, we recommend systematic, partial undercutting of at least 3 ft below the bottom of spread footings be performed to remove very loose to loose soils below immediate design footing grades. Under this scenario, and in consideration of stress distribution occurring within the improved upper portions of foundation subgrades, complete removal of very loose soils would not be required. Due to the extent of the very loose to loose soils up to about 17 ft below current site grades, which extend near or slightly below the groundwater table, complete removal would generally be cost prohibitive. Therefore, if a higher allowable bearing pressure is desired, an intermediate foundation system, such as aggregate piers, stone columns, or similar, could be considered to improve the soils in-place to limit settlement without the need for extensive undercutting. Actual undercut depths to achieve the recommended design soil bearing pressure may vary somewhat across the building area and should be determined following careful evaluation by CGC at the time of foundation excavation.

If shallow spread footings with the described undercutting/replacement approach are desired, we recommend using 3-in. DGB that is placed in loose 10-in. lifts and compacted with a large vibratory plate compactor or excavator-mounted hoe-pack until deflection ceases to restore design footing grades. The backfill should be completely enveloped in non-woven geotextile fabric (e.g., Mirafi 160N or equivalent) to prevent the migration of fines from the surrounding soils to provide separation. *The base of the undercut excavations should be widened beyond the footing edges at least 0.5 ft in each direction for each foot of undercut depth for stress distribution purposes.*

Provided foundation subgrades are prepared as discussed in this report, we recommend the following parameters be used for foundation design:

- Maximum net allowable bearing pressure: 1500 psf

- Minimum foundation widths:
  - Continuous wall footings: 18 in.
  - Column pad footings: 30 in.

- Minimum footing depths:
  - Exterior/perimeter footings: 4 ft
  - Interior footings: no minimum requirement

As a variety of subsurface conditions may be encountered across the site, footing subgrades should be checked by a CGC field representative to document that the subgrade soils are suitable for footing support or otherwise advise on corrective measures, such as undercutting. We recommend using a smooth-edged backhoe bucket for footing and undercut excavations. Granular soils exposed at footing grade or the bottom of undercut excavations should be thoroughly recompacted with a large vibratory plate compactor or an excavator-mounted hoe-pack prior to backfilling or formwork/concrete placement to densify soils loosened during the excavation process. As noted, the addition of water may be required to facilitate adequate compaction or recompaction of the on-site sands. Soils potentially susceptible to disturbance from vibratory compaction (e.g., cohesive/fine-grained soils or sands with elevated moisture contents) should be hand-trimmed. OSHA slope guidelines should be followed if workers need to enter footing excavations.

Although we generally do not expect groundwater to be encountered during footing or undercut excavations, footing subgrades in isolated areas may be fairly wet due to the presence of locally perched water. *Wet subgrades should be stabilized by placing a minimum 6-in. thick layer of crushed clear stone and compacting it into the subgrade until deflection ceases.* If conditions are such that a total clear stone layer thickness of more than 12 in. will be required to stabilize wet subgrades, we recommend the clear stone layer also be completely wrapped in non-woven geotextile fabric (e.g., Mirafi 160N or equivalent) to prevent migration of fines from the surrounding soils into the void spaces of the clear stone.

Provided the foundation design/construction recommendations discussed above are followed, we estimate that total and differential settlements should be on the order of 1.0 and 0.5 in., respectively.

B. *Intermediate Foundations*

As discussed in the previous section, fairly widespread undercutting below anticipated footing grades is expected to be necessary to remove and replace soils considered unsuitable for direct foundation support. In order to practically eliminate the need for undercutting, consideration could be given to utilizing an intermediate foundation system, such as aggregate piers or stone columns, to improve the unsuitable soils in-place for adequate support of the planned building addition. For reference, it has been our experience that intermediate foundations become economical when undercut depths would otherwise exceed about 8 to 10 ft.

Aggregate piers/stone columns (or similar) are not deep foundations but are considered intermediate foundations. They essentially stiffen the existing lower- to marginal-strength native soils to a sufficient depth below grade such that conventional spread footings at a moderate to high bearing pressure are feasible without the need for deep undercutting. Based on our past experience in similar soil conditions, an allowable bearing pressure of up to 6,000 psf may be achieved with the use of typical intermediate foundations. For foundation support, relatively closely-spaced holes are drilled or vibrated into the ground to a sufficient depth to stabilize the bearing soils and limit total settlement to less than 1 in. For floor slab support (although not expected to be necessary for this project), aggregate pier/stone column spacing is generally wider than below footings but would depend on slab loading. We anticipate that the piers/columns would generally terminate within at least medium dense natural sand soils, although the exact termination depth would be determined by the contractor/designer of the intermediate foundation system. The holes are then filled with compacted crushed stone/dense graded base. *Note that the allowable bearing pressure for the design of footings supported on aggregate piers/stone columns (or similar) is determined by the intermediate foundation designer on a project-by-project basis.*

Several proprietary systems exist, and aggregate piers/stone columns (or similar) can be bid as an alternative to undercutting/replacing unsuitable soils below footings, with foundation design typically included in the package. Full-time inspection is recommended during intermediate foundation installation to document their construction according to design requirements, and this cost is typically included in the installation cost by the contractor, who will generally also conduct one or more load or modulus tests to check that the installed elements satisfy design assumptions. Footing subgrade preparation where aggregate piers/stone columns (or similar) are installed generally includes recompaction of the pier/column tops, recompaction or hand-trimming of the soils between the piers/columns, as well as other site-specific guidelines determined by the contractor.

3. Seismic Site Class

In our opinion, the average soil properties in the upper 100 ft of the site (based on N-values projected to be less than 15 blows/ft, on average, in the granular soils underlying the site) may be characterized as a soft soil profile. This characterization would place the site in Site Class E for seismic design according to the International Building Code and ASCE 7.

4. Floor Slabs

We anticipate that floor slab subgrades will consist of natural, very loose sand soils with moderate to significant silt and also newly placed fill on the western portion of the site. Prior to slab construction, granular subgrade soils should be thoroughly recompacted with a vibratory smooth-drum roller to densify soils that may become disturbed or loosened during construction activities. Cohesive or fine-grained subgrades (silt or clay), if any, should be statically recompacted and subsequently proof-rolled to check for soft/yielding areas. Areas of disturbed soil or where soils remain loose after recompaction should be undercut and replaced with compacted 3-in. DGB or granular fill. *Due to the anticipated presence of areas with granular soils containing higher amounts of silt at the base of the floor slab,*

which are considered moisture sensitive and susceptible to disturbance from repetitive construction traffic, we recommend that the project budget include a contingency for subgrade improvement in floor slab areas.

To act as a capillary break, we recommend including a minimum 6-in. thick layer of well-graded sand or gravel with no more than 5% by weight passing a No. 200 U.S. standard sieve below the slabs. A subgrade modulus of 100 pci should be used for slab design if a clean, well-graded sand layer is used below the slabs. Note that some structural engineers prefer to include a layer of crushed aggregate base course (such as 1¼-in. DGB) immediately below floor slabs to improve the subgrade modulus. If a minimum of 6 in. of DGB is used below the slabs instead of the sand/gravel capillary break, it is our opinion that the subgrade modulus can be increased to 150 pci. To reduce the potential for moisture migration, a vapor barrier can also be utilized below the slabs. The slabs should be structurally separate from the foundations and have construction joints and adequate reinforcement for crack control.

5. Retaining Walls

Site retaining walls (if planned) that are not laterally restrained from rotating can be designed for *active* earth pressures behind the walls and *passive* pressures in front of the walls. Lateral earth pressures behind the retaining walls can be reduced by backfilling with sand with less than 12% by weight passing the No. 200 U.S. standard sieve (i.e., USCS designations SP, SP-SM, GP or GP-GM). In addition, weepholes should be placed near the base of these walls on 10-ft centers to provide drainage of the wall backfill. The weepholes should be hydraulically connected with the backfill and should be protected with a non-woven geotextile fabric to minimize soil loss through the weepholes. The wall designer may have other and/or additional drainage requirements.

Assuming the inclusion of free-draining wall backfill, retaining walls constructed in accordance with the above recommendations may be designed for an *active* equivalent fluid pressure of 35 psf per foot of depth. *Passive* pressures are expected to be on the order of 200 psf per foot of depth. The passive pressure value includes a safety factor of 2 to prevent excessive wall deflection. The retaining wall design should also take into account surcharge effects which could be applied during or after construction.

We recommend using an *ultimate* concrete-to-soil friction factor of 0.3 for retaining wall footings bearing on at least medium stiff clay and silt soils. For footings bearing on sand/gravel, an *ultimate* concrete-to-soil friction factor of 0.4 may be implemented. We recommend retaining wall footings be designed for a maximum net allowable bearing pressure of 1,000 psf in order to reduce (although not eliminate) the need for undercutting below retaining wall footings. If a higher allowable bearing pressure is desired for the design of retaining wall footings, deeper and more widespread undercutting should be expected, as discussed in the Foundation Design section.

6. Pavement Design

We anticipate that pavement design will be controlled primarily by a variety of newly-placed fill and shallow native sand soils with moderate to significant amounts of fines (P200 content) encountered in the borings. Subgrades should be prepared as described in the Site Preparation section of this report, with recompaction/proof-rolling completed prior to base course and asphalt placement. The areas requiring undercutting/stabilization and the depth of undercutting should be determined in the field by proof-rolling prior to installing the base course layer, and the need for undercutting/stabilization will likely depend on the weather conditions during construction. *The need for undercutting below the pavement section will likely be reduced where site grades are raised at least 2 ft above existing grade with high-quality granular fill.*

We anticipate that some asphalt pavement on this site, such as smaller staff parking areas or low-traffic-volume driveways, if any, may be exposed to primarily automobile traffic with less than one 18-kip equivalent single-axle load (ESAL) per day. In view of this, we have assumed Traffic Class I following Wisconsin Asphalt Pavement Association (WAPA) recommendations for smaller parking areas and driveways that are mainly used by light passenger vehicles. However, main sections of driveways are likely to experience heavier traffic loads from truck traffic. For pavement areas where trucks will routinely travel, we have assumed a traffic load of up to 5 ESALs per day and Traffic Class II according to WAPA. We have also included a heavy-duty pavement section where higher truck traffic loads (up to 50 ESALs per day, Traffic Class III or IV) are expected. The pavement sections summarized in Table 1 below were selected using typical granular soil parameters and a design life of 20 years.

TABLE 1 – Recommended Pavement Sections

Layer	Thicknesses (in.)			WDOT Specification[1]
	Traffic Class I (Light Duty)	Traffic Class II (Medium Duty)	Traffic Class III/IV (Heavy Duty)	
Bituminous Upper Layer[2,3]	1.75	1.75	2.5	Section 460, Table 460-1
Bituminous Lower Layer[2,3]	1.75	2.25	3.5	Section 460, Table 460-1
Dense Graded Base Course[2,4]	10.0	12.0	14.0	Sections 301 and 305
Total Thickness	**13.5**	**16.0**	**20.0**	

Notes:

1) Wisconsin DOT *Standard Specifications for Highway and Structure Construction*, latest edition, including supplemental specifications, and Wisconsin Asphalt Pavement Association *2021 Asphalt Pavement Design Guide*.

2) Compaction requirements:
   - Bituminous concrete: Refer to Section 460, Table 460-3 of the *Standard Specifications*.
   - Base course: Refer to Section 301.3.4.2, Standard Compaction

3) Mixture Type LT bituminous; refer to Section 460, Table 460-2 of the *Standard Specifications*. Mixture type MT is recommended in heavy-duty traffic areas. Note that an "H Grade" asphalt surface layer is recommended where there will be slow moving heavy truck traffic making turning movements.

4) The upper 4 in. should consist of 1¼-in. DGB; the bottom part of the layer can consist of 3-in. DGB.

The recommended pavement sections assume that regular maintenance (crack sealing, etc.) will occur, as needed. Note that if traffic volumes are greater than those assumed, CGC should be allowed to review the recommended pavement sections and adjust them accordingly. Alternative pavement designs may prove acceptable and should be reviewed by CGC. The medium-duty pavement section may be used in light-duty areas for ease of grading purposes. If there is a delay between subgrade preparation and placing the base course, the subgrade should be recompacted.

Where concrete pavement will be used instead of flexible pavement in high truck traffic areas, such as for the approach on the west side of the addition, the recommended concrete pavement section is included in Table 2. The minimum recommended concrete thickness assumes the concrete pavement will include edge support (e.g., tied concrete shoulder, curb and gutter or widened lane). We have also included a reduced pavement section for light duty concrete pavement (e.g., dumpster pads, light duty entrance aprons, etc.). The concrete pavement should be designed by a structural engineer and include appropriate reinforcement for flexural strength and crack control. The concrete sections in Table 2 are based upon the development of a firm granular subgrade with a minimum subgrade modulus of 100 pci.

TABLE 2 – Recommended Concrete Pavement Sections

Layer	Thicknesses (in.)		Recommended Material
	Light Duty (≤5 ESALs/day)	Heavy Duty (≤50 ESALs/day)	
Portland Cement Concrete	6.0	8.0	Concrete with minimum modulus of rupture of 580 psi
Dense Graded Base Course	6.0	8.0	WisDOT Specification, Sections 301 and 305, 3 in. and 1¼ in.
Total Thickness	**12.0**	**16.0**	

CONSTRUCTION CONSIDERATIONS

Due to variations in weather, construction methods and other factors, specific construction problems are difficult to predict. Soil related difficulties which could be encountered on the site are discussed below:

- Due to the potentially sensitive nature of some of the on-site soils, we recommend that final site grading activities be completed during dry weather, if possible. Construction traffic should be avoided on prepared subgrades to minimize potential disturbance.

- Contingencies in the project budget for subgrade stabilization with coarse aggregate in pavement and floor slab areas should be increased if the project schedule requires that work proceed during adverse weather conditions.

- Earthwork construction during the late fall through early spring could be complicated as a result of wet weather and freezing temperatures. During cold weather, exposed subgrades should be protected from freezing before and after footing construction. Fill should never be placed while frozen or on frozen ground.

- Excavations extending greater than 4 ft in depth below the ground surface should be sloped or braced in accordance with current OSHA standards. Earth retention systems, if needed, should be designed by an appropriately qualified professional engineer.

- Based on the observations made during our field exploration and provided building grades, we generally do not anticipate groundwater to be encountered during excavations. However, isolated areas of perched water may potentially be encountered. Water accumulating at the bottom of excavations as a result of precipitation or seepage from perched water layers (or seasonally high groundwater) should be quickly removed, with dewatering means and methods being the contractor's responsibility. Stabilization of wet subgrades may also be required, as previously discussed.

RECOMMENDED CONSTRUCTION MONITORING

The quality of the foundation, floor slab and pavement subgrades will be largely determined by the level of care exercised during site development. To check that earthwork and foundation construction proceed in accordance with our recommendations, the following operations should be monitored by CGC:

- Topsoil stripping and subgrade proof-rolling/compaction;
- Fill/backfill placement and compaction;
- Intermediate foundation installation;
- Foundation excavation/subgrade preparation; and
- Concrete placement.

* * * * *

It has been a pleasure to serve you on this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

CGC, Inc.

Andrew A. Aken, EIT
Geotechnical Staff Engineer

Michael N. Schultz, PE
Principal/Senior Consulting Professional

Encl: Appendix A - Field Exploration
Appendix B - Soil Boring Location Exhibit
Logs of Test Borings (3)
Log of Test Boring-General Notes
Unified Soil Classification System
Appendix C - Document Qualifications
Appendix D - Recommended Compacted Fill Specifications

Cc: William Boettcher - Lien & Peterson Architects

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

Subsurface conditions for this study were explored by drilling three Standard Penetration Test (SPT) soil borings to depths of 20 ft below current site grades, which were sampled at 2.5-ft intervals to a depth of 10 ft and at 5-ft intervals thereafter. The samples were obtained in general accordance with specifications for standard penetration testing, ASTM D1586, and the specific procedures used for drilling and sampling are described below.

1. Boring Procedures between Samples

   The boring is extended downward, between samples, by a hollow-stem auger.

2. Standard Penetration Test and Split-Barrel Sampling of Soils
   (ASTM Designation: D1586)

   This method consists of driving a 2-in. outside diameter split-barrel sampler using a 140-lb weight falling freely through a distance of 30 in. The sampler is first seated 6 in. into the material to be sampled and then driven 12 in. The number of blows required to drive the sampler the final 12 in. is recorded on the log of borings and is known as the Standard Penetration Resistance.

During the field exploration, the driller visually classified the soil and prepared a field log. *Field screening of the soil samples for possible environmental contaminants was not conducted by the driller as these services were not part of CGC's work scope*. Water level observations were made in each boring during and, in some cases, shortly after drilling and are shown at the bottom of each boring log. Upon completion of drilling, the borings were backfilled in accordance with WDNR regulations, and the soil samples were delivered to our laboratory for visual classification and limited geotechnical laboratory testing. The soils were visually classified by a geotechnical engineer using the Unified Soil Classification System (USCS). The final logs prepared by the engineer, including lab results, along with a Soil Boring Location Exhibit and a description of the Unified Soil Classification System are presented in Appendix B.

APPENDIX B

SOIL BORING LOCATION EXHIBIT
LOGS OF TEST BORINGS (3)
LOG OF TEST BORING-GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM


N
Graphic Scale:
Approx. 33 ft
Legend
Denotes Soil Boring Location and Number
Notes
1. Borings were drilled by PTS on May 29, 2026.
2. Boring locations are approximate.
3. Base map was obtained via Columbia County GIS.
4. Site Plan was prepared by Lien & Peterson Architects, Inc. (Sheet C201; March 3, 2026)
West Franklin Street
South Columbus Street
West Dodge Street
B-1
B-2
B-3
S83°10'38"E
110.32'
BRUSH
N08°41'14"E
29.51'
49.50'
132.04'
55.03
85.16'
S07°35'54"W
55.04
54.14'
N83°14'16"W
N14°42'56"E
82.54'
PARCEL 11191-55.06
FIRE STATION
73.80'
S09°45'59"W
GARAGE
P.O.S
(195-34)
BY PULVER
41.39'
N75°32'59"W
30.88'
S00°42'41"E
10.05'
R/W
Job No.: C26232
Date: June 2026
CGC, Inc.
SOIL BORING LOCATION EXHIBIT
Wyocena Fire Station Addition
284 South Columbus Street
Wyocena, WI

CGC Inc.

LOG OF TEST BORING

Project: **Wyocena Fire Station Addition**

Location: **Wyocena, WI**

Boring No. **B-1**
Surface Elevation (ft) **806±**
Job No. **C26232**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LOI
						6± in. TOPSOIL					
1	■	3	M	2		Very Loose, Reddish-Brown Fine SAND, Little Silt, Trace Gravel (SP-SM)					
2	■	10	M	3	5						
3	■	16	W	2	▽	Very Loose, Brown Fine to Medium SAND, Little Silt, Trace Gravel (SP-SM)					
4	■	14	W	4	10	Very Loose, Brown Fine to Medium SAND, Some Gravel, Trace Silt (SP)					
5	■	18	W	11	▼ 15	Loose to Medium Dense, Dark Brown Fine to Coarse SAND, Trace Silt and Gravel (SP)					
6	■	18	W	10	20						
						End of Boring at 20 ft Borehole Backfilled with Bentonite Chips					
					25						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **7.0'** Upon Completion of Drilling _____
Time After Drilling **(Possible** _____ _____ **1 Hour**
Depth to Water **Perched** _____ _____ **14'** ▼
Depth to Cave in **Water)** _____ _____ _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **5/29/26** End **5/29/26**
Driller **PTS** Chief **Nick** Rig **7822DT**
Logger **Nick** Editor **AAA**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project: **Wyocena Fire Station Addition**

Location: **Wyocena, WI**

Boring No. **B-2**
Surface Elevation (ft) **810±**
Job No. **C26232**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LOI
						6± in. TOPSOIL					
1	■	8	M	3		Very Loose, Reddish-Brown Fine SAND, Some Silt, Trace Clay (SM)					
						Very Loose, Reddish-Brown Fine SAND, Little Silt, Trace Gravel (SP-SM)					
2	■	10	M	3							
					5						
						Very Loose, Tan Fine SAND, Little Silt, Trace Gravel, Scattered Silt Seams (SP-SM)					
3	■	10	M	3							
						Loose, Tan Fine to Medium SAND, Little Silt, Trace Gravel (SP-SM)					
4	■	16	M	8							
					10						
						Loose to Medium Dense, Brown to Dark Brown Fine to Coarse SAND, Trace Silt and Gravel (SP)					
5	■	18	M/W	5							
					15						
					▽						
6	■	18	W	12							
					20	End of Boring at 20 ft					
						Borehole Backfilled with Bentonite Chips					
					25						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **17.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **5/29/26** End **5/29/26**
Driller **PTS** Chief **Nick** Rig **7822DT**
Logger **Nick** Editor **AAA**
Drill Method **2.25" HSA; Autohammer**

CGC Inc.

LOG OF TEST BORING

Project: **Wyocena Fire Station Addition**

Location: **Wyocena, WI**

Boring No. **B-3**
Surface Elevation (ft) **809±**
Job No. **C26232**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LOI
						6± in. TOPSOIL					
1	■	8	M	3		Very Loose to Loose, Brown Fine SAND, Little Silt, Trace Gravel (SP-SM)					
2	■	10	M	4	5						
3	■	18	M	6							
4	■	18	M	6		Loose, Brown Fine to Medium SAND, Some Gravel, Trace Silt (SP)					
5	■	18	M	7	10						
6	■	18	W	10	15 ▽	Loose, Dark Brown Fine to Coarse SAND, Trace Silt and Gravel (SP)					
					20	End of Boring at 20 ft Borehole Backfilled with Bentonite Chips					
					25						

WATER LEVEL OBSERVATIONS

While Drilling ▽ **15.0'** Upon Completion of Drilling _____
Time After Drilling _____
Depth to Water _____ ▼
Depth to Cave in _____

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **5/29/26** End **5/29/26**
Driller **PTS** Chief **Nick** Rig **7822DT**
Logger **Nick** Editor **AAA**
Drill Method **2.25" HSA; Autohammer**

CGC, Inc.

LOG OF TEST BORING

General Notes

DESCRIPTIVE SOIL CLASSIFICATION

Grain Size Terminology

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to 12"	3" to 12"
Gravel: Coarse	¾" to 3"	¾" to 3"
Fine	4.76 mm to ¾"	#4 to ¾"
Sand: Coarse	2.00 mm to 4.76 mm	#10 to #4
Medium	0.42 to mm to 2.00 mm	#40 to #10
Fine	0.074 mm to 0.42 mm	#200 to #40
Silt	0.005 mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

General Terminology

Physical Characteristics
Color, moisture, grain shape, fineness, etc.
Major Constituents
Clay, silt, sand, gravel
Structure
Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin
Glacial, alluvial, eolian, residual, etc.

Relative Density

Term	"N" Value
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

Relative Proportions Of Cohesionless Soils

Proportional Term	Defining Range by Percentage of Weight
Trace	0% - 5%
Little	5% - 12%
Some	12% - 35%
And	35% - 50%

Consistency

Term	q_u-tons/sq. ft
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Medium	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

Organic Content by Combustion Method

Soil Description	Loss on Ignition
Non Organic	Less than 4%
Organic Silt/Clay	4 – 12%
Sedimentary Peat	12% - 50%
Fibrous and Woody Peat	More than 50%

Plasticity

Term	Plastic Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6" penetrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test.

SYMBOLS

Drilling and Sampling

CS – Continuous Sampling
RC – Rock Coring: Size AW, BW, NW, 2"W
RQD – Rock Quality Designation
RB – Rock Bit/Roller Bit
FT – Fish Tail
DC – Drove Casing
C – Casing: Size 2 ½", NW, 4", HW
CW – Clear Water
DM – Drilling Mud
HSA – Hollow Stem Auger
FA – Flight Auger
HA – Hand Auger
COA – Clean-Out Auger
SS - 2" Dia. Split-Barrel Sample
2ST – 2" Dia. Thin-Walled Tube Sample
3ST – 3" Dia. Thin-Walled Tube Sample
PT – 3" Dia. Piston Tube Sample
AS – Auger Sample
WS – Wash Sample
PTS – Peat Sample
PS – Pitcher Sample
NR – No Recovery
S – Sounding
PMT – Borehole Pressuremeter Test
VS – Vane Shear Test
WPT – Water Pressure Test

Laboratory Tests

q_a – Penetrometer Reading, tons/sq ft
q_a – Unconfined Strength, tons/sq ft
W – Moisture Content, %
LL – Liquid Limit, %
PL – Plastic Limit, %
SL – Shrinkage Limit, %
LI – Loss on Ignition
D – Dry Unit Weight, lbs/cu ft
pH – Measure of Soil Alkalinity or Acidity
FS – Free Swell, %

Water Level Measurement

▽ - Water Level at Time Shown
NW – No Water Encountered
WD – While Drilling
BCR – Before Casing Removal
ACR – After Casing Removal
CW – Cave and Wet
CM – Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

CGC, Inc.

Madison - Milwaukee

Unified Soil Classification System

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

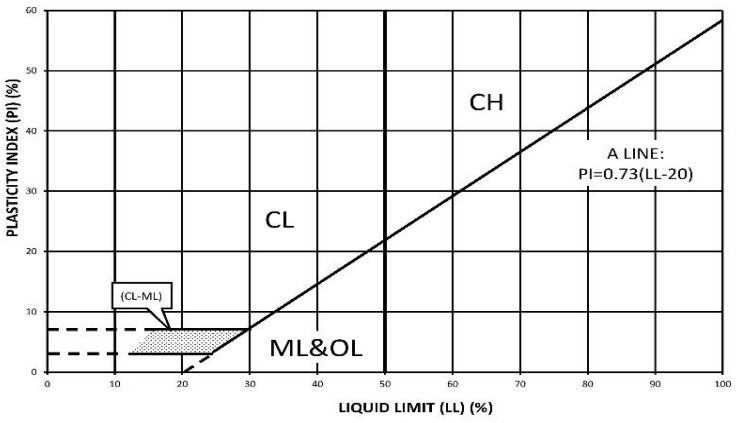
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limts below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limts above "A" line or P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



APPENDIX C

DOCUMENT QUALIFICATIONS

APPENDIX C
DOCUMENT QUALIFICATIONS

I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in compliance with the design concepts, specifications and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until construction.

II. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

READ THE FULL REPORT

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not informed.*

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most

effective method of managing the risks associated with unanticipated conditions.

A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the confirmation-dependent recommendations included in your report. *Those confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgement and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *CGC cannot assume responsibility or liability for the report's confirmation-dependent recommendations if we do not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical engineering report. Confront that risk by having CGC participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

GIVE CONSTRUCTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and constructors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

ENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in the Geotechnical Business Council (GBC) of Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of GBC, for more information.

Modified and reprinted with permission from:

Geotechnical Business Council
of the Geoprofessional Business Association
8811 Colesville Road, Suite G 106
Silver Spring, MD 20910

APPENDIX D

RECOMMENDED COMPACTED FILL SPECIFICATIONS

APPENDIX D

CGC, INC.

RECOMMENDED COMPACTED FILL SPECIFICATIONS

General Fill Materials

Proposed fill shall contain no vegetation, roots, topsoil, peat, ash, wood or any other non-soil material which by decomposition might cause settlement. Also, fill shall never be placed while frozen or on frozen surfaces. Rock, stone or broken concrete greater than 6 in. in the largest dimension shall not be placed within 10 ft of the building area. Fill used greater than 10 ft beyond the building limits shall not contain rock, boulders or concrete pieces greater than a 2 sq ft area and shall not be placed within the final 2 ft of finish subgrade or in designated utility construction areas. Fill containing rock, boulders or concrete pieces should include sufficient finer material to fill voids among the larger fragments.

Special Fill Materials

In certain cases, special fill materials may be required for specific purposes, such as stabilizing subgrades, backfilling undercut excavations or filling behind retaining walls. For reference, WisDOT gradation specifications for various types of granular fill are attached in Table 1.

Placement Method

The approved fill shall be placed, spread and leveled in layers generally not exceeding 10 in. in thickness before compaction. The fill shall be placed at moisture content capable of achieving the desired compaction level. For clay soils or granular soils containing an appreciable amount of cohesive fines, moisture conditioning will likely be required.

It is the Contractor's responsibility to provide all necessary compaction equipment and other grading equipment that may be required to attain the specified compaction. Hand-guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns or in confined areas.

Compaction Specifications

Maximum dry density and optimum moisture content of the fill soil shall be determined in accordance with modified Proctor methods (ASTM D1557). The recommended field compaction as a percentage of the maximum dry density is shown in Table 2. Note that these compaction guidelines would generally not apply to coarse gravel/stone fill. Instead, a method specification would apply (e.g., compact in thin lifts with a vibratory compactor until no further consolidation is evident).

Testing Procedures

Representative samples of proposed fill shall be submitted to CGC, Inc. for optimum moisture-maximum density determination (ASTM D1557) prior to the start of fill placement. The sample size should be approximately 50 lb.

CGC, Inc. shall be retained to perform field density tests to determine the level of compaction being achieved in the fill. The tests shall generally be conducted on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.

Table 1
Gradation of Special Fill Materials

Material	WisDOT Section 311	WisDOT Section 312	WisDOT Section 305			WisDOT Section 209		WisDOT Section 210
	Breaker Run	Select Crushed Material	3-in. Dense Graded Base	1 1/4-in. Dense Graded Base	3/4-in. Dense Graded Base	Grade 1 Granular Backfill	Grade 2 Granular Backfill	Structure Backfill
Sieve Size	Percent Passing by Weight							
6 in.	100							
5 in.		90-100						
3 in.			90-100					100
1 1/2 in.		20-50	60-85					
1 1/4 in.				95-100				
1 in.					100			
3/4 in.			40-65	70-93	95-100			
3/8 in.				42-80	50-90			
No. 4			15-40	25-63	35-70	100 (2)	100 (2)	25-100
No. 10		0-10	10-30	16-48	15-55			
No. 40			5-20	8-28	10-35	75 (2)		
No. 100						15 (2)	30 (2)	
No. 200			2-12	2-12	5-15	8 (2)	15 (2)	15 (2)

Notes:

1. Reference: Wisconsin Department of Transportation *Standard Specifications for Highway and Structure Construction.*
2. Percentage applies to the material passing the No. 4 sieve, not the entire sample.
3. Per WisDOT specifications, both breaker run and select crushed material can include concrete that is 'substantially free of steel, building materials and other deleterious material'.

Table 2
Compaction Guidelines

Area	Percent Compaction (1)	
	Clay/Silt	Sand/Gravel
Within 10 ft of building lines		
Footing bearing soils	93 - 95	95
Under floors, steps and walks		
- Lightly loaded floor slab	90	90
- Heavily loaded floor slab and thicker fill zones	92	95
Beyond 10 ft of building lines		
Under walks and pavements		
- Less than 2 ft below subgrade	92	95
- Greater than 2 ft below subgrade	90	90
Landscaping	85	90

Notes:

1. Based on Modified Proctor Dry Density (ASTM D 1557)

SECTION 00 31 43
PERMIT APPLICATION

PERMIT APPLICATION INFORMATION

This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. This Document and its attachments are not part of the Contract Documents.

Permit Application: Complete building permit application and file with authorities having jurisdiction within five days of the date of execution of the Contract.

END OF DOCUMENT

Page Intentionally Left Blank

SECTION 00 41 13
BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

BID INFORMATION

Bidder: _____.
Project Name: Wyocena Fire Department Addition
Architect Project Number: 26057
Project Location: 284 S Columbus Street, Wyocena, WI 53969
Owner: City of Wyocena
Architect: Lien & Peterson Architects, Inc.
Date: September 10, 2026

CERTIFICATIONS AND BASE BID

Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Lien & Peterson Architects, Inc. and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

_____ Dollars ($_____).

The above amount may be modified by amounts indicated by the Bidder on the attached Document 004322 "Unit Prices Form."

BID GUARANTEE

The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within 10 days after a written Notice of Award, if offered within 60 days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

_____ Dollars ($_____).

In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

SUBCONTRACTORS AND SUPPLIERS

The following companies shall execute subcontracts for the portions of the Work indicated:

Roofing Work: _____.

Plumbing Work: _____.

HVAC Work: _____.

Electrical Work: _____.

TIME OF COMPLETION

The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within an estimated 365 calendar days.

ACKNOWLEDGMENT OF ADDENDA

The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

Addendum No. 1, dated _____.

Addendum No. 2, dated _____.

Addendum No. 3, dated _____.

Addendum No. 4, dated _____.

BID SUPPLEMENTS

The following supplements are a part of this Bid Form and are attached hereto.

Bid Form Supplement - Unit Prices.
Bid Form Supplement - Bid Bond Form (AIA Document A310-2010).

CONTRACTOR'S LICENSE

The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the State of Wisconsin, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

SUBMISSION OF BID

Respectfully submitted this ____ day of _____, 2026.

Submitted By:_____(Name of bidding firm or corporation).

Authorized Signature:_____(Handwritten signature).

Signed By:_____(Type or print name).

Title:_____(Owner/Partner/President/Vice President).

Witnessed By:_____(Handwritten signature).

Attest:_____(Handwritten signature).

By:_____(Type or print name).

Title:_____(Corporate Secretary or Assistant Secretary).

Street Address:_____.

City, State, Zip:_____.

Phone:_____.

License No.:_____.

Federal ID No.:_____(Affix Corporate Seal Here).

END OF DOCUMENT

SECTION 00 43 13
BID SECURITY FORMS

BID FORM SUPPLEMENT

A completed bid bond form is required to be attached to the Bid Form.

BID BOND FORM

AIA Document A312-2010 "Bid Bond" is the recommended form for a bid bond. A bid bond acceptable to Owner, or other bid security as described in the Instructions to Bidders, is required to be attached to the Bid Form as a supplement.

Copies of AIA standard forms may be obtained from The American Institute of Architects; https://www.aiacontracts.org/; email: docspurchases@aia.org; (800) 942-7732.

END OF DOCUMENT

Page Intentionally Left Blank

SECTION 00 43 22
UNIT PRICES FORM

BID INFORMATION

Bidder: _____.
Project Identification: Wyocena Fire Department Addition
Project Number: 26057
Project Location: 284 S Columbus Street, Wyocena, WI 53969
Owner: City of Wyocena
Architect: Lien & Peterson Architects, Inc.
Supervising Professional: William Boettcher, PE

BID FORM SUPPLEMENT

This form is required to be attached to the Bid Form.

The undersigned Bidder proposes the amounts below be added to or deducted from the Contract Sum on performance and measurement of the individual items of Work and for adjustment of the quantity given in the Unit-Price Allowance for the actual measurement of individual items of the Work.

If the unit price does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."

UNIT PRICES

Unit-Price No. 1: Removal of unsatisfactory soil below footings and replacement with 3" dense graded base. Base bid price to include 200 cubic yards of material.

_____ dollars ($_____) per cubic yard.

SUBMISSION OF BID SUPPLEMENT

Respectfully submitted this ____ day of _____, 2026.

Submitted By:_____(Insert name of bidding firm or corporation).

Authorized Signature:_____(Handwritten signature).

Signed By:_____(Type or print name).

Title:_____(Owner/Partner/President/Vice President).

END OF DOCUMENT

Page Intentionally Left Blank

SECTION 00 43 93
BID SUBMITTAL CHECKLIST

BID INFORMATION

Bidder: _____.

Prime Contract: _____.
Project Name: Wyocena Fire Department Addition
Architect Project Number: 26057
Project Location: 284 S Columbus Street, Wyocena, WI 53969
Owner: City of Wyocena
Architect: Lien & Peterson Architects, Inc.
Date: September 10, 2026

BIDDER'S CHECKLIST

In an effort to assist the Bidder in properly completing all documentation required, the following checklist is provided for the Bidder's convenience. The Bidder is solely responsible for verifying compliance with bid submittal requirements.

Attach this completed checklist to the outside of the Submittal envelope.

- Used the Bid Form provided in the Project Manual.
- Prepared the Bid Form as required by the Instructions to Bidders.
- Indicated on the Bid Form the Addenda received.
- Attached to the Bid Form: Bid Bond OR a certified check for the amount required.
- Bid envelope shows name and address of the Bidder.
- Bid envelope shows the Bidder's Contractor's License Number.
- Bid envelope shows name of Project being bid.
- Bid envelope shows name of Prime Contract being bid, if applicable.
- Bid envelope shows time and day of Bid Opening.
- Verified that the Bidder can provide executed Performance Bond and Labor and Material Bond.
- Verified that the Bidder can provide Certificates of Insurance in the amounts indicated.

END OF DOCUMENT

Page Intentionally Left Blank

SECTION 00 60 00
PROJECT FORMS

FORM OF AGREEMENT AND GENERAL CONDITIONS

The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:

AIA Document A101-2017 "Standard Form of Agreement between Owner and Contractor Where the Basis of Payment is a Stipulated Sum."

The General Conditions for Project are AIA Document A201-2017 "General Conditions of the Contract for Construction."

The General Conditions are incorporated by reference.

ADMINISTRATIVE FORMS

Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.

Copies of AIA standard forms may be obtained from the American Institute of Architects; www.aiacontractdocsaiacontracts.org; (800) 942-7732.

Preconstruction Forms:

Form of Performance Bond and Labor and Material Bond: AIA Document A312-2010 "Performance Bond and Payment Bond."

Form of Certificate of Insurance: AIA Document G715-2017 "Supplemental Attachment for ACORD Certificate of Insurance 25."

Information and Modification Forms:

Form for Requests for Information (RFIs): AIA Document G716-2004 "Request for Information (RFI)."

Form of Request for Proposal: AIA Document G709-2018 "Proposal Request."

Change Order Form: AIA Document G701-2017 "Change Order."

Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G710-2017 "Architect's Supplemental Instructions."

Form of Change Directive: AIA Document G714-2017 "Construction Change Directive."

Payment Forms:

Schedule of Values Form: AIA Document G703-1992 "Continuation Sheet."

Payment Application: AIA Document G702-1992/703-1992 "Application and Certificate for Payment and Continuation Sheet."

Form of Contractor's Affidavit: AIA Document G706-1994 "Contractor's Affidavit of Payment of Debts and Claims."

Form of Affidavit of Release of Liens: AIA Document G706A-1994 "Contractor's Affidavit of Payment of Release of Liens."

Form of Consent of Surety: AIA Document G707-1994 "Consent of Surety to Final Payment."

END OF SECTION

Page Intentionally Left Blank

SECTION 01 10 00
SUMMARY

PART 1 - GENERAL

SUMMARY

Section Includes:

- Project information.
- Work covered by Contract Documents.
- Contractor's use of site and premises.
- Coordination with occupants.
- Work restrictions.

PROJECT INFORMATION

Project Identification: Wyocena Fire Department Addition

- Project Location: 284 S Columbus Street, Wyocena, WI 53969
- Owner: City of Wyocena

Consultants: The following design professionals have prepared designated portions of the Contract Documents:

- Architect: Lien & Peterson Architects, Inc.

- Designer: Apex Engineering
  - Address: 110 E Grand Avenue, Eau Claire, WI 54701
  - Plumbing Designer: Heath Mathews
  - Mechanical Designer: Landon Julson
  - Electrical Designer: Paul Kuchta

WORK COVERED BY CONTRACT DOCUMENTS

The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

- This building addition will be constructed of concrete masonry unit walls and wood roof trusses. This addition includes three offices, a laundry room, one restroom, and an apparatus bay. There will be a precast mechanical platform above the new office portion. In addition, the existing pre-engineered metal building will be reworked to consist of an equipment bay, a conference room, a police office with a secured storage closet for evidence, and a break room. All associated plumbing, electrical, and mechanical rework will be necessary, see plans.

Type of Contract:

- Project will be constructed under a single prime contract.

CONTRACTOR'S USE OF SITE AND PREMISES

Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

Limits on Use of Site: Confine construction operations to area of work.

Driveways, Walkways, and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

COORDINATION WITH OCCUPANTS

Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

WORK RESTRICTIONS

Comply with restrictions on construction operations.

Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

Notify Architect and Owner not less than seven days in advance of proposed utility interruptions.

Obtain Architect's written permission before proceeding with utility interruptions.

Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

Notify Architect and Owner not less than three days in advance of proposed disruptive operations.

Obtain Architect's written permission before proceeding with disruptive operations.

Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

SUMMARY

Section includes administrative and procedural requirements for substitutions.

Related Requirements:

- Document 00 26 00 "Contract Modification Procedures" for requirements for substitution requests prior to award of Contract.
- Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

DEFINITIONS

Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

- Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
- Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

ACTION SUBMITTALS

Substitution Requests: 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.

- Substitution Request Form: Use form acceptable to Architect.
- Documentation: Show compliance with requirements for substitutions and the following, as applicable:
  - Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
  - Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
  - Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
  - Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - Samples, where applicable or requested.
  - Certificates and qualification data, where applicable or requested.
  - List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
  - Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
  - Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter

from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

Cost information, including a proposal of change, if any, in the Contract Sum.

Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.

Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.

Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

QUALITY ASSURANCE

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

PROCEDURES

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

SUBSTITUTIONS

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

Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

Requested substitution is consistent with the Contract Documents and will produce indicated results.

Substitution request is fully documented and properly submitted.

Requested substitution will not adversely affect Contractor's construction schedule.

Requested substitution has received necessary approvals of authorities having jurisdiction.

Requested substitution is compatible with other portions of the Work.

Requested substitution has been coordinated with other portions of the Work.

Requested substitution provides specified warranty.

If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

Requested substitution does not require extensive revisions to the Contract Documents.

Requested substitution is consistent with the Contract Documents and will produce indicated results.

Substitution request is fully documented and properly submitted.

Requested substitution will not adversely affect Contractor's construction schedule.

Requested substitution has received necessary approvals of authorities having jurisdiction.

Requested substitution is compatible with other portions of the Work.

Requested substitution has been coordinated with other portions of the Work.

Requested substitution provides specified warranty.

If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

Page Intentionally Left Blank

SECTION 01 26 00
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

SUMMARY

Section includes administrative and procedural requirements for handling and processing Contract modifications.

MINOR CHANGES IN THE WORK

Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.

PROPOSAL REQUESTS

Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.

Within 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

Include costs of labor and supervision directly attributable to the change.

Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

Include costs of labor and supervision directly attributable to the change.

Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

CHANGE ORDER PROCEDURES

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

SUMMARY

Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

SCHEDULE OF VALUES

Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

- Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
- Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

- Arrange schedule of values consistent with format of AIA Document G703.
- Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
- Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
  - Differentiate between items stored on-site and items stored off-site.
- Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
- Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
- Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
- Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
- Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

APPLICATIONS FOR PAYMENT

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

Payment Application Times: Submit Application for Payment to Architect by the first day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.

Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.

Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

Transmittal: Submit one signed and notarized copies of each Application for Payment to Architect via email. This copy shall include waivers of lien and similar attachments if required.

Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.

When an application shows completion of an item, submit conditional final or full waivers.

Owner reserves the right to designate which entities involved in the Work must submit waivers.

Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

List of subcontractors.

Schedule of values.

Contractor's construction schedule (preliminary if not final).

Submittal schedule (preliminary if not final).

Copies of building permits.

Certificates of insurance and insurance policies.

Performance and payment bonds.

Data needed to acquire Owner's insurance.

Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

Evidence of completion of Project closeout requirements.

Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.

Updated final statement, accounting for final changes to the Contract Sum.

Evidence that claims have been settled.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

Page Intentionally Left Blank

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

SUMMARY

Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

- General coordination procedures.
- Coordination drawings.
- RFIs.

Related Requirements:

- Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

INFORMATIONAL SUBMITTALS

Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

- Name, address, telephone number, and email address of entity performing subcontract or supplying products.
- Number and title of related Specification Section(s) covered by subcontract.
- Drawing number and detail references, as appropriate, covered by subcontract.

GENERAL COORDINATION PROCEDURES

Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

- Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
- Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
- Make adequate provisions to accommodate items scheduled for later installation.

Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

- Preparation of Contractor's construction schedule.
- Preparation of the schedule of values.
- Installation and removal of temporary facilities and controls.
- Delivery and processing of submittals.
- Progress meetings.
- Project closeout activities.
- Startup and adjustment of systems.

COORDINATION DRAWINGS

Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

Coordination Drawing Organization: Organize coordination drawings as follows:

Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.

Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

Structural Penetrations: Indicate penetrations and openings required for all disciplines.

Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

REQUEST FOR INFORMATION (RFI)

General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.

Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

Owner name.

Owner's Project number.

Name of Architect.

Architect's Project number.

Date.

Name of Contractor.

RFI number, numbered sequentially.

RFI subject.

Specification Section number and title and related paragraphs, as appropriate.

Drawing number and detail references, as appropriate.

Field dimensions and conditions, as appropriate.
Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
Contractor's signature.
Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

RFI Forms: AIA Document G716.

Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

The following Contractor-generated RFIs will be returned without action:

Requests for approval of submittals.
Requests for approval of Contractor's means and methods.
Requests for coordination information already indicated in the Contract Documents.
Requests for adjustments in the Contract Time or the Contract Sum.
Requests for interpretation of Architect's actions on submittals.
Incomplete RFIs or inaccurately prepared RFIs.

Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architectof additional information.
Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."

If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five days of receipt of the RFI response.

RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly.

Project name.
Name and address of Contractor.
Name and address of Architect.
RFI number including RFIs that were returned without action or withdrawn.
RFI description.
Date the RFI was submitted.
Date Architect's response was received.

On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

PROJECT MEETINGS

General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the

conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

Agenda: Discuss items of significance that could affect progress, including the following:

Responsibilities and personnel assignments.
Tentative construction schedule.
Phasing.
Critical work sequencing and long lead items.
Designation of key personnel and their duties.
Lines of communications.
Procedures for processing field decisions and Change Orders.
Procedures for RFIs.
Procedures for testing and inspecting.
Procedures for processing Applications for Payment.
Distribution of the Contract Documents.
Submittal procedures.
Sustainable design requirements.
Preparation of Record Documents.
Use of the premises and existing building.
Work restrictions.
Working hours.
Owner's occupancy requirements.
Responsibility for temporary facilities and controls.
Procedures for moisture and mold control.
Procedures for disruptions and shutdowns.
Construction waste management and recycling.
Parking availability.
Office, work, and storage areas.
Equipment deliveries and priorities.
First aid.
Security.
Progress cleaning.

Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

Progress Meetings: Conduct progress meetings at biweekly intervals.

Coordinate dates of meetings with preparation of payment requests.

Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

Review schedule for next period.

Review present and future needs of each entity present, including the following:

Interface requirements.
Sequence of operations.
Status of submittals.
Status of sustainable design documentation.
Deliveries.
Off-site fabrication.
Access.
Site use.
Temporary facilities and controls.
Progress cleaning.
Quality and work standards.
Status of correction of deficient items.
Field observations.
Status of RFIs.
Status of Proposal Requests.
Pending changes.
Status of Change Orders.
Pending claims and disputes.
Documentation of information for payment requests.

Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

Page Intentionally Left Blank

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

SUMMARY

Section Includes: Administrative and procedural requirements for submittals.

DEFINITIONS

Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

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

SUBMITTAL SCHEDULE

Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

SUBMITTAL FORMATS

Submittal Information: Include the following information in each submittal:

- Project name.
- Date.
- Name of Architect.
- Name of Contractor.
- Name of firm or entity that prepared submittal.
- Names of subcontractor, manufacturer, and supplier.
- Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
- Category and type of submittal.
- Submittal purpose and description.
- Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
- Drawing number and detail references, as appropriate.
- Indication of full or partial submittal.
- Location(s) where product is to be installed, as appropriate.
- Other necessary identification.
- Remarks.
- Signature of transmitter.

Options: Identify options requiring selection by Architect.

Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number. Email to admin@2dlp.com

SUBMITTAL PROCEDURES

Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
Resubmittal Review: Allow 15 days for review of each resubmittal.

Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

SUBMITTAL REQUIREMENTS

Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
Mark each copy of each submittal to show which products and options are applicable.
Include the following information, as applicable:

Manufacturer's catalog cuts.
Manufacturer's product specifications.
Standard color charts.
Statement of compliance with specified referenced standards.
Testing by recognized testing agency.
Application of testing agency labels and seals.
Notation of coordination requirements.
Availability and delivery time information.

For equipment, include the following in addition to the above, as applicable:

- Wiring diagrams that show factory-installed wiring.
- Printed performance curves.
- Operational range diagrams.
- Clearances required to other construction, if not indicated on accompanying Shop Drawings.

Submit Product Data before Shop Drawings, and before or concurrent with Samples.

Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

- Identification of products.
- Schedules.
- Compliance with specified standards.
- Notation of coordination requirements.
- Notation of dimensions established by field measurement.
- Relationship and attachment to adjoining construction clearly indicated.
- Seal and signature of professional engineer if specified.

Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.

Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

Identification: Permanently attach label on unexposed side of Samples that includes the following:

- Project name and submittal number.
- Generic description of Sample.
- Product name and name of manufacturer.
- Sample source.
- Number and title of applicable Specification Section.
- Specification paragraph number and generic name of each item.

Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.

- Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
- Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

- Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.

Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

Certificates:

Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.

Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

CONTRACTOR'S REVIEW

Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

ARCHITECT'S REVIEW

Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.

PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.

Paper Submittals: Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

Architect will discard submittals received from sources other than Contractor.

Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

Page Intentionally Left Blank

SECTION 01 35 16
ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

SUMMARY

Section includes special procedures for alteration work.

DEFINITIONS

Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

Consolidate: To strengthen loose or deteriorated materials in place.

Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

Retain: To keep an element or detail secure and intact.

Strip: To remove existing finish down to base material unless otherwise indicated.

QUALITY ASSURANCE

Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.

- Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
- Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

Safety and Health Standard: Comply with ANSI/ASSP A10.6.

STORAGE AND HANDLING OF SALVAGED MATERIALS

Salvaged Materials:

- Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
- Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
- Store items in a secure area until delivery to Owner.
- Transport items to Owner's storage area designated by Owner.
- Protect items from damage during transport and storage.

Salvaged Materials for Reinstallation:

- Repair and clean items for reuse as indicated.
- Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
- Protect items from damage during transport and storage.
- Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

- Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
- Secure stored materials to protect from theft.
- Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

PROTECTION

Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

- Use only proven protection methods, appropriate to each area and surface being protected.
- Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
- Erect temporary barriers to form and maintain fire-egress routes.
- Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.

Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
Protect floors and other surfaces along hauling routes from damage, wear, and staining.
Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

Temporary Protection of Materials to Remain:

Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

Utility and Communications Services:

Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

Existing Roofing: Prior to the start of work in an area, install roofing protection as needed.

PROTECTION FROM FIRE

General: Follow fire-prevention plan and the following:

Comply with NFPA 241 requirements unless otherwise indicated.
Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
If combustible material cannot be removed, provide fire blankets to cover such materials.

PROTECTION DURING APPLICATION OF CHEMICALS

Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

GENERAL ALTERATION WORK

Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

Do not proceed with the work in question until directed by Architect.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

SUMMARY

The Work of This Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

Related Requirements:

Section 01 25 00 "Substitution Procedures" for requests for substitutions.

DEFINITIONS

Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.

New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products unless otherwise indicated.

Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

Evaluating Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.

Data indicating compliance with the requirements specified in "Comparable Products" Article.

Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 "Submittal Procedures."

Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

QUALITY ASSURANCE

Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

PRODUCT DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

PRODUCT WARRANTIES

Warranties specified in other Sections are to be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of Owner or endorsed by manufacturer to Owner.

Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of Owner or endorsed by manufacturer to Owner.

Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.

See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

PRODUCT SELECTION PROCEDURES

General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.

Where products are accompanied by the term "as selected," Architect will make selection.

Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of products.

Product Selection Procedures:

Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."

Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."

Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."

Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."

Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

COMPARABLE PRODUCTS

Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.

Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.

Evidence that proposed product provides specified warranty.

List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.

Samples, if requested.

Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for a comparable product. Architect will notify Contractor of approval or rejection of proposed comparable product within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

Architect's Approval of Submittal: Marked with approval notation from Architect's action stamp. See Section 01 33 00 "Submittal Procedures."

Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

Submittal Requirements, Two-Step Process: Approval by Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 73 00
EXECUTION

PART 1 - GENERAL

SUMMARY

Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

- Construction layout.
- Installation.
- Cutting and patching.
- Progress cleaning.
- Starting and adjusting.
- Protection of installed construction.
- Correction of the Work.

Related Requirements:

- Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
- Section 02 41 19 "Selective Demolition" for demolition and removal of selected portions of the building.

DEFINITIONS

Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

QUALITY ASSURANCE

Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

- Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
- 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.
- Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
- Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

MATERIALS

Comply with requirements specified in other Sections.

For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

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

Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

EXAMINATION

Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.

Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.

Furnish location data for work related to Project that must be performed by public utilities serving Project site.

Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.

List of detrimental conditions, including substrates.

List of unacceptable installation tolerances.

Recommended corrections.

Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

PREPARATION

Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 01 31 00 "Project Management and Coordination."

CONSTRUCTION LAYOUT

Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect and Construction Manager promptly.

Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

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

INSTALLATION

Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.

Allow for building movement, including thermal expansion and contraction.

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

Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

Repair or remove and replace damaged, defective, or nonconforming Work.

Comly with section 01 77 00 “Closeout Proceedures” for repairing or removing and replacing defective Work.

CUTTING AND PATCHING

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

Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

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

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

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

Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 01 10 00 "Summary."

Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize and prevent interruption to occupied areas.

Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.

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.

Proceed with patching after construction operations requiring cutting are complete.

Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

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.

Clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

PROGRESS CLEANING

Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.

Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, in accordance with regulations.

Use containers intended for holding waste materials of type to be stored.

Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

Site: Maintain Project site free of waste materials and debris.

Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

Remove liquid spills promptly.
Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

Installed Work: Keep installed work clean. Clean installed surfaces in accordance with written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

STARTING AND ADJUSTING

Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

PROTECTION OF INSTALLED CONSTRUCTION

Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

Comply with manufacturer's written instructions for temperature and relative humidity.

CORRECTION OF THE WORK

Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

Restore permanent facilities used during construction to their specified condition.

Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

Page Intentionally Left Blank

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

SUMMARY

Section includes administrative and procedural requirements for the following:

- Salvaging nonhazardous demolition and construction waste.
- Recycling nonhazardous demolition and construction waste.
- Disposing of nonhazardous demolition and construction waste.

DEFINITIONS

Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.

Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

ACTION SUBMITTALS

Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

WASTE MANAGEMENT PLAN

General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

- Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
- Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
- Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
- Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
- Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

General: Achieve end-of-Project rates for salvage/recycling of 25 percent by weight of total nonhazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

PART 3 - EXECUTION

PLAN IMPLEMENTATION

General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.

SALVAGING DEMOLITION WASTE

Comply with requirements in Section 02 41 19 "Selective Demolition" for salvaging demolition waste.

Salvaged Items for Reuse in the Work:

Clean salvaged items.
Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
Store items in a secure area until installation.
Protect items from damage during transport and storage.
Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

Salvaged Items for Sale and Donation: Not permitted on Project site.

Salvaged Items for Owner's Use:

Clean salvaged items.
Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
Store items in a secure area until delivery to Owner.
Transport items to Owner's storage area designated by Owner.
Protect items from damage during transport and storage.

RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

- Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
  - Inspect containers and bins for contamination and remove contaminated materials if found.
- Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- Stockpile materials away from construction area. Do not store within drip line of remaining trees.
- Store components off the ground and protect from the weather.
- Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

RECYCLING DEMOLITION WASTE

Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

Metals: Separate metals by type.

- Structural Steel: Stack members according to size, type of member, and length.
- Remove and dispose of bolts, nuts, washers, and other rough hardware.

RECYCLING CONSTRUCTION WASTE

Packaging:

- Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
- Polystyrene Packaging: Separate and bag materials.
- Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
- Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

Wood Materials:

- Clean Cut-Offs of Lumber: Grind or chip into small pieces.
- Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

DISPOSAL OF WASTE

General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

- Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
- Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner’s property.

Burning: Do not burn waste materials.

Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

SUMMARY

Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

- Substantial Completion procedures.
- Final Completion procedures.
- List of incomplete items.
- Submittal of Project warranties.
- Final cleaning.

Related Requirements:

- Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
- Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
- Section 01 79 00 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

ACTION SUBMITTALS

Product Data: For each type of cleaning agent.
Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
Certified List of Incomplete Items: Final submittal at Final Completion.

CLOSEOUT SUBMITTALS

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

SUBSTANTIAL COMPLETION PROCEDURES

Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

- Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
- Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
- Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
- Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
- Submit testing, adjusting, and balancing records.

Submit sustainable design submittals not previously submitted.
Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

Advise Owner of pending insurance changeover requirements.
Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
Complete startup and testing of systems and equipment.
Perform preventive maintenance on equipment used prior to Substantial Completion.
Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
Advise Owner of changeover in utility services.
Participate with Owner in conducting inspection and walkthrough with local emergency responders.
Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
Complete final cleaning requirements.
Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

FINAL COMPLETION PROCEDURES

Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

Submit a final Application for Payment in accordance with Section 01 29 00 "Payment Procedures."
Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

LIST OF INCOMPLETE ITEMS

Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

Organize list of spaces in sequential order, starting with exterior areas first, listed by room or space number.
Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.

Include the following information at the top of each page:

Project name.
Date.
Name of Architect.
Name of Contractor.
Page number.

Submit list of incomplete items in the following format:

PDF Electronic File: Architect will return annotated file.

SUBMITTAL OF PROJECT WARRANTIES

Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

Submit by email to Architect.

Warranties in Paper Form:

Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

MATERIALS

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

Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

FINAL CLEANING

Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

Clean Project site of rubbish, waste material, litter, and other foreign substances.

Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.

Vacuum and mop concrete.

Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.

Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.

Remove labels that are not permanent.

Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

Clean luminaires, lamps, globes, and reflectors to function with full efficiency.

Clean strainers.

Leave Project clean and ready for occupancy.

Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

CORRECTION OF THE WORK

Complete repair and restoration operations required by "Correction of the Work" Article in Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

SUMMARY

Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

- Operation and maintenance documentation directory manuals.
- Systems and equipment operation manuals.
- Systems and equipment maintenance manuals.
- Product maintenance manuals.

CLOSEOUT SUBMITTALS

Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

- Architect will comment on whether content of operation and maintenance submittals is acceptable.
- Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

Format: Submit operation and maintenance manuals in the following format:

- Submit by email to Architect. Enable reviewer comments on draft submittals.

Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

- Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

FORMAT OF OPERATION AND MAINTENANCE MANUALS

Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

- Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
- File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

- Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
- Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual to contain the following materials, in the order listed:

- Title page.
- Table of contents.
- Manual contents.

Title Page: Include the following information:

- Subject matter included in manual.
- Name and address of Project.
- Name and address of Owner.
- Date of submittal.
- Name and contact information for Contractor.
- Name and contact information for Architect.
- Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
- Cross-reference to related systems in other operation and maintenance manuals.

Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

SYSTEMS AND EQUIPMENT OPERATION MANUALS

Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

- System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
- Performance and design criteria if Contractor has delegated design responsibility.
- Operating standards.
- Operating procedures.
- Operating logs.
- Wiring diagrams.
- Control diagrams.
- Piped system diagrams.
- Precautions against improper use.
- License requirements including inspection and renewal dates.

Descriptions: Include the following:

- Product name and model number. Use designations for products indicated on Contract Documents.
- Manufacturer's name.
- Equipment identification with serial number of each component.
- Equipment function.

Operating characteristics.
Limiting conditions.
Performance curves.
Engineering data and tests.
Complete nomenclature and number of replacement parts.

Operating Procedures: Include the following, as applicable:
Startup procedures.
Equipment or system break-in procedures.
Routine and normal operating instructions.
Regulation and control procedures.
Instructions on stopping.
Normal shutdown instructions.
Seasonal and weekend operating instructions.
Required sequences for electric or electronic systems.
Special operating instructions and procedures.

Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.

Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
Identification and nomenclature of parts and components.
List of items recommended to be stocked as spare parts.

Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
Test and inspection instructions.
Troubleshooting guide.
Precautions against improper maintenance.
Disassembly; component removal, repair, and replacement; and reassembly instructions.
Aligning, adjusting, and checking instructions.
Demonstration and training video recording, if available.

Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

Include procedures to follow and required notifications for warranty claims.

Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

PRODUCT MAINTENANCE MANUALS

Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

Product Information: Include the following, as applicable:

Product name and model number.
Manufacturer's name.
Color, pattern, and texture.
Material and chemical composition.
Reordering information for specially manufactured products.

Maintenance Procedures: Include manufacturer's written recommendations and the following:

Inspection procedures.
Types of cleaning agents to be used and methods of cleaning.
List of cleaning agents and methods of cleaning detrimental to product.
Schedule for routine cleaning and maintenance.
Repair instructions.

Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

SUMMARY

Section includes administrative and procedural requirements for Project Record Documents, including the following:

- Record Drawings.
- Record specifications.
- Record Product Data.

Related Requirements:

- Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

CLOSEOUT SUBMITTALS

Record Drawings: Comply with the following:

- Number of Copies: Submit one set(s) of marked-up record prints.

RECORD DRAWINGS

Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

- Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
  - Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
  - Accurately record information in an acceptable drawing technique.
  - Record data as soon as possible after obtaining it.
  - Record and check the markup before enclosing concealed installations.
  - Cross-reference record prints to corresponding photographic documentation.
- Content: Types of items requiring marking include, but are not limited to, the following:
  - Dimensional changes to Drawings.
  - Revisions to details shown on Drawings.
  - Depths of foundations.
  - Locations and depths of underground utilities.
  - Revisions to routing of piping and conduits.
  - Revisions to electrical circuitry.
  - Actual equipment locations.
  - Duct size and routing.
  - Locations of concealed internal utilities.
  - Changes made by Change Order or Construction Change Directive.
  - Changes made following Architect's written orders.
  - Details not on the original Contract Drawings.
  - Field records for variable and concealed conditions.
  - Record information on the Work that is shown only schematically.

Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

Mark important additional information that was either shown schematically or omitted from original Drawings.

Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

Identification: As follows:

Project name.
Date.
Designation "PROJECT RECORD DRAWINGS."
Name of Architect.
Name of Contractor.

MAINTENANCE OF RECORD DOCUMENTS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

SUMMARY

Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

Instruction in operation and maintenance of systems, subsystems, and equipment.

QUALITY ASSURANCE

Preconstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

COORDINATION

Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

INSTRUCTION PROGRAM

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

INSTRUCTION

Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final Operation and Maintenance Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

Page Intentionally Left Blank

SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 - GENERAL

SUMMARY

The Work of this Section Includes:

- Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
- Removal and salvage of existing items for delivery to Owner and removal of existing items for reinstallation.

Related Requirements:

- Section 01 10 00 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
- Section 01 73 00 "Execution" for cutting and patching procedures.

MATERIALS OWNERSHIP

Unless otherwise indicated, demolition waste becomes property of Contractor.

Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

- Carefully salvage in a manner to prevent damage and promptly return to Owner.

INFORMATIONAL SUBMITTALS

Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

Schedule of selective demolition activities with starting and ending dates for each activity.

CLOSEOUT SUBMITTALS

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

FIELD CONDITIONS

Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

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

Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

Hazardous Materials:

- Hazardous materials are present in building to be selectively demolished. A report on the presence of hazardous materials is included in Section 00 31 26 "Existing Hazardous Material Information" for review and use. Examine report to become aware of locations where hazardous materials are present.

On-site sale of removed items or materials is not permitted.

WARRANTY

Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

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

Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

EXAMINATION

Verify that utilities have been disconnected and capped before starting selective demolition operations.

Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

- Inventory and record the condition of items to be removed for salvage or reinstallation. Photograph or video conditions that might be misconstrued as damage caused by removal.
- Photograph or video existing conditions of adjoining construction including finish surfaces, that might be misconstrued as damage caused by selective demolition operations or removal of items for salvage or reinstallation.

PREPARATION

Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

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 and reinstalled in their original locations after selective demolition operations are complete.

UTILITY SERVICES AND BUILDING SYSTEMS

Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.

Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.

- Owner will arrange to shut off indicated utilities when requested by Contractor.
- Arrange to shut off utilities with utility companies.
- If disconnection of utilities and building systems will affect adjacent occupied parts of the building, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to those parts of the building.
- Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.
  - Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - Equipment to Be Removed: Disconnect and cap services and remove equipment and components.

Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.

Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.

Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

Remove and reinstall/salvage existing building systems, equipment, and components indicated on drawings to be removed and reinstalled or removed and salvaged:

Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.

Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and components and deliver to Owner.

SALVAGE/REINSTALL

Removed and Salvaged Items:

Clean salvaged items.

Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.

Store items in a secure area until delivery to Owner.

Transport items to Owner's storage area designated by Owner.

Protect items from damage during transport and storage.

Removed and Reinstalled Items:

Clean and repair items to functional condition adequate for intended reuse.

Pack or crate items after cleaning and repairing. Identify contents of containers.

Protect items from damage during transport and storage.

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.

SELECTIVE DEMOLITION, GENERAL

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

Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

Maintain fire watch during and for at least 2 hours after flame-cutting operations.

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

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.

DISPOSAL OF DEMOLISHED MATERIALS

Remove demolition waste materials from Project site and recycle or dispose of them in accordance with Section 01 74 19 "Construction Waste Management and Disposal."

Do not allow demolished materials to accumulate on-site.

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

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

Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

Burning: Do not burn demolished materials.

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.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

SUMMARY

Section Includes:

- Form-facing material for cast-in-place concrete.
- Shoring, bracing, and anchoring.

ACTION SUBMITTALS

Product Data: For each of the following:

- Exposed surface form-facing material.
- Concealed surface form-facing material.
- Form ties.
- Form-release agent.

Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

- For exposed vertical concrete walls, indicate dimensions and form tie locations.
- Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.
  - Location of construction joints is subject to approval of the Architect.

INFORMATIONAL SUBMITTALS

Field quality-control reports.

Minutes of preinstallation conference.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

- Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
- Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
  - For architectural concrete specified in Section 03 33 00 "Architectural Concrete," limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

FORM-FACING MATERIALS

As-Cast Surface Form-Facing Material:

- Provide continuous, true, and smooth concrete surfaces.
- Furnish in largest practicable sizes to minimize number of joints.
- Acceptable Materials: As required to comply with Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete, and as follows:
  - Plywood, metal, or other approved panel materials.
  - Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

APA HDO (high-density overlay).
APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
APA Plyform Class I, B-B or better; mill oiled and edge sealed.

Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

Provide lumber dressed on at least two edges and one side for tight fit.

RELATED MATERIALS

Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

Formulate form-release agent with rust inhibitor for steel form-facing materials.
Form release agent for form liners shall be acceptable to form liner manufacturer.

Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

INSTALLATION OF FORMWORK

Comply with ACI 301.

Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete" for as-cast finishes.

Limit concrete surface irregularities as follows:

Surface Finish-1.0: ACI 117 Class D, 1 inch.
Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
Surface Finish-3.0: ACI 117 Class A, 1/8 inch.

Construct forms tight enough to prevent loss of concrete mortar.

Minimize joints.
Exposed Concrete: Symmetrically align joints in forms.

Construct removable forms for easy removal without hammering or prying against concrete surfaces.

- Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
- Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
- Install keyways, reglets, recesses, and other accessories, for easy removal.

Do not use rust-stained, steel, form-facing material.

Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

- Provide and secure units to support screed strips.
- Use strike-off templates or compacting-type screeds.

Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

- Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
- Locate temporary openings in forms at inconspicuous locations.

Chamfer exterior corners and edges of permanently exposed concrete.

At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

- Determine sizes and locations from trades providing such items.
- Obtain written approval of Architect prior to forming openings not indicated on Drawings.

Construction and Movement Joints:

- Construct joints true to line with faces perpendicular to surface plane of concrete.
- Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- Place joints perpendicular to main reinforcement.
- Locate joints for beams, slabs, joists, and girders in the middle third of spans.
    - Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
- Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
- Space vertical joints in walls as indicated on Drawings.
    - Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

- Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
- Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

INSTALLATION OF EMBEDDED ITEMS

Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

- Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
- Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
- Install dovetail anchor slots in concrete structures, as indicated on Drawings.
- Clean embedded items immediately prior to concrete placement.

SHORING AND RESHORING INSTALLATION

Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

- Do not remove shoring or reshoring until measurement of slab tolerances is complete.

In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

SUMMARY

Section Includes:

- Steel reinforcement bars.
- Welded-wire reinforcement.

ACTION SUBMITTALS

Product Data: For the following:

- Each type of steel reinforcement.
- Bar supports.
- Mechanical splice couplers.

Shop Drawings: Comply with ACI SP-066:

- Include placing drawings that detail fabrication, bending, and placement.
- Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

Construction Joint Layout: Indicate proposed construction joints required to build the structure.

- Location of construction joints is subject to approval of the Architect.

INFORMATIONAL SUBMITTALS

Welding certificates.

- Reinforcement to Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M

Material Certificates: For each of the following, signed by manufacturers:

- Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."

Material Test Reports: For the following, from a qualified testing agency:

- Steel Reinforcement:
  - For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
- Mechanical splice couplers.

Field quality-control reports.

QUALITY ASSURANCE

Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

PART 2 - PRODUCTS

STEEL REINFORCEMENT

Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.

Headed-Steel Reinforcing Bars: ASTM A970/A970M.

Galvanized Reinforcing Bars:

Steel Bars: ASTM A615/A615M, Grade 60, deformed bars.
Zinc Coating: ASTM A767/A767M, Class I zinc coated after fabrication and bending.

Epoxy-Coated Reinforcing Bars:

Steel Bars: ASTM A615/A615M, Grade 60, deformed bars.
Epoxy Coating: ASTM A775/A775M with less than 2 percent damaged coating in each 12-inch bar length.

Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

REINFORCEMENT ACCESSORIES

Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
For stainless steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

Mechanical Splice Couplers: ACI 318 Type 1, same material of reinforcing bar being spliced; tension-compression type.

Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
Finish: Galvanized.

Stainless Steel Tie Wire: ASTM A1022/A1022M, not less than 0.0508 inch in diameter.

FABRICATING REINFORCEMENT

Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

PREPARATION

Protection of In-Place Conditions:

Do not cut or puncture vapor retarder.
Repair damage and reseal vapor retarder before placing concrete.

Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

INSTALLATION OF STEEL REINFORCEMENT

Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

Accurately position, support, and secure reinforcement against displacement.

Locate and support reinforcement with bar supports to maintain minimum concrete cover.
Do not tack weld crossing reinforcing bars.

Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

Provide concrete coverage in accordance with ACI 318.

Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

Splices: Lap splices as indicated on Drawings.

Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
Stagger splices in accordance with ACI 318.
Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

Install welded-wire reinforcement in longest practicable lengths.

Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.

Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
Lace overlaps with wire.

JOINTS

Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

Place joints perpendicular to main reinforcement.
Continue reinforcement across construction joints unless otherwise indicated.
Do not continue reinforcement through sides of strip placements of floors and slabs.

INSTALLATION TOLERANCES

Comply with ACI 117.

FIELD QUALITY CONTROL

Special Inspections: Concrete Testing Agency to do rebar special inspections.

Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

Inspections:
Steel-reinforcement placement.
Steel-reinforcement mechanical splice couplers.
Steel-reinforcement welding.

END OF SECTION

Page Intentionally Left Blank

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

SUMMARY

Section Includes:

Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

Related Requirements:

Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials, form liners, and insulating concrete forms.

Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

DEFINITIONS

Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.

Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

PREINSTALLATION MEETINGS

Preinstallation Conference: Conduct conference at Project site.

ACTION SUBMITTALS

Product Data: For each of the following.

Portland cement.

Fly ash.

Slag cement.

Blended hydraulic cement.

Aggregates.

Admixtures:

Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

Vapor retarders.

Liquid floor treatments.

Curing materials.

Joint fillers.

Design Mixtures: For each concrete mixture, include the following:

Mixture identification.

Minimum 28-day compressive strength.

Durability exposure class.

Maximum w/cm.

Calculated equilibrium unit weight, for lightweight concrete.

Slump limit.

Air content.

Nominal maximum aggregate size.

Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.

Intended placement method.

Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

Shop Drawings:
Construction Joint Layout: Indicate proposed construction joints required to construct the structure. Location of construction joints is subject to approval of the Architect.

Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
Concrete Class designation.
Location within Project.
Exposure Class designation.
Formed Surface Finish designation and final finish.
Final finish for floors.
Curing process.
Floor treatment if any.

INFORMATIONAL SUBMITTALS
Material Certificates: For each of the following, signed by manufacturers:
Cementitious materials.
Admixtures.
Curing compounds.
Vapor retarders.
Joint-filler strips.

Material Test Reports: For the following, from a qualified testing agency:
Portland cement.
Fly ash.
Slag cement.
Blended hydraulic cement.
Aggregates.
Admixtures

Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
Preconstruction Test Reports: For each mix design.
Field quality-control reports.
Minutes of preinstallation conference.

QUALITY ASSURANCE
Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

PRECONSTRUCTION TESTING
Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
Include the following information in each test report:
Admixture dosage rates.
Slump.
Air content.
Seven-day compressive strength.
28-day compressive strength.

DELIVERY, STORAGE, AND HANDLING
Comply with ASTM C94/C94M and ACI 301.

FIELD CONDITIONS

Cold-Weather Placement: Comply with ACI 301 and ACI 306.1.

Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

PART 2 - PRODUCTS

CONCRETE, GENERAL

ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

CONCRETE MATERIALS

Cementitious Materials:

- Portland Cement: ASTM C150/C150M, Type I/II.
- Fly Ash: ASTM C618, Class C or F.
- Slag Cement: ASTM C989/C989M, Grade 100 or 120.
- Blended Hydraulic Cement: ASTM C595/C595M, Type IS, portland blast-furnace slag cement.

Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

- Alkali-Silica Reaction: Comply with one of the following:
  - Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
  - Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
  - Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
- Maximum Coarse-Aggregate Size: 1 inch nominal.
- Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

Lightweight Aggregate: ASTM C330/C330M, 1/2-inch nominal maximum aggregate size.

Air-Entraining Admixture: ASTM C260/C260M.

Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

- Water-Reducing Admixture: ASTM C494/C494M, Type A.
- Retarding Admixture: ASTM C494/C494M, Type B.
- Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.

Water and Water Used to Make Ice: ASTM C94/C94M, potable or complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4.

VAPOR RETARDERS

Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

CURING MATERIALS

Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
Color:
Ambient Temperature Below 50 deg F: Black.
Ambient Temperature between 50 deg F and 85 deg F: Any color.
Ambient Temperature Above 85 deg F: White.

Water: Potable or complying with ASTM C1602/C1602M.

Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B.

Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

RELATED MATERIALS

Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

Floor Slab Protective Covering: Eight-feet-wide cellulose fabric.

CONCRETE MIXTURES, GENERAL

Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

Fly Ash or Other Pozzolans: 25 percent by mass.
Slag Cement: 50 percent by mass.
Total of Fly Ash or Other Pozzolans, Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.
Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.

Admixtures: Use admixtures in accordance with manufacturer's written instructions.
Use water-reducing admixture in concrete, as required, for placement and workability.
Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
Use water-reducing admixture in pumped concrete.

CONCRETE MIXTURES

Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
Exposure Class: ACI 318 - F2.
Minimum Compressive Strength: 4000 psi at 28 days.
Maximum w/cm: 0.45.
Slump Limit: 5 inches, plus or minus 1 inch.
Slump Flow Limit: 30 inches, plus or minus 2.5 inches.
Air Content:
Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.
Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.
Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

Class B: Normal-weight concrete used for foundation walls.
- Exposure Class: ACI 318 - F2.
- Minimum Compressive Strength: 4000 psi at 28 days.
- Maximum w/cm: 0.45.
- Slump Limit: 5 inches, plus or minus 1 inch.
- Slump Flow Limit: 30 inches, plus or minus 2.5 inches.
- Air Content:
  - Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.
  - Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.
- Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

Class C: Normal-weight concrete used for interior slabs-on-ground.
- Exposure Class: ACI 318 - F0.
- Minimum Compressive Strength: 4000 psi at 28 days.
- Maximum w/cm: 0.45.
- Minimum Cementitious Materials Content: 520 lb/cu. yd.
- Slump Limit: 5 inches, plus or minus 1 inch.
- Slump Flow Limit: 30 inches, plus or minus 2.5 inches.
- Air Content:
  - Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
- Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

Class F: Normal-weight concrete used for concrete toppings.

- Exposure Class: ACI 318 F0.
- Minimum Compressive Strength: 4000 psi at 28 days.
- Minimum Cementitious Materials Content: 520 lb/cu. yd..
- Slump Limit: 5 inches, plus or minus 1 inch.

- Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

  - Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished toppings.

CONCRETE MIXING

Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

- For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
- For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
- Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

INSTALLATION OF EMBEDDED ITEMS

Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

- Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
- Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

INSTALLATION OF VAPOR RETARDER

Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

- Install vapor retarder with longest dimension parallel with direction of concrete pour.
- Face laps away from exposed direction of concrete pour.
- Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
- Lap joints 6 inches and seal with manufacturer's recommended tape.
- Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
- Seal penetrations in accordance with vapor retarder manufacturer's instructions.
- Protect vapor retarder during placement of reinforcement and concrete.
    - Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

JOINTS

Construct joints true to line, with faces perpendicular to surface plane of concrete.

Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

- Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
- Place joints perpendicular to main reinforcement.
    - Continue reinforcement across construction joints unless otherwise indicated.
    - Do not continue reinforcement through sides of strip placements of floors and slabs.
- Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
- Locate joints for slabs at third points of spans.
- Locate horizontal joints in walls at underside of floors or slabs and at the top of footings or floor slabs.
- Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.

Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

- Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

Doweled Joints:
Install dowel bars and support assemblies at joints where indicated on Drawings.
Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

Dowel Plates: Install dowel plates at joints where indicated on Drawings.

CONCRETE PLACEMENT
Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

If a section cannot be placed continuously, provide construction joints as indicated.
Deposit concrete to avoid segregation.
Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

Do not use vibrators to transport concrete inside forms.
Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.

At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

Do not place concrete floors and slabs in a checkerboard sequence.
Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
Maintain reinforcement in position on chairs during concrete placement.
Screed slab surfaces with a straightedge and strike off to correct elevations.
Level concrete, cut high areas, and fill low areas.
Slope surfaces uniformly to drains where required.
Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
Do not further disturb slab surfaces before starting finishing operations.

FINISHING FORMED SURFACES

As-Cast Surface Finishes:

ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
Remove projections larger than 1 inch.
Tie holes do not require patching.
Surface Tolerance: ACI 117 Class D.
Apply to concrete surfaces not exposed to public view.

ACI 301Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
Patch voids larger than 3/4 inch wide or 1/2 inch deep.
Remove projections larger than 1/4 inch.
Patch tie holes.
Surface Tolerance: ACI 117 Class B.
Locations: Apply to concrete surfaces exposed to public view or to receive a rubbed finish.

ACI 301 Surface Finish SF-3.0:
Patch voids larger than 3/4 inch wide or 1/2 inch deep.
Remove projections larger than 1/8 inch.
Patch tie holes.
Surface Tolerance: ACI 117 Class A.
Locations: Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete.

Related Unformed Surfaces:

At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

FINISHING FLOORS AND SLABS

Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

Float Finish:

When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.

Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.

Apply float finish to surfaces to receive trowel finish.

Trowel Finish:

After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.

Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.

Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

Do not add water to concrete surface.

Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.

Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

Coordinate required final finish with Architect before application.

INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

Filling In:

Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.

Mix, place, and cure concrete, as specified, to blend with in-place construction.

Provide other miscellaneous concrete filling indicated or required to complete the Work.

Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

Equipment Bases and Foundations:

Coordinate sizes and locations of concrete bases with actual equipment provided.

Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.

Minimum Compressive Strength: 4000 psi at 28 days.

Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.

Prior to pouring concrete, place and secure anchorage devices.

Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Cast anchor-bolt insert into bases.

Install anchor bolts to elevations required for proper attachment to supported equipment.

CONCRETE CURING

Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

- Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
- Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
- Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

Curing Formed Surfaces: Comply with ACI 308.1 as follows:

- Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
- Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
- If forms remain during curing period, moist cure after loosening forms.
- If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
  - Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
  - Continuous Sprinkling: Maintain concrete surface continuously wet.
  - Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
  - Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
  - Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
    - Recoat areas subject to heavy rainfall within three hours after initial application.
    - Maintain continuity of coating and repair damage during curing period.

Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

- Begin curing immediately after finishing concrete.
- Interior Concrete Floors:
  - Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
    - Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
      - Lap edges and ends of absorptive cover not less than 12-inches.
      - Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
    - Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
      - Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      - Cure for not less than seven days.
    - Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
      - Water.
      - Continuous water-fog spray.
  - Floors to Receive Polished Finish: Contractor has option of the following:
    - Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

Lap edges and ends of absorptive cover not less than 12 inches.
Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
Water.
Continuous water-fog spray.

Floors to Receive Curing and Sealing Compound:
Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
Recoat areas subjected to heavy rainfall within three hours after initial application.
Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

TOLERANCES

Conform to ACI 117.

FIELD QUALITY CONTROL

Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

Project name.
Name of testing agency.
Names and certification numbers of field and laboratory technicians performing inspections and testing.
Name of concrete manufacturer.
Date and time of inspection, sampling, and field testing.
Date and time of concrete placement.
Location in Work of concrete represented by samples.
Date and time sample was obtained.
Truck and batch ticket numbers.
Design compressive strength at 28 days.
Concrete mixture designation, proportions, and materials.
Field test results.
Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
Type of fracture and compressive break strengths at seven days and 28 days.

Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

Inspections:

- Headed bolts and studs.
- Verification of use of required design mixture.
- Concrete placement, including conveying and depositing.
- Curing procedures and maintenance of curing temperature.
- Verification of concrete strength before removal of shores and forms from beams and slabs.
- Batch Plant Inspections: On a random basis, as determined by Architect.

Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

Slump: ASTM C143/C143M:

One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.

Perform additional tests when concrete consistency appears to change.

Slump Flow: ASTM C1611/C1611M:

One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.

Perform additional tests when concrete consistency appears to change.

Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.

One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

Concrete Temperature: ASTM C1064/C1064M:

One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.

One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

Compression Test Specimens: ASTM C31/C31M:

Cast and laboratory cure two sets of three 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.

Cast, initial cure, and field cure two sets of three standard cylinder specimens for each composite sample.

Compressive-Strength Tests: ASTM C39/C39M.

Test one set of three laboratory-cured specimens at seven days and one set of two specimens at 28 days.

Test one set of three field-cured specimens at seven days and one set of two specimens at 28 days.

A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.

Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

Additional Tests:

Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

PROTECTION

Protect concrete surfaces as follows:

Protect from petroleum stains.

Diaper hydraulic equipment used over concrete surfaces.

Prohibit vehicles from interior concrete slabs.

Prohibit use of pipe-cutting machinery over concrete surfaces.

Prohibit placement of steel items on concrete surfaces.

Prohibit use of acids or acidic detergents over concrete surfaces.

Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION

Page Intentionally Left Blank

SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

SUMMARY

Section Includes:

- Concrete masonry units.
- Lintels.
- Mortar and grout materials.
- Reinforcement.
- Ties and anchors.
- Embedded flashing.
- Accessories.
- Mortar and grout mixes.

ACTION SUBMITTALS

Product Data: For each type of product.

Shop Drawings: For reinforcing steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R.

Samples: For each type and color of exposed masonry unit and colored mortar.

INFORMATIONAL SUBMITTALS

Material Certificates: For each type and size of product and for masonry units, include data on material properties.

Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

- Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
- Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

QUALITY ASSURANCE

Sample Panel Mockups: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 40 00 "Quality Requirements" for mockups.

- Build sample panels for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness.

FIELD CONDITIONS

Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

UNIT MASONRY, GENERAL

Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

CONCRETE MASONRY UNITS

Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

CMUs: ASTM C90, normal weight and lightweight unless otherwise indicated.

Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3250 psi.

LINTELS

Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

MORTAR AND GROUT MATERIALS

Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

Hydrated Lime: ASTM C207, Type S.

Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime, sand, mortar pigments, and admixtures and complying with ASTM C1714/C1714M.

Aggregate for Mortar: ASTM C144.
For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
White-Mortar Aggregates: Natural white sand or crushed white stone.

Aggregate for Grout: ASTM C404.

Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

Water: Potable.

REINFORCEMENT

Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

Masonry-Joint Reinforcement, General: ASTM A951/A951M.

- Interior Walls: Mill- galvanized carbon steel.
- Exterior Walls: Hot-dip galvanized carbon steel.
- Wire Size for Side Rods: 0.187-inch diameter.
- Wire Size for Cross Rods: 0.187-inch diameter.
- Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
- Provide in lengths of not less than 10 ft.

Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

Masonry-Joint Reinforcement for Multiwythe Masonry:

- Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus one side rod at each wythe of masonry 4 inches wide or less.
- Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.
- Adjustable (two-piece) type, ladder design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

TIES AND ANCHORS

General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

- Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
- Stainless Steel Wire: ASTM A580/A580M, Type 304.
- Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
- Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
- Steel Plates, Shapes, and Bars: ASTM A36/A36M.

Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

- Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.

- Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

EMBEDDED FLASHING

Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft.. Provide splice plates at joints of formed, smooth metal flashing.
Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
Fabricate metal expansion-joint strips from stainless steel to shapes indicated.

Flexible Flashing: Use one of the following unless otherwise indicated:

Stainless Steel Fabric Flashing: Composite, flashing product consisting of 2-mil Type 304 stainless steel sheet, bonded to a layer of polymeric fabric, to produce an overall thickness of 40-mil.

Self-Adhering, Stainless Steel Fabric Flashing: Composite, flashing product consisting of 2 mil of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric with a butyl adhesive, to produce an overall thickness of 40 mil.
Applications: Use 10-mil-thick flashing at windows, doors, and small wall penetrations; not at base of walls. Use 40-mil-thick flashing at base of walls.

EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 40 mil thick.

Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.

Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

Termination Bars for Flexible Flashing: Stainless steel bars 0.075 inch by 1 inch.

Termination Bars for Flexible Flashing, Flanged: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8-inch sealant flange at top.

ACCESSORIES

Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC-65406 and

designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

Weep/Cavity Vents: Use one of the following unless otherwise indicated:

Wicking Material: Absorbent rope, made from cotton, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity. Use only for weeps.
Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.
Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches long.

Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.

Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.

Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

Rainscreen Drainage Mat: Sheets or strips not less than full depth of cavity installed to full height of cavity, with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity to prevent weep holes from clogging with mortar.

Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

MORTAR AND GROUT MIXES

General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

Do not use calcium chloride in mortar or grout.
Use portland cement-lime mortar unless otherwise indicated.
For exterior masonry, use portland cement-lime mortar.
For reinforced masonry, use portland cement-lime mortar.
Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

For masonry below grade or in contact with earth, use Type M.
For reinforced masonry, use Type S.
For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type S.

Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

Pigments shall not exceed 10 percent of portland cement by weight.
Pigments shall not exceed 5 percent of masonry cement by weight.
Mix to match Architect's sample.

Grout for Unit Masonry: Comply with ASTM C476.

Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

INSTALLATION, GENERAL
Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

TOLERANCES
Dimensions and Locations of Elements:

For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

Lines and Levels:

For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft. or 1/2-inch maximum.

Joints:

For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

LAYING MASONRY WALLS

Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

MORTAR BEDDING AND JOINTING

Lay CMUs as follows:

Bed face shells in mortar and make head joints of depth equal to bed joints.
Bed webs in mortar in all courses of piers, columns, and pilasters.
Bed webs in mortar in grouted masonry, including starting course on footings.
Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

MASONRY-JOINT REINFORCEMENT

General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

Space reinforcement not more than 16 inches o.c.
Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

Provide continuity at wall intersections by using prefabricated T-shaped units.

Provide continuity at corners by using prefabricated L-shaped units.

REINFORCED UNIT MASONRY

Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

- Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
- Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

Placing Reinforcement: Comply with requirements in TMS 602.

Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

- Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
- Limit height of vertical grout pours to not more than 60 inches.

FIELD QUALITY CONTROL

Testing Agency: Engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.

Inspections: Special inspections in accordance with Level 3 in TMS 402.

- Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
- Place grout only after inspectors have verified proportions of site-prepared grout.

Testing Prior to Construction: One set of tests.

Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.

Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength.

Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

CLEANING

In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

- Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.

MASONRY WASTE DISPOSAL

Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

Do not dispose of masonry waste as fill within 18 inches of finished grade.

Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

Page Intentionally Left Blank

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

SUMMARY

Section Includes:

- Structural steel.
- Shrinkage-resistant grout.

DEFINITIONS

Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

ACTION SUBMITTALS

Product Data:

- Structural-steel materials.
- High-strength, bolt-nut-washer assemblies.
- Anchor rods.
- Threaded rods.
- Forged-steel hardware.
- Shop primer.
- Etching cleaner.
- Shrinkage-resistant grout.

Shop Drawings: Show fabrication of structural-steel components.

INFORMATIONAL SUBMITTALS

Welding certificates.

Mill test reports for structural-steel materials, including chemical and physical properties.

Source quality-control reports.

Field quality-control reports.

QUALITY ASSURANCE

Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Comply with applicable provisions of the following specifications and documents:

- ANSI/AISC 303.
- ANSI/AISC 360.
- RCSC's "Specification for Structural Joints Using High-Strength Bolts."

Connection Design Information:

- Option 1: Connection designs have been completed and connections indicated on the Drawings.
- Option 2: Fabricator's experienced steel detailer selects or completes connections in accordance with ANSI/AISC 303.

Select and complete connections using schematic details indicated and ANSI/AISC 360.
Use Allowable Stress Design; data are given at service-load level.

Option 3 and 3A: Design connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer. Member reinforcement at connections is indicated on Drawings.
Use Allowable Stress Design; data are given at service-load level.

Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.
Use Allowable Stress Design; data are given at service-load level.

Construction: Shear wall system.

STRUCTURAL-STEEL MATERIALS

W-Shapes: ASTM A992/A992M .

Channels, Angles: ASTM A36/A36M.

Plate and Bar: ASTM A36/A36M.

Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.

Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

Welding Electrodes: Comply with AWS requirements.

BOLTS AND CONNECTORS

High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.

High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

Direct-Tension Indicators: ASTM F959/F959M, Type 490-1, compressible-washer type with plain finish.

RODS

Unheaded Anchor Rods: ASTM F1554, Grade 36.

Configuration: Straight.

Finish: Plain.

Headed Anchor Rods: ASTM F1554, Grade 36, straight.

Finish: Plain.

Threaded Rods: ASTM A36/A36M.

Finish: Plain.

PRIMER

Steel Primer:

Zinc rich primer.

Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

SHRINKAGE-RESISTANT GROUT

Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

FABRICATION

Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

SHOP CONNECTIONS

High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

Joint Type: Snug tightened.

Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

SHOP PRIMING

Shop prime steel surfaces, except the following:

Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

Surfaces to be field welded.

Surfaces of high-strength bolted, slip-critical connections.

Surfaces enclosed in interior construction.

Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

SSPC-SP 2.

SSPC-SP 3.

SSPC-SP 7 (WAB)/NACE WAB-4.

SSPC-SP 6 (WAB)/NACE WAB-3.

Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

SOURCE QUALITY CONTROL

Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

Liquid Penetrant Inspection: ASTM E165/E165M.

Prepare test and inspection reports.

PART 3 - EXECUTION

EXAMINATION

Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

Proceed with installation only after unsatisfactory conditions have been corrected.

ERECTION

Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

Set plates for structural members on wedges, shims, or setting nuts as required.

Weld plate washers to top of baseplate.

Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

Maintain erection tolerances of structural steel within ANSI/AISC 303.

FIELD CONNECTIONS

High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

Joint Type: Snug tightened.

Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

FIELD QUALITY CONTROL

Special Inspections: Owner will engage a special inspector to perform the following special inspections:

Verify structural-steel materials and inspect steel frame joint details.

Verify connection materials and inspect high-strength bolted connections.

Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

SUMMARY

Section Includes:

- Load-bearing wall framing.
- Interior non-load-bearing wall framing.

ACTION SUBMITTALS

Product Data: For the following:

- Cold-formed steel framing materials.
- Load-bearing wall framing.
- Interior non-load-bearing wall framing.
- Vertical deflection clips.
- Single deflection track.
- Drift clips.
- Post-installed anchors.
- Power-actuated anchors.

Shop Drawings:

- Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
- Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

INFORMATIONAL SUBMITTALS

Product certificates.

Product test reports.

Research Reports:

- For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

QUALITY ASSURANCE

Product Tests: Mill certificates or data from a qualified independent testing agency.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

- Wall Studs: AISI S211.
- Headers: AISI S212.
- Lateral Design: AISI S213.

Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

COLD-FORMED STEEL FRAMING MATERIALS

Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

Grade: ST33H or As required by structural performance.
Coating: G60, A60, AZ50, or GF30.

Steel Sheet for Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

Grade: 33 or As required by structural performance.
Coating: G60.

LOAD-BEARING WALL FRAMING

Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

Minimum Base-Metal Thickness: 0.0329 inch.
Flange Width: 1-3/8 inches.

Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and matching minimum base-metal thickness of steel studs.

Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

Minimum Base-Metal Thickness: 0.0329 inch.
Flange Width: 1-3/8 inches.

INTERIOR NON-LOAD-BEARING WALL FRAMING

Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

Minimum Base-Metal Thickness: 0.0329 inch.
Flange Width: 1-3/8 inches.

Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

FRAMING ACCESSORIES

Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

ANCHORS, CLIPS, AND FASTENERS

Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

Uses: Securing cold-formed steel framing to structure.
Type: adhesive anchor.
Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

MISCELLANEOUS MATERIALS

Galvanizing Repair Paint: ASTM A780/A780M or SSPC-Paint 20.

Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

PART 3 - EXECUTION

PREPARATION

Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

INSTALLATION, GENERAL

Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

INSTALLATION OF LOAD-BEARING WALL FRAMING

Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

Anchor Spacing: 32 inches max.

Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track.

Fasten both flanges of studs to top and bottom tracks.
Space studs as follows:

Stud Spacing: 16 inches.

Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

Install horizontal bridging in stud system, spaced vertically 48 inches. Fasten at each stud intersection.

Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING

Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:

Stud Spacing: 16 inches.

Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

Install single deep-leg deflection tracks and anchor to building structure.
Install double deep-leg deflection tracks and anchor outer track to building structure.
Connect vertical deflection clips to studs and anchor to building structure.
Connect drift clips to cold-formed steel metal framing and anchor to building structure.

Install horizontal bridging in wall studs, spaced vertically in rows indicated but not more than 48 inches apart. Fasten at each stud intersection.

Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

Install solid blocking at centers indicated.

Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

INSTALLATION TOLERANCES

Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

REPAIRS

Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 – GENERAL

SUMMARY

Section Includes:

- Miscellaneous framing and supports.
- Miscellaneous steel trim.
- Metal bollards.
- Pipe and downspout guards.
- Loose bearing and leveling plates.

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

- Loose steel lintels.
- Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
- Steel weld plates and angles for casting into concrete.

ACTION SUBMITTALS

Product Data: For the following:

- Nonslip aggregates and nonslip-aggregate surface finishes.
- Fasteners.
- Shop primers.
- Shrinkage-resisting grout.
- Prefabricated building columns.
- Manufactured metal ladders.
- Metal bollards.
- Pipe and downspout guards.
- Abrasive metal nosings, treads, and thresholds.

Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

Samples: For each type and finish of extruded nosing and tread.

PART 2 – PRODUCTS

METALS

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.

Steel Plates, Shapes, and Bars: ASTM A36/A36M.

Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

Rolled-Stainless Steel Floor Plate: ASTM A793.

Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

FASTENERS

General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

Provide stainless steel fasteners for fastening aluminum or stainless steel.

Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

Post-Installed Anchors: Torque-controlled expansion anchors.

Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

MISCELLANEOUS MATERIALS

Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.

Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

FABRICATION, GENERAL

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.

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.

Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

Form exposed work with accurate angles and surfaces and straight edges.

Weld corners and seams continuously to comply with the following:

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
Obtain fusion without undercut or overlap.
Remove welding flux immediately.
At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches from ends and corners of units and 24 inches o.c.

MISCELLANEOUS FRAMING AND SUPPORTS

General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

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.

Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.

Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

MISCELLANEOUS STEEL TRIM

Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

Galvanize exterior miscellaneous steel trim.

Prime exterior miscellaneous steel trim with zinc-rich primer.

METAL BOLLARDS

Fabricate metal bollards from Schedule 40 steel pipe steel shapes, as indicated.
Cap bollards with 1/4-inch-thick steel.

Fabricate bollards with 3/8-inch-thick, steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.

Fabricate sleeves for bollard anchorage from steel or stainless steel pipe or tubing with 1/4-inch-thick, steel or stainless steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

Prime steel bollards with zinc-rich primer.

LOOSE BEARING AND LEVELING PLATES

Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

Galvanize bearing and leveling plates.

Prime plates with zinc-rich primer.

STEEL WELD PLATES AND ANGLES

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

GENERAL FINISH REQUIREMENTS

Finish metal fabrications after assembly.

STEEL AND IRON FINISHES

Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

Shop prime with universal shop primer unless zinc-rich primer is indicated.

Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

Items Indicated to Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."

Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

INSTALLATION, GENERAL

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.

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.

Field Welding: Comply with the following requirements:

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

Obtain fusion without undercut or overlap.
Remove welding flux immediately.
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.

Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

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

Anchor supports for overhead doors and overhead grilles securely to, and rigidly brace from, building structure.

Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

INSTALLATION OF METAL FLOOR PLATE

Install metal floor plates flush with finished surface. Adjust as required to avoid lippage that could present a tripping hazard.

INSTALLATION OF STRUCTURAL-STEEL DOOR FRAMES

Fasten structural steel door frames to the floor slab by means of angle clips and expansion bolts. Anchor door jambs to adjacent construction in accordance with shop drawing details.

INSTALLATION OF MISCELLANEOUS STEEL TRIM

Anchor to concrete construction to comply with manufacturer's written instructions.

INSTALLATION OF METAL BOLLARDS

Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

Anchor bollards to existing construction with anchor bolts. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
Embed anchor bolts at least 4 inches in concrete.

Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
Fill bollards solidly with concrete, mounding top surface to shed water.

INSTALLATION OF LOOSE BEARING AND LEVELING PLATES

Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off

flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

REPAIRS

Touchup Painting:

Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 06 10 53
MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

SUMMARY

Section Includes: Framing with dimension lumber, wood blocking and nailers, wood furring and grounds, wood sleepers, plywood backing panels.

ACTION SUBMITTALS

Product Data: For each type of process and factory-fabricated product.

INFORMATIONAL SUBMITTALS

Evaluation Reports: For the following, from ICC-ES:

- Preservative-treated wood.
- Power-driven fasteners.

PART 2 - PRODUCTS

WOOD PRODUCTS, GENERAL

Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

- Factory mark each piece of lumber with grade stamp of grading agency.
- For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
- Dress lumber, S4S, unless otherwise indicated.

Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

WOOD-PRESERVATIVE-TREATED MATERIALS

Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

- Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

Application: Treat items indicated on Drawings, and the following:

- Wood cants, nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
- Wood, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
- Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
- Wood floor plates that are installed over concrete slabs-on-grade.

DIMENSION LUMBER FRAMING

Non-Load-Bearing Interior Partitions: Construction or No. 2 grade of any species.

Other Framing: No. 2 grade of any of the following species:

- Hem-fir (north); NLGA.
- Southern pine; SPIB.
- Douglas fir-larch; WCLIB or WWPA.
- Southern pine or mixed southern pine; SPIB.
- Spruce-pine-fir; NLGA.
- Douglas fir-south; WWPA.
- Hem-fir; WCLIB or WWPA.
- Douglas fir-larch (north); NLGA.
- Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

MISCELLANEOUS LUMBER

General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

- Blocking.
- Nailers.
- Rooftop equipment bases and support curbs.
- Cants.
- Furring.
- Grounds.
- Utility shelving.

Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:

- Mixed southern pine or southern pine, No. 2 grade; SPIB.
- Eastern softwoods, No. 2 Common grade; NELMA.
- Northern species, No. 2 Common grade; NLGA.
- Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

PLYWOOD BACKING PANELS

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

FASTENERS

General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

- Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

MISCELLANEOUS MATERIALS

Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

INSTALLATION

Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

Do not splice structural members between supports unless otherwise indicated.

Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

- Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- ICC-ES evaluation report for fastener.

PROTECTION

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

END OF SECTION

Page Intentionally Left Blank

SECTION 06 16 00
SHEATHING

PART 1 - GENERAL

SUMMARY
Section Includes:
- Wall sheathing.
- Roof sheathing.

ACTION SUBMITTALS
Product Data: For each type of process and factory-fabricated product.

INFORMATIONAL SUBMITTALS
Evaluation Reports: For the following, from ICC-ES:
- Wood-preservative-treated plywood.
- Foam-plastic sheathing.

PART 2 – PRODUCTS

WOOD PANEL PRODUCTS
Emissions: Products are to meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PRESERVATIVE-TREATED PLYWOOD
Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

WALL SHEATHING
Plywood Sheathing, Walls: , Exterior, Structural I sheathing.

Oriented-Strand-Board Sheathing, Walls: DOC PS 2, Exposure 1, Structural I sheathing.

ROOF SHEATHING
Plywood Sheathing, Roofs: , Exterior, Structural I sheathing.

Oriented-Strand-Board Sheathing, Roofs: DOC PS 2, Exposure 1, Structural I sheathing.

FASTENERS
General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

- For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- For roof and wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours in accordance with ASTM B117.

MISCELLANEOUS MATERIALS

Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

INSTALLATION, GENERAL

Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

Securely attach to substrate by fastening as indicated, complying with the following:

- Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
- Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
- ICC-ES evaluation report for fastener.

Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

WOOD STRUCTURAL PANEL INSTALLATION

General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

Fastening Methods: Fasten panels as indicated below:

- Wall and Roof Sheathing:
  - Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
  - Screw to cold-formed metal framing.
  - Space panels 1/8 inch apart at edges and ends.

END OF SECTION

SECTION 06 17 53
SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

SUMMARY
Section Includes:
- Wood roof trusses.

ACTION SUBMITTALS
Product Data: For metal-plate connectors, metal truss accessories, and fasteners.

Shop Drawings: Show fabrication and installation details for trusses.

- Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
- Indicate sizes, stress grades, and species of lumber.
- Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
- Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
- Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
- Show splice details and bearing details.

Delegated-Design Submittals: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

INFORMATIONAL SUBMITTALS
Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.

Evaluation Reports: For the following, from ICC-ES:
- Metal-plate connectors.
- Metal truss accessories.

QUALITY ASSURANCE
Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

- Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
- Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

DELIVERY, STORAGE, AND HANDLING
Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal-plate-connected wood trusses.

Structural Performance: Metal-plate-connected wood trusses are to be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1.

Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.

Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

DIMENSION LUMBER

Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

Provide dry lumber with 15 percent maximum moisture content at time of dressing.

Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 10 00 "Rough Carpentry."

METAL CONNECTOR PLATES

Fabricate connector plates to comply with TPI 1.

Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

FASTENERS

Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.

Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

Nails, Brads, and Staples: ASTM F1667.

METAL FRAMING ANCHORS AND ACCESSORIES

Allowable design loads, as published by manufacturer, are to comply with or exceed those of basis-of-design products. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors are to be punched for fasteners adequate to withstand same loads as framing anchors.

Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

FABRICATION

Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

Fabricate wood trusses within manufacturing tolerances in TPI 1.

Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

INSTALLATION

Install wood trusses only after supporting construction is in place and is braced and secured.

If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

Install and brace trusses according to TPI recommendations and as indicated.

Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

Securely connect each truss ply required for forming built-up girder trusses.

Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

Install bracing to comply with Section 06 10 00 "Rough Carpentry."
Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

Install wood trusses within installation tolerances in TPI 1.

Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

Replace wood trusses that are damaged or do not comply with requirements.

END OF SECTION

Page Intentionally Left Blank

SECTION 06 20 13
EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

SUMMARY
Section Includes:
Engineered Wood Siding and Trim.
LP Smart Siding

DEFINITIONS
MDO: Plywood with a medium-density overlay on the face.
PVC: Polyvinyl chloride.

ACTION SUBMITTALS
Product Data: For each type of process and factory-fabricated product.
Samples: For each exposed product and for each color and texture specified.

WARRANTY
Manufacturer's Warranty for Engineered Wood Siding and Trim: Manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

Warranty Period for Factory-Applied Finish: Five years from date of Substantial Completion.
Warranty Period for Siding and Trim (Excluding Finish): 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

MATERIALS, GENERAL
Softwood Plywood: DOC PS 1.

Hardboard: ANSI A135.4.

PLYWOOD SIDING
Plywood Type: CCA treated siding in panel sizes indicated.

Thickness: 1/2 inch.

Pattern: Plain.

Surface: Smooth.

ENGINEERED WOOD SIDING
Engineered Wood Siding: ANSI A135.6, primed with manufacturer's standard exterior primer.

7/16-inch-thick, shiplap-edge panels; Wood grain.

Colors, Textures, and Patterns: As selected by Architect from manufacturer's full range.

MISCELLANEOUS MATERIALS
Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.

For face-fastening siding, provide ringed-shank siding nails or hot-dip galvanized-steel siding nails.

For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
For pressure-preservative-treated wood, provide hot-dip galvanized-steel fasteners.

Flashing: Comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.

Horizontal Joint Flashing for Panel Siding: Aluminum.

PART 3 – EXECUTION

PREPARATION

Clean substrates of projections and substances detrimental to application.

Prime lumber and moldings to be painted, including both faces and edges, unless factory primed.

Cut to required lengths and prime ends.

INSTALLATION, GENERAL

Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.

Use concealed shims where necessary for alignment.
Scribe and cut exterior finish carpentry to fit adjoining work.
Refinish and seal cuts as recommended by manufacturer.
Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

INSTALLATION OF STANDING AND RUNNING TRIM

Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.

Use scarf joints for end-to-end joints.
Stagger end joints in adjacent and related members.

Fit exterior joints to exclude water.

Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

INSTALLATION OF SIDING

Install siding to comply with manufacturer's written instructions and warranty requirements.

Engineered Wood Siding:

Install engineered wood siding to comply with manufacturer's written instructions.
Install panels with edges over framing or blocking.
Leave 3/16-inch gap at perimeter, openings, and horizontal panel joints unless otherwise recommended by panel manufacturer.
Seal butt joints at inside and outside corners and at trim locations.

Install continuous metal flashing at horizontal panel joints.
Apply battens and corner trim as indicated.
Conceal fasteners to greatest practical extent by placing in grooves of siding pattern or by concealing with applied trim or battens as detailed.

Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer.

Finish: Apply finish within two weeks of installation.

END OF SECTION

Page Intentionally Left Blank

SECTION 06 46 00
WOOD TRIM

PART 1 - GENERAL

SUMMARY

Section Includes: Interior standing and running trim, wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation, shop priming of wood trim, and shop finishing of wood trim.

ACTION SUBMITTALS

Product Data: For each type of product, including factory-finishing specifications.

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

Samples:

Lumber for transparent finish, for each species and cut, finished on one side and one edge.

Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.

QUALITY ASSURANCE

Installer Qualifications: Employs skilled workers who experience installing similar products to those required for this Project.

PART 2 - PRODUCTS

WOOD TRIM, GENERAL

Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.

WOOD MATERIALS

Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

Wood Moisture Content for Interior Materials: 5 to 10 percent.

MISCELLANEOUS MATERIALS

Interior Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

FABRICATION

Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.

Assemble casings in shop except where shipping limitations require field assembly.

SHOP PRIMING

Interior Wood Trim for Opaque Finish: Shop prime with one coat of wood primer specified in Section 09 91 23 "Interior Painting."

Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.

Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim.

SHOP FINISHING

General: Finish wood trim at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Section 09 91 23 "Interior Painting" for field finishing wood trim not indicated to be shop finished.

Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.

Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to end-grain surfaces.

PART 3 - EXECUTION

PREPARATION

Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

INSTALLATION

Grade: Install wood trim to comply with same grade as item to be installed.

Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

For shop-finished items, use filler matching finish of items being installed.

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 96 inches long except where shorter single-length pieces are necessary.

Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 - GENERAL

SUMMARY

Section Includes:

Extruded polystyrene foam-plastic board insulation.

ACTION SUBMITTALS

Product data.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.

Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

Thermal-Resistance Value (R-Value): R-value as indicated on Drawings in accordance with ASTM C518.

R-Value at: R-5 per inch.

EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (XPS)

Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25 psi minimum compressive strength; unfaced.

INSULATION FASTENERS

Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

Insulation Fastener Accessories: Provide double-pointed weld pins, lagging pins, quilting pins, duct liner pins, insulation hangers, specialty washers, special caps, j-hooks, capacitor discharge annular weld pins, capacitor discharge acoustical lagging pins, and other accessory materials that are recommended in writing by insulation fastener manufacturer to produce complete insulation supports.

ACCESSORIES

Miscellaneous Application Accessories:

Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

Crack Sealer: Closed-cell insulating foam in aerosol dispenser recommended in writing by insulation manufacturer for filling gaps in board insulation.

Detailing Foam Insulation for Voids: Urethane foam complying with AAMA 812, low expansion pressure suitable for filling insulation gaps and voids adjacent to openings to protect against water, air, and sound intrusion.

Tapes for Reflective Insulation and Barriers:

Aluminum-foil tape for repairs or splicing material.
Double-sided tape for adhering to metal framing or overlapping material.
Reinforced-foil tape for sealing tears or cuts in sheet vapor barrier.

PART 3 - EXECUTION

PREPARATION

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

INSTALLATION, GENERAL

Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.

Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

Install insulation with manufacturer's R-value label exposed after insulation is installed.

Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

INSTALLATION OF FOUNDATION WALL INSULATION

Butt panels together for tight fit.

Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

- Fasten insulation anchors to concrete substrates with insulation anchor adhesive in accordance with anchor manufacturer's written instructions.
- Space anchors in accordance with insulation manufacturer's written instructions for insulation type, thickness, and application.
- After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.

Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing in accordance with manufacturer's written instructions.

INSTALLATION OF BOARD INSULATION

Install board insulation in accordance with manufacturer's written instructions per project applications and conditions.

Install interior radiation control coating system in accordance with ASTM C1321.

PROTECTION

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

SECTION 07 25 00
WEATHER BARRIERS

PART 1 - GENERAL

SUMMARY
Section Includes: Building wrap and Flexible flashing.

ACTION SUBMITTALS
Product data.

INFORMATIONAL SUBMITTALS
Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

QUALITY ASSURANCE
Installer Qualifications: A qualified firm that is approved, authorized, certified, or licensed by the weather barrier system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

PART 2 - PRODUCTS

WEATHER BARRIERS
Drainage Wrap: Dimensional water-resistive barrier that also creates a drainage plane; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84; and acceptable to authorities having jurisdiction.

Manufacturers: Description is based on Green Guard RainDrop 3D. Other manufactures may submit subject to compliance with performance requirements.

Water Resistance: 120 minutes
Water Penetration Resistance: 600 CM H2O
Drainage Efficiency: 90% water drained
Water-Vapor Permeance: 16 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
Water Vapor Transmission Rate: 128 g/m²/24 hrs.
Air Permeance: 0.001 L/s/m² @ 75 Pa
Flame Propagation Test: Materials and construction shall be as tested according to ASTM E 84.

Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

FLEXIBLE FLASHING
Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

ACCESSORY MATERIALS

Requirement: Provide primers, fasteners, seam tapes, flashing, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by weather barrier manufacturer to produce a complete weather barrier assembly and that are compatible with primary weather barrier material and adjacent construction to which they may seal.

PART 3 - EXECUTION

INSTALLATION OF WEATHER BARRIERS

Weather Barriers:

Building Wrap: Comply with manufacturer's written instructions and warranty requirements.

Drainage Material: Comply with manufacturer's written instructions.

Install weather barrier accessories for a complete installation with weather barriers in accordance with manufacturers written instructions.

FLEXIBLE FLASHING INSTALLATION

Apply flexible flashing where indicated to comply with manufacturer's written instructions.

Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.

Lap flashing over water-resistive barrier at bottom and sides of openings.

Lap water-resistive barrier over flashing at heads of openings.

END OF SECTION

SECTION 07 26 00
VAPOR RETARDERS

PART 1 - GENERAL

SUMMARY
Section Includes: Polyethylene vapor retarders.

Related Requirements:
Section 03 30 00 “Cast-in-Place Concrete” for under-slab vapor retarders.
Section 07 21 00 “Thermal Insulation” for vapor retarders integral with insulation products.

ACTION SUBMITTALS
Product Data: For each type of product.

INFORMATIONAL SUBMITTALS
Product test reports.

PART 2 - PRODUCTS

POLYETHYLENE VAPOR RETARDERS
Under Slab: 10-mil- thick sheet, with a maximum permeance rating of 0.1 perm.

PART 3 - EXECUTION

INSTALLATION OF VAPOR RETARDERS ON FRAMING
Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.

Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

END OF SECTION

Page Intentionally Left Blank

SECTION 07 31 13
ASPHALT SHINGLES

PART 1 - GENERAL

SUMMARY

Section Includes:

- Glass-fiber-reinforced asphalt shingles.
- Underlayment materials.
- Ridge vents.
- Metal flashing and trim.

ACTION SUBMITTALS

Product Data: For each type of product.

Samples: For each exposed product and for each color and blend specified.

INFORMATIONAL SUBMITTALS

Product test reports.

Evaluation reports.

Sample warranty.

CLOSEOUT SUBMITTALS

Maintenance data.

QUALITY ASSURANCE

Installer Qualifications: An authorized installer who is trained and approved by manufacturer.

WARRANTY

Materials Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.

- Materials Warranty Period: 40 years from date of Substantial Completion, prorated, with first 10 years nonprorated.
- Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds of up to 110 mph for 15 years from date of Substantial Completion.
- Algae-Resistance Warranty Period: Asphalt shingles will not discolor for 10 years from date of Substantial Completion.
- Workmanship Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

GLASS-FIBER-REINFORCED ASPHALT SHINGLES

Laminated-Strip Asphalt Shingles: ASTM D3462/D3462M, laminated, multi-ply overlay construction; glass-fiber reinforced, mineral-granule surfaced, and self-sealing.

- Basis of Design: Landmark Premium or Equivalent.
- Butt Edge: Straight cut.
- Strip Size: Manufacturer's standard.
- Algae Resistance: Granules resist algae discoloration.
- Color and Blends: As selected by Architect from manufacturer's full range.

Impact-Resistant, Laminated-Strip Asphalt Shingles: ASTM D3462/D3462M, laminated, multi-ply overlay construction; glass-fiber reinforced, mineral-granule surfaced, and self-sealing; with impact resistance complying with UL 2218, Class 4.

Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

UNDERLAYMENT MATERIALS

Felt: Asphalt-saturated organic felts, nonperforated and complying with the following:

Synthetic Underlayment: UV-resistant polypropylene, polyolefin, or polyethylene polymer fabric with surface coatings or treatments to improve traction underfoot and abrasion resistance; evaluated and documented to be suitable for use as a roof underlayment under applicable codes by a testing and inspecting agency acceptable to authorities having jurisdiction.

Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum 40-mil- thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied. Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.

RIDGE VENTS

Rigid Ridge Vent: Manufacturer's standard, rigid-section, high-density, UV-stabilized plastic ridge vent for use under ridge shingles.

Minimum Net Free Area: 16”/lineal foot.
Width: Per manufacturers standard.
Thickness: Per manufacturers standard.
Features:

Nonwoven geotextile filter strips.
External deflector baffles.
Rigid with built-in end run closures.

Roof Vent: Plastic Square Top Roof Vent.

Minimum Net Free Area: 60 square inches.
Basis of Design: GAF Master Flow Roof Louver RT65 Plastic Square-Top.

ACCESSORIES

Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.

Roofing Nails: ASTM F1667, aluminum, stainless steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch-diameter, sharp-pointed, with a 3/8- to 7/16-inch-diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through sheathing less than 3/4 inch thick.

Where nails are in contact with metal flashing, use nails made from same metal as flashing.

Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, 1-inch-minimum diameter.

Provide with minimum 0.0134-inch-thick metal cap, 0.010-inch-thick power-driven metal cap, or 0.035-inch-thick plastic cap; and with minimum 0.083-inch-thick ring shank or 0.091-inch-thick smooth shank of length to penetrate at least 3/4 inch into roof sheathing or to penetrate through roof sheathing less than 3/4 inch thick.

METAL FLASHING AND TRIM

Comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim."

Sheet Metal: Zinc-tin alloy coated copper.

Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item unless otherwise indicated on Drawings.

PART 3 - EXECUTION

INSTALLATION OF UNDERLAYMENT MATERIALS

Comply with asphalt shingle and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.

Asphalt-Saturated Felt: Install on roof deck parallel with and starting at eaves and fasten with underlayment nails.

Single-Layer Installation:

Lap sides a minimum of 2 inches over underlying course.
Lap ends a minimum of 4 inches.
Stagger end laps between succeeding courses at least 72 inches.

Double-Layer Installation:

Install a 19-inch-wide starter course at eaves and completely cover with a 36-inch-wide second course.
Install succeeding 36-inch-wide courses lapping previous courses 19 inches in shingle fashion.
Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches.
Apply a continuous layer of asphalt roofing cement over starter course and on felt surface to be concealed by succeeding courses as each felt course is installed. Apply at locations indicated on Drawings.

Install felt underlayment on roof sheathing not covered by self-adhering, polymer-modified bitumen sheet unless otherwise specified in this Section or indicated on Drawings.

Lap sides of felt over self-adhering sheet not less than 4 inches in direction that sheds water.
Lap ends of felt not less than 6 inches over self-adhering sheet.

Install fasteners in a grid pattern of 12 inches between side laps with 6-inch spacing at side and end laps.

Synthetic Underlayment:

Install on roof deck parallel with and starting at the eaves.
Lap sides and ends as recommended in writing by manufacturer, but not less than 4 inches for side laps and 6 inches for end laps.
Stagger end laps between succeeding courses at interval recommended in writing by manufacturer, but not less than 72 inches.
Fasten with underlayment nails in accordance with manufacturer's written instructions.
Cover underlayment within period recommended in writing by manufacturer.

Install in single layer on roofs sloped at 4:12 and greater.
Install in double layer on roofs sloped at less than 4:12.
Install synthetic underlayment on roof sheathing not covered by self-adhering, polymer-modified bitumen sheet unless otherwise specified in this Section or indicated on Drawings.

Lap sides of underlayment over self-adhering sheet not less than 4 inches in direction to shed water.

Lap ends of underlayment not less than 6 inches over self-adhering sheet.

Install fasteners in a grid pattern of 12 inches between side laps with 6-inch spacing at side and end laps.

Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free, on roof deck in locations indicated on Drawings.

Comply with low-temperature installation restrictions of underlayment manufacturer.
Install lapped in direction that sheds water.

Lap sides not less than 4 inches.
Lap ends not less than 6 inches, staggered 24 inches between succeeding courses.
Roll laps with roller.

Prime concrete, masonry, and metal surfaces to receive self-adhering sheet.
Cover underlayment within seven days.

INSTALLATION OF METAL FLASHING AND TRIM

Install metal flashings and trim to comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim."

Install metal flashings in accordance with recommendations in ARMA's "Asphalt Roofing Residential Manual - Design and Application Methods" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."

INSTALLATION OF ASPHALT SHINGLES

Install asphalt shingles in accordance with manufacturer's written instructions and recommendations in ARMA's "Asphalt Roofing Residential Manual - Design and Application Methods" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."

Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.

Extend asphalt shingles 1/2 inch over fasciae at eaves and rakes.
Install starter strip along rake edge.

Install first and remaining courses of laminated asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

Fasten asphalt shingle strips with a minimum of six roofing nails, but not less than the number indicated in manufacturer's written instructions for roof slope and design wind speed indicated on Drawings and for warranty requirements specified in this Section.

Locate fasteners in accordance with manufacturer's written instructions.
Where roof slope exceeds 18:12, hand seal self-sealing asphalt shingles to improve the shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
Where roof slope is less than 4:12, hand seal self-sealing asphalt shingles to improve the shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
When ambient temperature during installation is below 50 deg F, hand seal self-sealing asphalt shingles by applying asphalt roofing cement spots between course overlaps after nailing the upper course.

Woven Valleys: Extend succeeding asphalt shingle courses from both sides of valley 12 inches beyond center of valley, weaving intersecting shingle-strip courses over each other. Use one-piece shingle strips without joints in valley.

Do not nail asphalt shingles within 6 inches of valley center.

Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley 12 inches beyond center of valley.

Use one-piece shingle strips without joints in valley.
Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line 2 inches short of valley centerline.
Trim upper concealed corners of cut-back shingle strips.
Do not nail asphalt shingles within 6 inches of valley center.
Set trimmed, concealed-corner asphalt shingles in a 3-inch-wide bed of asphalt roofing cement.

Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips.

Maintain uniform width of exposed open valley from highest to lowest point.
Extend shingle a minimum of 4 inches over valley metal.
Set valley edge of asphalt shingles in a 3-inch-wide bed of asphalt roofing cement.
Do not nail asphalt shingles to metal open-valley flashings.

Ridge Vents: Install continuous ridge vents over asphalt shingles in accordance with manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.

Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing-shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds.

Fasten with roofing nails of sufficient length to penetrate sheathing.
Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION

Page Intentionally Left Blank

SECTION 07 42 13.13
FORMED METAL WALL PANELS

PART 1 - GENERAL

SUMMARY
Section Includes:
Exposed-fastener, lap-seam metal wall panels.
Metal liner panels.

ACTION SUBMITTALS
Product Data: For each type of product.

Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

Samples: For each type of metal panel indicated.

INFORMATIONAL SUBMITTALS
Product test reports.
Warranties: Samples of special warranties.

CLOSEOUT SUBMITTALS
Maintenance data.

QUALITY ASSURANCE
Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

WARRANTY
Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

Warranty Period: Two years from date of Substantial Completion.

Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS
Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

Wind Loads: As indicated on Drawings.
Other Design Loads: As indicated on Drawings.
Deflection Limits: For wind loads, no greater than 1/180 of the span.

Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

Test-Pressure Difference: 1.57 lbf/sq. ft..

Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

Test-Pressure Difference: 2.86 lbf/sq. ft..

Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

Provide factory-formed metal panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.

Basis of Design: Menards Pro-Rib or Equivalent.

METAL LINER PANELS

Provide factory-formed metal liner panels designed for interior side walls and field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for a complete installation.

Basis of Design: Menards Pro-Rib or Equivalent.

MISCELLANEOUS MATERIALS

Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.

Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

FABRICATION

Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

PART 3 - EXECUTION

PREPARATION

Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

INSTALLATION

Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
Flash and seal panels with weather closures at perimeter of all openings.

Watertight Installation:

Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.

Provide sealant or tape between panels and protruding equipment, vents, and accessories.

At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

Metal Liner Panels: Install panels on interior side of girts with flush appearance on the inside.

Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

CLEANING

Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION

SECTION 07 42 93
SOFFIT PANELS

PART 1 - GENERAL

SUMMARY
Section Includes: Metal soffit panels.

ACTION SUBMITTALS
Product Data: For each type of product.

Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

Samples: For each type of metal panel indicated.

INFORMATIONAL SUBMITTALS
Product test reports.
Warranties: Samples of special warranties.

CLOSEOUT SUBMITTALS
Maintenance data.

WARRANTY
Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

Warranty Period: Two years from date of Substantial Completion.

Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS
Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

Wind Loads: As indicated on Drawings.
Other Design Loads: As indicated on Drawings .

Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283.

Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331.

Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

METAL SOFFIT PANELS

Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

Metal Soffit Panels: Match profile and material of metal roof panels.

Finish: Match finish and color of metal roof panels as selected by Owner from Manufacturers full range.

Sealant: Factory applied within interlocking joint.

Flush-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.

Material: Same material, finish, and color as metal roof panels.

MISCELLANEOUS MATERIALS

Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/8 inch thick.

Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.

Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

FABRICATION

Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and

warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

FINISHES

Panels and Accessories:

- Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- Three-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
- Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

PREPARATION

Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

- Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

INSTALLATION

Metal Soffit Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

- Apply panels and associated items true to line for neat and weathertight enclosure.
- Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
- Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
- Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

Watertight Installation:

- Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
- Provide sealant or tape between panels and protruding equipment, vents, and accessories.
- At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

CLEANING

Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION

SECTION 07 53 23
ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 – GENERAL

SUMMARY

Section Includes:

- Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
- Accessory roofing materials.
- Roof insulation.
- Insulation accessories and cover board.
- Asphalt materials.

ACTION SUBMITTALS

Product Data: For each type of product.

- For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

- Layout and thickness if insulation.
- Base flashings and membrane terminations.
- Flashing details at penetrations.
- Tapered insulation, thickness, and slopes.
- Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
- Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- Tie-in with air barrier.

Samples: For the following products:

- Roof membrane and flashings of color required.

Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

INFORMATIONAL SUBMITTALS

Manufacturer Certificates:

- Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

  Submit evidence of complying with performance requirements.

Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

Sample warranties.

CLOSEOUT SUBMITTALS

Maintenance data.

Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

QUALITY ASSURANCE

Qualifications:

Manufacturers: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.
Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

WARRANTY

Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

Warranty Period: 20 years from Date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.

Impact Resistance: Roof membrane to resist impact damage when tested in accordance with ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

Fire/Windstorm Classification: Class 1A-90.
Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 SH.

Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class C; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

EPDM Sheet: ASTM D4637/D4637M, Type I, nonreinforced, EPDM sheet with factory-applied seam tape.

Thickness: 60 mils, nominal.
Exposed Face Color: Black.

ACCESSORY ROOFING MATERIALS

General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

Sheet Flashing: 60-mil-thick EPDM, partially cured or cured, according to application.

Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 55 to 60 mils thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.

Slip Sheet: Manufacturer's standard, of thickness required for application.

Bonding Adhesive: Manufacturer's standard.

Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.

Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.

Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum, butyl splice tape with release film.

Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.

Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

ROOF INSULATION

Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, 1.45-lb/cu. ft. minimum density, 25 psi minimum compressive strength square edged.

Thermal Resistance: R-value of 5.0 per 1 inch.

Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 2 coated glass-fiber facer on both major

INSULATION ACCESSORIES AND COVER BOARD

Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

Modified asphaltic, asbestos-free, cold-applied adhesive.
Bead-applied, low-rise, one-component or multicomponent urethane adhesive.

Polyisocyanurate Insulation Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2 inch thick, with a minimum compressive strength of 80 psi.

Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric; water permeable and resistant to UV degradation; type and weight as recommended by roofing system manufacturer for application.

ASPHALT MATERIALS

Roofing Asphalt: ASTM D312/D312M, Type III or Type IV.

Asphalt Primer: ASTM D41/D41M.

PART 3 - EXECUTION

EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

PREPARATION

Perform fastener-pullout tests in accordance with roof system manufacturer's written instructions.

Submit test result within 24 hours of performing tests.

Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

Install sound-absorbing insulation strips in accordance with acoustical roof deck manufacturer's written instructions.

INSTALLATION OF ROOFING, GENERAL

Install roofing system in accordance with roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

INSTALLATION OF INSULATION

Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

Installation Over Metal Decking:

Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.

Locate end joints over crests of decking.

Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

Make joints between adjacent insulation boards not more than 1/4 inch in width.

At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

Trim insulation so that water flow is unrestricted.

Fill gaps exceeding 1/4 inch with insulation.

Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

Loosely lay base layer of insulation units over substrate.
Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.

Fasten insulation in accordance with requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

Install upper layers of insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

Staggered end joints within each layer not less than 24 inches in adjacent rows.
Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
Make joints between adjacent insulation boards not more than 1/4 inch in width.
At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
Trim insulation so that water flow is unrestricted.
Fill gaps exceeding 1/4 inch with insulation.
Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
Loosely lay each layer of insulation units over substrate.
Adhere each layer of insulation to substrate using adhesive in accordance with FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly

INSTALLATION OF COVER BOARDS

Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
At internal roof drains, conform to slope of drain sump.

Trim cover board so that water flow is unrestricted.

Cut and fit cover board tight to nailers, projections, and penetrations.
Loosely lay cover board over substrate.
Adhere cover board to substrate using adhesive in accordance with FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

Set cover board in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

Install slip sheet over cover board and immediately beneath roofing.

ADHERED ROOFING INSTALLATION

Adhere roof membrane over area to receive roofing in accordance with roofing system manufacturer's written instructions.

Unroll membrane roof membrane and allow to relax before installing.

Start installation of roofing in presence of roofing system manufacturer's technical personnel.

Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer, and install fabric-backed roofing. Do not apply to splice area of roof membrane.

Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.

In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.

Apply roof membrane with side laps shingled with slope of roof deck where possible.

Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.

Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
Apply lap sealant and seal exposed edges of roofing terminations.
Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.

Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.

Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
Apply lap sealant and seal exposed edges of roofing terminations.

Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.

Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
Apply lap sealant and seal exposed edges of roofing terminations.

Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

Adhere protection sheet over roof membrane at locations indicated.

MECHANICALLY FASTENED MEMBRANE ROOFING INSTALLATION

Mechanically fasten roof membrane over area to receive roofing in accordance with roofing system manufacturer's written instructions.

Unroll roofing membrane and allow to relax before installing.

For in-splice attachment, install roof membrane with long dimension perpendicular to steel roof deck flutes.

Start installation of roofing in presence of roofing system manufacturer's technical personnel.

Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.

Apply roof membrane with side laps shingled with slope of roof deck where possible.

Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.

Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
Apply lap sealant and seal exposed edges of roofing terminations.
Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.

Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.

Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
Apply lap sealant and seal exposed edges of roofing terminations.

Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.

Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
Apply lap sealant and seal exposed edges of roofing terminations.

Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

In-Splice Attachment: Secure one edge of roof membrane using fastening plates or metal battens centered within splice, and mechanically fasten roof membrane to roof deck. Field splice seam.

Through-Membrane Attachment: Secure roofing using fastening plates or metal battens, and mechanically

PROTECTING AND CLEANING

Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.

Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

Page Intentionally Left Blank

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

SUMMARY
Section Includes:
- Manufactured reglets with counterflashing.
- Formed roof-drainage sheet metal fabrications.
- Formed low-slope roof sheet metal fabrications.
- Formed wall sheet metal fabrications.

ACTION SUBMITTALS
Product Data: For each of the following
- Underlayment materials.
- Elastomeric sealant.
- Butyl sealant.
- Epoxy seam sealer.

Shop Drawings: For sheet metal flashing and trim.
- Include plans, elevations, sections, and attachment details.
- Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
- Include identification of material, thickness, weight, and finish for each item and location in Project.
- Include details for forming, including profiles, shapes, seams, and dimensions.
- Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
- Include details of termination points and assemblies.
- Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
- Include details of roof-penetration flashing.
- Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
- Include details of special conditions.
- Include details of connections to adjoining work.

INFORMATIONAL SUBMITTALS
Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.

Evaluation Reports: For copings and roof edge flashing, from ICC-ES showing compliance with ANSI/SPRI/FM 4435/ES-1.

Sample warranty.

CLOSEOUT SUBMITTALS
Maintenance data.
Special warranty.

QUALITY ASSURANCE
Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop is to be listed as able to fabricate required details as tested and approved.

WARRANTY

Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.

Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.

Cracking, checking, peeling, or failure of paint to adhere to bare metal.

Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

SHEET METALS

Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.

Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).

Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation; prepainted by coil-coating process to comply with ASTM A755/A755M.

Surface: Smooth, flat.

Exposed Coil-Coated Finish:

Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Color: As selected by Architect from manufacturer's full range.

Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

UNDERLAYMENT MATERIALS

Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified

asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.

Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.

Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

MISCELLANEOUS MATERIALS

Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

Solder:

For Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.

For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

FABRICATION, GENERAL

Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

Fabricate sheet metal flashing and trim in shop to greatest extent possible.

Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.

Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

Fabrication Tolerances:

Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

Use lapped expansion joints only where indicated on Drawings.

Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

Seams:

Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

ROOF-DRAINAGE SHEET METAL FABRICATIONS

Hanging Gutters:

Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.

Fabricate in minimum 96-inch-long sections.

Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.

Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.

Gutters with Girth up to 15 Inches: Fabricate from Galvanized Steel: 0.022 inches thick.

Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

Fabricate from Galvanized Steel: 0.022 inches thick.

LOW-SLOPE ROOF SHEET METAL FABRICATIONS

Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates.

Fabricate from Galvanized Steel: 0.028 inches thick.

Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight.

Fabricate from Galvanized Steel: 0.040 inches thick.

Base Flashing: Fabricate from the following materials:

Fabricate from Galvanized Steel: 0.028 inches thick.

Counterflashing: Fabricate from the following materials:

Fabricate from Galvanized Steel: 0.022 inches thick.

Roof-Penetration Flashing: Fabricate from the following materials:

Fabricate from Galvanized Steel: 0.028 inches thick.

WALL SHEET METAL FABRICATIONS

Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:

Stainless Steel: 0.0156 inches thick.

Galvanized Steel: 0.022 inches thick.

PART 3 - EXECUTION

INSTALLATION OF UNDERLAYMENT

Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.

Install in shingle fashion to shed water.

Lap joints not less than 2 inches.

Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

Lap horizontal joints not less than 4 inches.

Lap end joints not less than 12 inches.

Self-Adhering, High-Temperature Sheet Underlayment:

Install self-adhering, high-temperature sheet underlayment; wrinkle free.

Prime substrate if recommended by underlayment manufacturer.

Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.

Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.

Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.

Roll laps and edges with roller.

Cover underlayment within 14 days.

Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

Install in shingle fashion to shed water.

Lapp joints not less than 4 inches.

INSTALLATION, GENERAL

Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder or sealant.

Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.

Install sheet metal flashing and trim to fit substrates and to result in watertight performance.

Install continuous cleats with fasteners spaced not more than 12 inches o.c.

Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.

Do not field cut sheet metal flashing and trim by torch.

Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

Use lapped expansion joints only where indicated on Drawings.

Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

Seal joints as required for watertight construction.

Use sealant-filled joints unless otherwise indicated.

Embed hooked flanges of joint members not less than 1 inch into sealant.

Form joints to completely conceal sealant.

When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.

Adjust setting proportionately for installation at higher ambient temperatures.

Do not install sealant-type joints at temperatures below 40 deg F.

Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.

Do not use torches for soldering.

Heat surfaces to receive solder, and flow solder into joint.

Fill joint completely.

Completely remove flux and spatter from exposed surfaces.

Stainless Steel Soldering:
Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
Promptly remove acid-flux residue from metal after tinning and soldering.
Comply with solder manufacturer's recommended methods for cleaning and neutralization.

INSTALLATION OF ROOF-DRAINAGE SYSTEM

Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

Hanging Gutters:
Join sections with riveted and soldered joints or joints sealed with sealant.
Provide for thermal expansion.
Attach gutters at eave or fascia to firmly anchor them in position.
Provide end closures and seal watertight with sealant.
Slope to downspouts.
Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 feet apart.
Install expansion-joint caps.

Downspouts:
Join sections with 1-1/2-inch telescoping joints.
Provide hangers with fasteners designed to hold downspouts securely to walls.
Locate hangers at top and bottom and at approximately 60 inches o.c.
Provide elbows at base of downspout to direct water away from building.
Connect downspouts to underground drainage system.

INSTALLATION OF ROOF FLASHINGS

Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
Install work with laps, joints, and seams that are permanently watertight and weather resistant.

Roof Edge Flashing:
Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

Copings:
Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
Insert counterflashing in reglets or receivers and fit tightly to base flashing.
Extend counterflashing 4 inches over base flashing.
Lap counterflashing joints minimum of 4 inches.

Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

INSTALLATION OF WALL FLASHINGS

Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

INSTALLATION TOLERANCES

Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

CLEANING

Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
Clean and neutralize flux materials. Clean off excess solder.
Clean off excess sealants.

PROTECTION

Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

SUMMARY
Section Includes:
Urethane joint sealants.

ACTION SUBMITTALS
Product data.
Samples: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

INFORMATIONAL SUBMITTALS
Sample warranties.

CLOSEOUT SUBMITTALS
Warranty Documentation.

PART 2 - PRODUCTS

JOINT SEALANTS, GENERAL
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.

Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

URETHANE JOINT SEALANTS
Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

JOINT-SEALANT BACKING
Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

Cylindrical Sealant Backings: ASTM C1330, 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.

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.

MISCELLANEOUS MATERIALS
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.

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.

Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

PREPARATION

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:

- 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.
- 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:
  - Concrete.
  - Masonry.

- Remove laitance and form-release agents from concrete.
- 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:
  - Metal.
  - Glass.

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.

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.

INSTALLATION OF JOINT SEALANTS

General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

Install sealant backings of type 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.

- Do not leave gaps between ends of sealant backings.
- Do not stretch, twist, puncture, or tear sealant backings.
- Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

Install sealants using proven techniques that comply with the following and at the same time backings are installed:

Place sealants so they directly contact and fully wet joint substrates.
Completely fill recesses in each joint configuration.
Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with 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.

Remove excess sealant from surfaces adjacent to joints.
Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

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.

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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

Page Intentionally Left Blank

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

SUMMARY

Section Includes:

- Interior standard steel doors and frames.
- Exterior standard steel doors and frames.

ACTION SUBMITTALS

Product Data: For each type of product.

Shop Drawings: Include the following:

- Elevations of each door type.
- Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
- Frame details for each frame type, including dimensioned profiles and metal thicknesses.

Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

INFORMATIONAL SUBMITTALS

Product test reports.

Field quality-control reports.

CLOSEOUT SUBMITTALS

Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS

Thermally Rated Door Assemblies: Provide exterior door assemblies with U-factor of not more than 0.37 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C1363 or ASTM E1423.

INTERIOR STANDARD STEEL DOORS AND FRAMES

Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

Standard-Duty Doors and Frames: ANSI/SDI A250.8, Level 1; ANSI/SDI A250.4, Level C. At locations indicated in the Door and Frame Schedule on Drawings.

Doors:

- Type: As indicated in the Door and Frame Schedule on Drawings.
- Thickness: 1-3/4 inches.
- Face: Uncoated steel sheet, minimum thickness of 0.032 inch.
- Edge Construction: Model 1, Full Flush.
- Core: Manufacturer's standard.
- Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.

Frames:

- Materials: Uncoated steel sheet, minimum thickness of 0.042 inch.
- Construction: Fully welded.

EXTERIOR STANDARD STEEL DOORS AND FRAMES

Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

Doors:

Type: As indicated in the Door and Frame Schedule on Drawings.

Thickness: 1-3/4 inches.

Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.

Edge Construction: Model 1, Full Flush.

Edge Bevel: Provide manufacturer's standard beveled or square edges.

Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.

Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.

Core: Manufacturer's standard.

Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.

Frames:

Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.

Construction: Fully welded.

FRAME ANCHORS

Jamb Anchors:

Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.

Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.

Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

MATERIALS

Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

Power-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.

Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

Glazing: Comply with requirements in Section 08 80 00 "Glazing."

FABRICATION

Door 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 or as required to comply with published listing of qualified testing agency.

Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

Double-Door Frames: Drill stop in head jamb to receive two door silencers.

Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

STEEL FINISHES

Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

PREPARATION

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. Touch up factory-applied finishes where spreaders are removed.

Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

INSTALLATION

Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.

Install frames with removable stops located on secure side of opening.

Fire-Rated Openings: Install frames in accordance with NFPA 80.

Floor Anchors: Secure with postinstalled expansion anchors.

Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

Solidly pack mineral-fiber insulation inside frames.

Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.

REPAIR

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.

Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint in accordance with manufacturer's written instructions.

Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08 33 13
COILING COUNTER DOORS

PART 1 - GENERAL

SUMMARY
Section Includes: Interior counter door assemblies.

Related Requirements:
Section 05 50 00 "Metal Fabrications" for door-opening framing and corner guards.

ACTION SUBMITTALS
Product Data: For each type and size of coiling counter door and accessory.

Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

Include points of attachment and their corresponding static and dynamic loads imposed on structure.
Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
Include diagrams for power, signal, and control wiring.

Samples: For each exposed product and for each color and texture specified.

CLOSEOUT SUBMITTALS
Maintenance data.

QUALITY ASSURANCE
Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

COUNTER DOOR ASSEMBLY
Counter Door: Coiling counter door formed with curtain of interlocking metal slats.

Operation Cycles: Door components and operators capable of operating for not less than 10,000.

STC Rating: 26.

Door Curtain Material: Aluminum.

Door Curtain Slats: Flat profile slats of 1-1/4-inch center-to-center height.

Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated aluminum extrusion and finished to match door.

Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

Hood: Match curtain material and finish.

Mounting: Between jambs.

Integral Frame, Hood, and Fascia: Galvanized steel.

Mounting: Between jambs.

Sill Configuration: Integral metal sill.

Manual Door Operator: Push-up operation.

Curtain Accessories: Equip door with push/pull handles and pull-down strap.

Door Finish:

Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.

Factory Prime Finish: Manufacturer's standard color.

Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

DOOR CURTAIN MATERIALS AND FABRICATION

Door Curtains: Fabricate coiling counter door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.

Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

Removable Posts and Jamb Guides: Manufacturer's standard.

HOODS

General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.

Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):

CURTAIN ACCESSORIES

Astragal: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

Pull-Down Strap: Provide pull-down straps for doors more than 84 inches high.

COUNTER DOOR ACCESSORIES

Integral Metal Sill: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with ASTM A480/A480M No. 4 finish.

COUNTERBALANCE MECHANISM

General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

MANUAL DOOR OPERATORS

General: Equip door with manual door operator by door manufacturer.

Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf.

PART 3 - EXECUTION

INSTALLATION, GENERAL

Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

END OF SECTION

Page Intentionally Left Blank

SECTION 08 36 13
SECTIONAL DOORS

PART 1 - GENERAL

SUMMARY
Section Includes:
Sectional-door assemblies.

ACTION SUBMITTALS
Product Data: For each type and size of sectional door and accessory.

Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

Samples: For each exposed product and for each color and texture specified.

INFORMATIONAL SUBMITTALS
Sample warranties.

CLOSEOUT SUBMITTALS
Maintenance data.

QUALITY ASSURANCE
Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

Regulatory Requirements: Comply with provisions in the ICC A117.1 applicable to sectional doors.

WARRANTY
Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

Warranty Period: Two years from date of Substantial Completion.

Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS
General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.

Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

Design Wind Load: As indicated on Drawings.
Testing: In accordance with ASTM E330/E330M.

SECTIONAL-DOOR ASSEMBLY

Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

Operation Cycles: Door components and operators capable of operating for not less than 10,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.

U-Value: 0.21 or better.

Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet.

Door-Section Thickness: Manufacturers standard thickness to meet required R-value.

Section Faces:

Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.

Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.

Steel Sheet Thickness: 27 gauge galvanized steel, baked-on finish.

Surface: Manufacturer's standard, flush.

Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:

Steel Sheet Thickness: 28 gauge galvanized steel, baked-on finish.

End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.040-inch nominal coated thickness and welded to door section.

Intermediate Stiles: Provide intermediate stiles formed from not less than 0.040-inch- thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.

Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.

Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weatherseal).

Hardware Locations: Provide reinforcement for hardware attachment.

Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard insulation.

Track: Manufacturer's standard, galvanized-steel, low-headroom track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.

Size: 2 inches wide.

Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous angle attached to track and wall.

Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom, top, and jambs of door.

Windows: Manufacturer's standard window units of shape and size and in locations indicated on Drawings. Set glazing in vinyl, rubber, or neoprene glazing channel. Provide removable stops of same material as door-section frames. Provide the following glazing:

Insulating Glass Units: Manufacturer's standard 5/8-inch thick, gray tinted.

Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.

Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.

Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.

Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.

Roller-Tire Material: Manufacturer's standard.

Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.

Locking Device:

Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

Counterbalance Mechanism:

Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.

Cables: Galvanized-steel, multistrand, lifting cables.

Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.

Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.

Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

.

Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

Comply with NFPA 70.
Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use.
Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
Operator Type: Manufacturer's standard for door requirements.
Motor: Reversible-type with controller (disconnect switch) for interior, clean, and dry motor exposure. Use adjustable motor-mounting bases for belt-driven operators.

Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.

Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel. **This is to be a light grid system that covers at minimum the bottom 3'-0" of the door frame.**

Monitored Entrapment Protection: Photoelectric sensor designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
Unmonitored Entrapment Protection: Retro-reflective photo sensor.

Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf.
Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

Metal Finish:

Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat.

Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

INSTALLATION

Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

Tracks:

Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.

Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION

Page Intentionally Left Blank

SECTION 08 52 00
WOOD WINDOWS

PART 1 - GENERAL

SUMMARY
Section includes aluminum-clad wood windows.

ACTION SUBMITTALS
Product Data: For each type of product.

Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

Samples: For each exposed product and for each color specified.

INFORMATIONAL SUBMITTALS
Product test reports.
Sample warranties.

WARRANTY
Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.

Warranty Period:
Window: 10 years from date of Substantial Completion.
Glazing Units: 20 years from date of Substantial Completion.
Aluminum-Cladding Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

WINDOW PERFORMANCE REQUIREMENTS
Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

Window Certification: WDMA certified with label attached to each window.

Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
Minimum Performance Class: LC.
Minimum Performance Grade: 15.

Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.34 Btu/sq. ft. x h x deg F.

Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.34.

WOOD WINDOWS
Aluminum-Clad Wood Windows:
Manufactures: Subject to compliance with requirements, available manufactures offering products that may be incorporated into the Work include, but are not limited to the following:
Anderson Windows and Doors
Pella Windows and Doors
Marvin Windows and Doors

Operating Types: As indicated on Drawings.

Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.

Exterior Finish: Aluminum-clad wood.
Exposed Unfinished Wood Surfaces: Manufacturer's standard paint-grade species.
Color: As selected by Architect from manufacturer's full range.

Interior Finish: Manufacturer's standard stain-and-varnish finish.
Exposed Unfinished Wood Surfaces: Manufacturer's standard species.
Color: As selected by Architect from manufacturer's full range.

Glass: ASTM C 1036, Type 1, Class 1, q3.
Tint: Gray.
Kind: Fully tempered.
Lites: Two.
Filling: Fill space between glass lites with argon.
Low-E Coating: Sputtered on second surface.

Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

Hardware, General: Provide manufacturer's standard corrosion-resistant hardware sized to accommodate sash weight and dimensions.
Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

Projected Window Hardware:
Gear-Type Rotary Operators: Complying with AAMA 901 when tested according to ASTM E 405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.
Type and Style: As selected by Architect from manufacturer's full range of types and styles.
Hinges: Manufacturer's standard type for sash weight and size indicated.
Single-Handle Locking System: Operates positive-acting arms that pull sash into locked position. Provide one arm on sashes up to 29 inches tall and two arms on taller sashes.
Limit Devices: Limit clear opening to 4 inches for ventilation; with custodial key release.

Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

FABRICATION

Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.

Glaze wood windows in the factory.

Weather strip each operable sash to provide weathertight installation.

Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of

window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

INSTALLATION

Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

Page Intentionally Left Blank

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

SUMMARY
Section Includes: Door hardware for interior doors.

ACTION SUBMITTALS
Product data.
Samples: For each exposed product in each finish specified.
Door hardware schedule.
Keying schedule.

CLOSEOUT SUBMITTALS
Maintenance data.

QUALITY ASSURANCE
Installer Qualifications: Worker trained and experienced in hardware installation.

WARRANTY
Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

SOURCE LIMITATIONS
Obtain each type of door hardware from single manufacturer.

PERFORMANCE REQUIREMENTS
Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.

HINGES
Hinges: ANSI/BHMA A156.1.

MECHANICAL LOCKS AND LATCHES
Lock Functions: As indicated in door hardware schedule.

Lock Backset: 2-3/4 inches unless otherwise indicated.

Lock Trim:
Levers: Forged.
Dummy Trim: Match lever lock trim and escutcheons.

Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

Bored Locks: ANSI/BHMA A156.2, Grade 1, Series 4000.

AUXILIARY LOCKS
Bored Auxiliary Locks: ANSI/BHMA A156.36, Grade 1; with strike that suits frame.

EXIT DEVICES AND AUXILIARY ITEMS
Exit Devices and Auxiliary Items: ANSI/BHMA A156.3.

LOCK CYLINDERS
Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.

Standard Lock Cylinders: ANSI/BHMA A156.5, Grade 1 permanent cores; face finished to match lockset.
Core Type: Interchangeable.

KEYING
Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.
No Master Key System: Only change keys operate cylinders.
Provide three cylinder change keys.
Existing System: Owner may have an existing master key or grand master key system.

Keys: Nickel silver.
Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
Notation: Information to be furnished by Owner.

OPERATING TRIM
Operating Trim: ANSI/BHMA A156.6; aluminum or stainless steel unless otherwise indicated.

SURFACE CLOSERS
Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

MECHANICAL STOPS AND HOLDERS
Wall Mounted Stops: ANSI/BHMA A156.16.

METAL PROTECTIVE TRIM UNITS
Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from 0.050-inch-thick aluminum; with manufacturer's standard machine or self-tapping screw fasteners.

AUXILIARY DOOR HARDWARE
Auxiliary Door Hardware: ANSI/BHMA A156.16.

FINISHES
Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.

PART 3 - EXECUTION

INSTALLATION
Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

Stops: Provide wall stops as indicated in door hardware schedule.

ADJUSTING

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.

DOOR HARDWARE SCHEDULE

See Plan Set

END OF SECTION

Page Intentionally Left Blank

SECTION 08 80 00
GLAZING

PART 1 - GENERAL

SUMMARY
Section Includes:

Glass for overhead doors.

COORDINATION
Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

ACTION SUBMITTALS
Product Data: For each type of product.

Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

INFORMATIONAL SUBMITTALS
Product Certificates: For glass.
Product test reports.
Sample warranties.

WARRANTY
Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS
Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

Design Wind Pressures: 115 MPH Exposure C
Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.Retain "Acoustic Performance" Paragraph below to suit Project.

GLASS PRODUCTS, GENERAL

Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

NGA Publications: "Glazing Manual."
AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

Thickness: Where glass thickness is indicated, it is a minimum.

Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

GLASS PRODUCTS

Tinted Low-E Glass

INSULATING GLASS

Insulating-Glass Units: Tinted Low-E Glass

Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
Perimeter Spacer: Manufacturer's standard spacer material and construction .
Desiccant: Molecular sieve or silica gel, or a blend of both.

GLAZING SEALANTS

General:

Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations.

GLAZING TAPES

Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

AAMA 804.3 tape, where indicated.
AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.

AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

MISCELLANEOUS GLAZING MATERIALS

Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

PART 3 - EXECUTION

GLAZING, GENERAL

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.

Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

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.

Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

Provide spacers for glass lites where length plus width is larger than 50 inches.

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 in accordance with requirements in referenced glazing publications.

TAPE GLAZING

Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

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.

Apply heel bead of elastomeric sealant.

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.

Apply cap bead of elastomeric sealant over exposed edge of tape.

GASKET GLAZING (DRY)

Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

Install gaskets so they protrude past face of glazing stops.

SEALANT GLAZING (WET)

Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

Tool exposed surfaces of sealants to provide a substantial wash away from glass.

CLEANING AND PROTECTION

Immediately after installation, remove nonpermanent labels and clean surfaces.

Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

Remove and replace glass that is damaged during construction period.

END OF SECTION

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

SUMMARY
Section Includes: Interior gypsum board.

ACTION SUBMITTALS
Product data.

Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

Samples: For each texture finish indicated on same backing indicated for Work.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS
Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

GYPSUM BOARD, GENERAL
Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

INTERIOR GYPSUM BOARD
Gypsum Wallboard: ASTM C1396/C1396M.
- Thickness: 5/8 inch.
- Long Edges: Tapered.

Gypsum Board, Type X: ASTM C1396/C1396M.
- Thickness: 5/8 inch.
- Long Edges: Tapered.

Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
- Core: 5/8 inch, Type X.
- Long Edges: Tapered.
- Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

TRIM ACCESSORIES
Interior Trim: ASTM C1047.
- Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
- Shapes:
  - Cornerbead.
  - Bullnose bead.
  - LC-Bead: J-shaped; exposed long flange receives joint compound.
  - L-Bead: L-shaped; exposed long flange receives joint compound.

U-Bead: J-shaped; exposed short flange does not receive joint compound.
Expansion (control) joint.

JOINT TREATMENT MATERIALS

General: Comply with ASTM C475/C475M.

Joint Tape: Paper.

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

Prefilling: At open joints and damaged surface areas, use setting-type taping compound.

Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

Use setting-type compound for installing paper-faced metal trim accessories.

Fill Coat: For second coat, use drying-type, all-purpose compound.

Finish Coat: For third coat, use drying-type, all-purpose compound.

Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

AUXILIARY MATERIALS

Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

Steel Drill Screws: ASTM C1002 unless otherwise indicated.

Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

PART 3 - EXECUTION

INSTALLATION OF PANELS

Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

Comply with ASTM C840.

Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

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.

FINISHING OF GYPSUM BOARD

Prefill open joints and damaged surface areas.

Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

Level 1: Ceiling plenum areas, concealed areas, and where indicated.

Level 4 or better: At panel surfaces that will be exposed to view unless otherwise indicated.
Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

PROTECTION

Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION

Page Intentionally Left Blank

SECTION 09 30 13
CERAMIC TILING

PART 1 - GENERAL

SUMMARY

Section Includes:

- Porcelain tile.
- Setting material.
- Grout materials.

ACTION SUBMITTALS

Product Data:

- Porcelain tile.
- Setting material.
- Grout materials.

Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces.

Samples:

- Full-size units of each type and composition of tile and for each color and finish required.
- Full-size units of each type of trim and accessory for each color and finish required.

INFORMATIONAL SUBMITTALS

Qualification Data: For Installer.

MAINTENANCE MATERIAL SUBMITTALS

Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

PRODUCTS, GENERAL

ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

PORCELAIN TILE

Porcelain Tile Type: Unglazed.

- Certification: Tile certified by the Porcelain Tile Certification Agency.
- Face Size: 6 by 6 inches or 8 by 8 inches.
- Face Size Variation: Rectified.
- Thickness: 5/16 inch.
- Product Use Classification: Interior, Wet (IW).
- Physical Properties: Chemical resistant when tested with indicated chemicals in accordance with ASTM C650.
- Tile Color, Glaze, and Pattern: As selected by Architect from manufacturer's full range.
- Grout Color: As selected by Architect from manufacturer's full range.

Precoat with temporary protective coating.

TILE BACKING PANELS

Water-Resistant Gypsum Backing Board: ASTM C1396/C1396M, with manufacturer's standard edges.

Core: As indicated on Drawings.

SETTING MATERIALS

Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

Cleavage Membrane: Installer's option of material that complies with ANSI A108.02, paragraph 3.8.

Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A1064/A1064M except for minimum wire size.

Expanded Metal Lath: Diamond-mesh lath complying with ASTM C847.

Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

GROUT MATERIALS

Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

Standard Cement Grout: ANSI A118.6.

MISCELLANEOUS MATERIALS

Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.

Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.

Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.

Description: L-shaped or Square.

Material and Finish: Metallic or combination of metal and PVC or neoprene base; color-coated aluminum exposed-edge material.

Color: As selected by Architect from manufacturer's full range.

Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.

Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

EXAMINATION

Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

Verify that concrete substrates for tile floors installed with bonded mortar bed comply with surface finish requirements in ANSI A108.01 for installations indicated.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION

Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.

Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.

Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

Substrate Flatness:

- For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
- For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

INSTALLATION OF CERAMIC TILE SYSTEM

Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.

Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges. (Provide metal edge at top of base tile on wall).

Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

Metal Flooring Transitions: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

END OF SECTION

SECTION 09 51 23
ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

SUMMARY
Section Includes: Acoustical tiles, Metal suspension system, and Accessories.

ACTION SUBMITTALS
Product Data: For each type of product.
Samples: For each exposed product and for each color and texture specified.

INFORMATIONAL SUBMITTALS
Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

Product test reports.
Research reports.

CLOSEOUT SUBMITTALS
Maintenance data.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS
Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
Flame-Spread Index: Class C in accordance with ASTM E1264.
Smoke-Developed Index: 450 or less.

ACOUSTICAL TILES
Acoustical Tile Standard: Manufacturer's standard tiles of configuration indicated that comply with ASTM E1264.
Product: USG Vinyl Rock 3260 or equal where vinyl wrapped acoustical ceiling tile is called out on plans. USG Radar 2220 Tegular or equal to be used where acoustical ceiling tile is called out on plans.
Color: White.
Light Reflectance (LR): 0.83.
Ceiling Attenuation Class (CAC): 33.
Noise Reduction Coefficient (NRC): 0.55.
Edge/Joint Detail: Tegular edge.
Thickness: 5/8 inch.
Modular Size: 24 by 24 inches.

METAL SUSPENSION SYSTEM
Metal Suspension-System Standard: Manufacturer's standard, direct-hung, fully concealed, metal suspension system that complies with applicable requirements in ASTM C635/C635M.

Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.
Structural Classification: Intermediate-duty system.
Access: Upward, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
Initial Access Opening: In each module, 24 by 24 inches.

ACCESSORIES

Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

METAL EDGE MOLDINGS AND TRIM

Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.

PART 3 - EXECUTION

PREPARATION

Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated.

Layout openings for penetrations centered on the penetrating items.

INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

Install suspended acoustical tile ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.

Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

- Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
- Do not use exposed fasteners, including pop rivets, on moldings and trim.

Arrange directionally patterned acoustical tiles as indicated on reflected ceiling plans.

END OF SECTION

SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

SUMMARY
Section Includes: Vinyl base.

ACTION SUBMITTALS
Product Data: For each type of product.
Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

VINYL BASE
Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
Group: I (solid, homogeneous).
Style and Location:
Style A, Straight: Provide in areas with carpet.
Style B, Cove: Provide in areas with resilient floor coverings.

Minimum Thickness: 0.125 inch.
Height: 4 inches.
Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
Outside Corners: Job formed or preformed.
Inside Corners: Job formed or preformed.
Colors and Patterns: As selected by Architect from manufacturer’s full range.

INSTALLATION MATERIALS
Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

PREPARATION
Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

Do not install resilient products until materials are the same temperature as space where they are to be installed.

Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

RESILIENT BASE INSTALLATION

Comply with manufacturer's written instructions for installing resilient base.

Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

Do not stretch resilient base during installation.

On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

Preformed Corners: Install preformed corners before installing straight pieces.

Job-Formed Corners:

Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

Form without producing discoloration (whitening) at bends.

Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

Miter or cope corners to minimize open joints.

RESILIENT ACCESSORY INSTALLATION

Comply with manufacturer's written instructions for installing resilient accessories.

Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

CLEANING AND PROTECTION

Comply with manufacturer's written instructions for cleaning and protecting resilient products.

Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish.

Apply two coat(s).

Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 09 68 13
TILE CARPETING

PART 1 - GENERAL

SUMMARY
Section Includes: Carpet tile.

ACTION SUBMITTALS
Product data.

Shop Drawings: For carpet tile installation.

Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of carpet tile.

INFORMATIONAL SUBMITTALS
Product test reports.
Sample warranties.

CLOSEOUT SUBMITTALS
Maintenance data.

WARRANTY
Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

CARPET TILE
Color: As selected by Architect from manufacturer's full range.
Pattern: As selected by Architect from manufacturer's full range.
Fiber Content: Nylon.
Pile Characteristic: Level-loop pile.
Primary Backing/Backcoating: Manufacturer's standard composite materials.
Secondary Backing: Manufacturer's standard material.
Size: 24 by 24 inches.

Performance Characteristics:
Texture Appearance Retention Rating (TARR): Moderate traffic, 2.5 minimum in accordance with ASTM D7330.
Dry Breaking Strength: Not less than 100 lbf in accordance with ASTM D2646.
Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
Electrostatic Propensity: Less than 3.5 kV in accordance with AATCC 134.

WALK OFF CARPET TILE
Color: As selected by Architect from manufacturer's full range.
Pattern: As selected by Architect from manufacturer's full range.
Fiber Content: Nylon.
Pile Characteristic: Multi-level-loop pile.
Primary Backing/Backcoating: Manufacturer's standard composite materials.
Secondary Backing: Manufacturer's standard material.

Size: 24 by 24 inches.
Gauge: 1/12th
Stitches: 10.3 per inch (ASTM D5793-95)
Tufted Yarn Weight: 28 oz./square yard (ASTM D5848)
Total Thickness: .279" maximum (ASTM D6860)
Average Density: 9,081 per cubic yard

Performance Characteristics:

Texture Appearance Retention Rating (TARR): Heavy traffic, 2.5 minimum in accordance with ASTM D7330.

Critical Radiant Flux Classification: Not less than 0.45 W/sq. sm according to NFPA 253.

Dry Breaking Strength: Not less than 100 lbf in accordance with ASTM D2646.

Tuft Bind: Not less than 8 lbf according to ASTM D 1335.

Delamination: Not less than 3.5 lbf/in. according to ASTM D 3936.

Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.

Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).

Noise Reduction Coefficient (NRC): According to ASTM C 423.

INSTALLATION ACCESSORIES

Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet tile manufacturer.

Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

Examine carpet tile for type, color, pattern, and potential defects.

Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

PREPARATION

General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.

Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

INSTALLATION

General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

Installation Method: As recommended in writing by carpet tile manufacturer.

Maintain dye-lot integrity. Do not mix dye lots in same area.

Maintain pile-direction patterns recommended in writing by carpet tile manufacturer, confirm with Owner.

Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.

Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

Install pattern parallel to walls and borders.

Access Flooring: Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

CLEANING AND PROTECTION

Perform the following operations immediately after installing carpet tile:

- Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
- Remove yarns that protrude from carpet tile surface.
- Vacuum carpet tile using commercial machine with face-beater element.

Protect installed carpet tile to comply with CRI 104, Section 13.7.

Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

Page Intentionally Left Blank

SECTION 09 91 23
INTERIOR PAINTING
PART 1 - GENERAL

SUMMARY
Section Includes:
- Primers.
- Water-based finish coatings.

ACTION SUBMITTALS
Product Data: For each type of product.

Samples: For each type of topcoat product.

Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

QUALITY ASSURANCE
Mockups: Apply mockups 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.

PART 2 - PRODUCTS

MANUFACTURERS
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:

Sherwin-Williams Paints

Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Interior Painting Schedule for the paint category indicated.

PRIMERS
Alkali-Resistant, Water-Based Primer: Water-based primer formulated for use on alkaline surfaces, such as plaster, vertical concrete, and masonry.

Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum wallboard surfaces.

WATER-BASED FINISH COATS
Interior, Latex, Satin: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

Interior, Pro Industrial Pre-Catalyzed Water Based Epoxy, Eggshell: Pro Industrial Pre-Catalyzed Water Based Epoxy offers the adhesion, durability and resistance to stains and most cleaning solvents usually characteristic of two-component water-borne acrylic epoxy products.

PART 3 - EXECUTION

EXAMINATION
Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

Proceed with coating application only after unsatisfactory conditions have been corrected.

Application of coating indicates acceptance of surfaces and conditions.

PREPARATION

Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

Remove hardware, covers, plates, and similar items already in place that are removable and 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.

After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

INSTALLATION

Apply paints according to manufacturer's written instructions.

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.

CLEANING AND PROTECTION

After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

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.

At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

SECTION 10 14 23.16
ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

SUMMARY
Section includes room-identification signs that are directly attached to the building.

ACTION SUBMITTALS
Product Data: For each type of product.
Shop Drawings: For room-identification signs.

Include fabrication and installation details and attachments to other work.
Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories as required.
Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

Samples: For each exposed product and for each color and texture specified.

INFORMATIONAL SUBMITTALS
Sample warranty.

CLOSEOUT SUBMITTALS
Maintenance data.

WARRANTY
Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS
Accessibility Standard: Comply with applicable provisions in ICC A117.1.

ROOM-IDENTIFICATION SIGNS
Room-Identification Sign Insert drawing designation: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

Composite- Face Sheet Thickness: Manufacturer's standard for size of sign.
Surface-Applied Graphics: Applied vinyl film.
Color(s): As selected by Architect from manufacturer's full range.

Sign-Panel Perimeter: Finish edges smooth.

Edge Condition: Beveled.
Corner Condition in Elevation: Rounded.

Mounting: Manufacturer’s standard method for substrates indicated for a surface mounted to wall type.

SIGN MATERIALS

Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

ACCESSORIES

Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

Use concealed fasteners and anchors unless indicated to be exposed.

Adhesive: As recommended by sign manufacturer.

Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

FABRICATION

General: Provide manufacturer's standard sign assemblies according to requirements indicated. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

PART 3 - EXECUTION

INSTALLATION

General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

Install signs so they do not protrude or obstruct according to the accessibility standard.

Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

END OF SECTION

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

SUMMARY
Section Includes: Private-use washroom, private-use shower room accessories and under-lavatory guards,

ACTION SUBMITTALS
Product Data: For each type of product.

Samples: For each exposed product and for each finish specified, full size.
Approved full-size Samples will be returned and may be used in the Work.

Delegated Design Submittals: For grab bars.
Include structural design calculations indicating compliance with specified structural-performance requirements.

INFORMATIONAL SUBMITTALS
Sample warranties.

CLOSEOUT SUBMITTALS
Maintenance data.

WARRANTY
Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS
Structural Performance: Design accessories and fasteners to comply with the following requirements:

Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
Shower Seats: Installed units are able to resist 360 lbf concentrated load applied in any direction and at any point.

PRIVATE-USE WASHROOM ACCESSORIES
Toilet Tissue (Roll) Dispenser:
Description: Single-roll dispenser.
Mounting: Surface mounted.
Operation: Noncontrol delivery with standard spindle.
Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
Material and Finish: Satin-finish aluminum bracket with plastic spindle.

Paper Towel (Folded) Dispenser:
Mounting: Surface mounted.
Minimum Capacity: 400 C-fold or 525 multifold towels.
Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
Lockset: None.
Refill Indicator: Pierced slots at sides or front.

Waste Receptacle:
Mounting: Freestanding.
Minimum Capacity: 2 gal.
Material and Finish: Plastic.
Liner: None.

Soap Dispenser:
Description: Designed for manual operation and dispensing soap in liquid or lotion form.
Mounting: Vertically oriented, surface mounted.
Capacity: 34 oz.
Materials: ABS Plastic and Polystyrene.
Lockset: None.
Refill Indicator: Window type.

Grab Bar:
Mounting: Flanges with concealed fasteners.
Material: Stainless steel, 0.05 inch thick.
Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
Outside Diameter: 1-1/2 inches.
Configuration and Length: As indicated on Drawings G103.

Mirror Unit:
Frame: Stainless steel channel.
Corners: Manufacturer's standard.
Size: As indicated on Drawings.
Hangers: Manufacturer's standard rigid, tamper and theft resistant.

PRIVATE-USE SHOWER ROOM ACCESSORIES

Shower Curtain Rod :
Description: 1-inch- outside diameter, straight rod.
Configuration: As indicated on Drawings
Mounting Flanges: Exposed fasteners; in manufacturer's standard material and finish.
Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

Shower Curtain:
Size: Minimum 12 inches wider than opening by 72 inches high.
Material: Vinyl, minimum 0.006 inch thick, opaque, matte.
Color: As selected by Owner from manufacturer’s full range.
Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

UNDERLAVATORY GUARDS

Underlavatory Guard:
Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
Material and Finish: Antimicrobial, molded plastic, white.

PART 3 - EXECUTION

INSTALLATION

Install accessories in accordance with 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.

Remove temporary labels and protective coatings.

Grab Bars: Install to comply with specified structural-performance requirements.

END OF SECTION

Page Intentionally Left Blank

SECTION 10 44 13
FIRE PROTECTION CABINETS

PART 1 - GENERAL

SUMMARY
Section Includes: Fire-protection cabinets for portable fire extinguishers.

ACTION SUBMITTALS
Product Data: For each type of product.
Shop Drawings: For fire-protection cabinets.

CLOSEOUT SUBMITTALS
Maintenance data.

COORDINATION
Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS
Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

FIRE-PROTECTION CABINET
Fire-Protection Cabinet Type: Suitable for fire extinguisher.

Cabinet Construction: Nonrated.

Cabinet Material: Cold-rolled steel sheet.

Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

Rolled-Edge Trim: 2-1/2-inch backbend depth.

Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

Cabinet Trim Material: Steel sheet.

Door Material: Steel sheet.

Door Style: Fully glazed panel with frame.

Door Glazing: Clear float glass.

Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

Accessories:

Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

Location: Applied to cabinet door.
Application Process: Decals.
Lettering Color: Red.

Materials:

Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

Finish: Baked enamel or powder coat.
Color: As selected by Architect from full range of industry colors and color densities.

Clear Float Glass: ASTM C1036, Type I, Class 1, Quality q3, 3 mm thick.

FABRICATION

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.

PART 3 - EXECUTION

INSTALLATION OF FIRE-PROTECTION CABINETS

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

Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

Identification: Apply decals at locations indicated.

Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION

SECTION 10 44 16
FIRE EXTINGUISHERS

PART 1 - GENERAL

SUMMARY
Section includes: Portable, hand-carried fire extinguishers.

ACTION SUBMITTALS
Product Data: For each type of product.

INFORMATIONAL SUBMITTALS
Warranty: Sample of special warranty.

CLOSEOUT SUBMITTALS
Operation and maintenance data.

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

WARRANTY
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.

Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

PERFORMANCE REQUIREMENTS
NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS
Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.

Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

Regular Dry-Chemical Type: UL-rated 4-A nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.

Multipurpose Dry-Chemical Type: UL-rated 4-A nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

INSTALLATION
Examine fire extinguishers for proper charging and tagging.

Remove and replace damaged, defective, or undercharged fire extinguishers.

END OF SECTION

Page Intentionally Left Blank

SECTION 12 32 16
MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

SUMMARY
Section Includes: Plastic-laminate-clad casework, hardware and accessories.

ACTION SUBMITTALS
Product Data: For each type of product.
Shop Drawings: For plastic-laminate-clad casework.
Samples: For casework and hardware finishes.

INFORMATIONAL SUBMITTALS
Qualification Data: For casework manufacturer and Installer.
Sample warranty.
Field quality-control reports.

WARRANTY
Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.
Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

GENERAL REQUIREMENTS FOR CASEWORK
Quality Standard: Unless otherwise indicated, comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.
Grade: Economy.

PLASTIC-LAMINATED-FACED CABINETS
Design: Face-frame cabinet construction with the following door and drawer-front style:
Lipped overlay with radiused wood edges.
Reveal overlay.
Flush overlay.

Grain Direction for Wood-Grain Plastic Laminate:
Doors: Vertical with continuous vertical matching.
Drawer Fronts: Horizontal.
Face Frame Members: Lengthwise.
End Panels: Vertical.
Bottoms and Tops of Units: Side to side.
Knee Space Panels: Vertical.
Aprons: Horizontal.

Exposed Materials:
Plastic-Laminate Grade: HGS.
Colors and Patterns: As selected by Architect from manufacturer's full range.

Edgebanding: Plastic laminate matching adjacent surfaces.
PVC Edgebanding Color: Casework manufacturer's standard.

Semiexposed Materials:

Plastic Laminate: Grade VGS unless otherwise indicated. Provide plastic laminate for semiexposed surfaces unless otherwise indicated.

Colors and Patterns: As selected by Architect from manufacturer's full range.

Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

Thermally Fused Laminate (TFL) Panels: Provide thermally fused laminate panels for semiexposed surfaces unless otherwise indicated.

Colors and Patterns: As selected by Architect from manufacturer's full range.

Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

Hardboard: Use only for cabinet backs where exterior side of back is not exposed.

Metal for Steel Drawer Pans: Cold-rolled, carbon-steel sheet complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.

Unless otherwise indicated, provide specified edgebanding on all semiexposed edges.

Concealed Materials:

Solid Wood: With no defects affecting strength or utility.

Plywood: Hardwood plywood.

Plastic Laminate: Grade VGS.

Particleboard.

MDF.

Hardboard.

MATERIALS

Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.

Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.

Softwood Plywood: DOC PS 1.

Particleboard: ANSI A208.1, Grade M-2.

MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.

Hardboard: ANSI A135.4, Class 1 tempered.

Plastic Laminate: High-pressure decorative laminate complying with ISO 4586-3.

PVC Edgebanding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3.0 mm thick at doors and drawer fronts, 1.0 mm thick elsewhere.

Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper.

Edgebanding for Thermally Fused Laminate (TFL) Panels: PVC or polyester edgebanding matching thermally fused laminate panels.

HARDWARE AND ACCESSORIES

Hardware, General: Unless otherwise indicated, provide manufacturer's standard powder-coated, commercial-quality, heavy-duty hardware.

Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

Butt Hinges: Powder-coated, semiconcealed, five-knuckle hinges complying with ANSI/BHMA A156.9, Grade 1, with antifriction bearings and rounded tips.

Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, Type B01602.

Wire Pulls: Solid aluminum or chrome-plated brass wire pulls, fastened from back with two screws.

Door Catches: Powder-coated.

Door and Drawer Bumpers: Self-adhering, clear silicone rubber.

Drawer Slides: Manufacturer's standard; complying with ANSI/BHMA A156.9.

Drawer and Hinged-Door Locks: Cylindrical (cam) type, five-pin tumbler, brass with chrome-plated finish, and complying with ANSI/BHMA A156.11, Grade 1.

Provide a minimum of two keys per lock and six master keys.
Provide locks where indicated.

Adjustable Shelf Supports:

Adjustable Shelf Supports: Pin-type, single-pin metal shelf rests complying with ANSI/BHMA A156.9, Type B04013.

PART 3 - EXECUTION

INSTALLATION

Grade: Install casework to comply with same quality standard grade as item to be installed.

Install casework level, plumb, and true in line; shim as required using concealed shims. Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.

Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten cabinets to hanging strips, masonry, framing, wood blocking, or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch.

Fasten casework to adjacent units and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI/AWMAC/WI's "Architectural Woodwork Standards."

Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

Adjust operating hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION

SECTION 12 36 26
PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

SUMMARY
Section Includes: Plastic-laminate-clad countertops and accessories.

ACTION SUBMITTALS
Product Data: For each type of product.
Shop Drawings: For plastic-laminate-clad countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

Samples: Plastic laminates in each type, color, pattern, and surface finish required.

INFORMATIONAL SUBMITTALS
Product Certificates: For the following:
- Composite wood products.
- High-pressure decorative laminate.
- Adhesives.

PART 2 - PRODUCTS

PLASTIC-LAMINATE-CLAD COUNTERTOPS
Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.

Grade: Economy.

High-Pressure Decorative Laminate: ISO 4586-3, Grade HGP.

Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

As selected by Architect from manufacturer's full range in the following categories:
- Solid colors, matte finish.
- Solid colors with core same color as surface, matte finish.
- Wood grains, matte finish with grain running parallel to length of countertop.
- Patterns, matte finish.

Edge Treatment: Same as laminate cladding on horizontal surfaces.

Core Material: MDF Particleboard made with exterior glue.

Core Material at Sinks: Particleboard made with exterior glue.

Core Thickness: 3/4 inch.

Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

Backer Sheet: Provide plastic-laminate backer sheet, ISO 4586-3, grade to match exposed surface, on underside of countertop substrate.

Paper Backing: Provide paper backing on underside of countertop substrate.

WOOD MATERIALS

Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

Wood Moisture Content: 5 to 10 percent.

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

MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.
Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
Softwood Plywood: DOC PS 1.

MISCELLANEOUS MATERIALS

Adhesive for Bonding Plastic Laminate: Type II water-resistant type as selected by fabricator to comply with requirements.

Adhesive for Bonding Edges: Hot-melt adhesive.

Installation Adhesive:

FABRICATION

Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:

Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

PART 3 - EXECUTION

INSTALLATION

Grade: Install countertops to comply with same grade as item to be installed.
Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
Seal edges of cutouts by saturating with varnish.

Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

- Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
- Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
- Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION

Page Intentionally Left Blank

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SCOPE

A. Applicable provisions of Division 1 shall govern work under this section. The contractor shall provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on the drawings and/or herein specified, including all materials, equipment, and incidentals necessary to produce a complete and operating system.

1.02 INDEX

A. General

1. Scope
2. Index
3. System Description
4. Related Sections
5. Submittals

B. General Provisions

1. Codes and Standards
2. Permits
3. Drawings, Coordination, Existing Conditions
4. Materials
5. Substitution
6. Execution
7. Sleeves and Inserts
8. Mounting Pads
9. Escutcheons
10. Frost Protection - Sanitary Sewers
11. Horizontal Sanitary Lines
12. Traps
13. Safing
14. Requirements for Substantial Completion
15. Tests and Adjustments
16. Certification of Tests and Adjustments - Plumbing
17. Guarantee

1.03 SYSTEM DESCRIPTION

A. Demolition. Disconnect existing fixtures and related piping as indicated on documents. Remove all unnecessary piping above ceiling and below floor as necessary to complete new work.

B. Provide and install fixtures, specialties, equipment, and all related piping as shown on floor plans, scheduled, and/or specified for a complete working system.

C. Provide and install all necessary sanitary waste, vent, water piping, and air piping as shown on floor plans, scheduled, and/or specified for a complete working system.

D. Plumbing Contractor shall provide sanitary pump discharge and extend to a point 5'-0" beyond exterior of building foundation. Pump discharge extends from ejector pump system and extends to sanitary sewer in street,. Continuation of pump discharge to street utilities by Civil Contractor.

E. Plumbing Contractor shall connect to water service at a point 5'-0" beyond exterior of building foundation. Plumbing Contractor shall extend water distribution from water service, water meter, and extend to truck fill. Water meter supplied by city utilities and installed by Plumbing Contractor. Bypass piping and valves Plumbing Contractor. Continuation to street utilities by others.

F. Install and furnish sheet insulation material above sewer piping as required to prevent system freezing. Install as per specifications and Department of Safety and Professional Services Plumbing Code requirements.

G. Plumbing Contractor to furnish and install garage catch basins as shown on floor plans, schedules and/or specified.

H. Furnish and install water softener units with brine tank as per floor plans, schedules, and specifications.

I. Provide and install sealed combustion gas water heater as shown on floor plans, scheduled, and/or specified. UL1738 certified vent intake and exhaust as per manufacturer's specifications. Coordinate power with Electrical Contractor.

J. Furnish and install hot return piping system with return pump, check valve, expansion tank thermometer and balancing valves as shown on floor plans, scheduled, and/or specified. Coordinate power with Electrical Contractor.

K. Furnish and install reduced pressure backflow preventer valve and non-potable water piping as indicated on drawings. Label "non-potable" piping as per Wisconsin Department of Safety and Professional Services Plumbing Code. Install RPBP valve as per detail, schedule and Wisconsin Department of Safety and Professional Services Plumbing Code. Plumbing Contractor is responsible for testing and registration of the cross connection control devise with DSPS.

L. Plumbing Contractor to install salvaged air compressor unit, compressed air piping, pipe drops, valves, and accessories per floor plans, schedules, and/or specifications. Owner to furnish quick disconnects and; Plumbing Contractor to install.

M. See specification front end and plans for project phases.

1.04 RELATED SECTIONS

A. Applicable provisions of Division 1 govern work under this section.

1. Division 3 - Concrete.
2. Division 6 - Rough Carpentry.
3. Division 23 - Mechanical.

4. Division 26 - Electrical.
5. Division 31 - Earthwork.
6. Division 33 - Utilities.

B. This section applies to all Division 22 00 00 Sections of Plumbing.

1.05 SUBMITTALS

A. The Plumbing Contractor shall review all shop drawings and mark each item with their approval before submitting to Architect/Engineer.

B. The Plumbing Contractor shall provide shop drawings for review in accordance with the requirements of the General Conditions.

C. Shop drawings shall contain complete dimensional, operational, material quality and manufacturer information on all fixture, specialty, and equipment items. Drawings shall also include title sheet with plumbing contractor's and supplier's name, address, phone number and email address.

D. Shop drawings shall have each piece of equipment, fixture, and specialty items identified in correlation with drawings and specifications, all accessories shall be checked or identified as being provided, index sheets alone are not acceptable. Shop drawings shall be submitted electronically in pdf format, or in booklet form. Each fixture, specialty, and equipment along with accessories be grouped together. Failure to do so, will result in shop drawings being returned to the sender marked "Incomplete" or "Revise and Resubmit."

E. The Plumbing Contractor shall be responsible for transmitting copies of the reviewed shop drawings to all affected trades, such as the Electrical Contractor for wiring connections, Heating Contractor for piping connections and General Contractor for supports, drains and equipment bases, etc. If submitting in booklet form, provide sufficient copies for all trades listed above along with contractors' own needs and a copy to be retained by Architect and Engineer.

F. Shop drawings are required on the following items:

1. Fixtures and Trim
2. Drains and Cleanouts
3. Garage Catch Basins
4. Gas Water Heater
5. Expansion Tank
6. Domestic Water Circulation Pump
7. Thermometers and Pressure Gauges
8. Backflow Preventers
9. Valves
10. Pipe Insulation
11. Compressed air equipment

PART 2 GENERAL PROVISIONS

2.01 CODES AND STANDARDS

A. All work specified in this section and applicable provisions of Division 1 shall conform to all applicable codes and to the standards for materials and workmanship of the nationally recognized approval agencies and trade associations such as the American Society of Mechanical Engineers, the American Society for Testing and Materials, The American Standards Association, National Fire Protection Association.

B. Comply with requirements of Wisconsin Administrative Code.

C. Standards. Abbreviations of standards organizations referenced in this, and other sections are as follows:

1. ABMA - American Boiler Manufacturers Association
2. ACPA - American Concrete Pipe Association
3. AGA - American Gas Association
4. AMCA - Air Movement and Control Association
5. ANSI - American National Standards Institute
6. ARI - Air Conditioning and Refrigeration Institute
7. ASME - American Society of Mechanical Engineers
8. ASPE - American society of Plumbing Engineers
9. ASSE - American Society of Sanitary Engineering
10. ASTM - American Society for Testing and Materials
11. AWWA - American Water Works Association
12. AWS - American Welding Society
13. CISPI - Cast Iron Soil Pipe Institute
14. CGA - Compressed Gas Association
15. CS - Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS
16. EPA - Environmental Protection Agency
17. FS - Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
18. GAMA - Gas Appliance Manufacturers Association
19. IAPMO - International Association of Plumbing & Mechanical Officials
20. IEEE - Institute of Electrical and Electronics Engineers
21. ISA - Instrument Society of America
22. MCA - Mechanical Contractors Association
23. MICA - Midwest Insulation Contractors Association
24. MSS - Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
25. NBS - National Bureau of Standards
26. NEC - National Electric Code
27. NEMA - National Electrical Manufacturers Association
28. NFPA - National Fire Protection Association
29. NSF - National Sanitation Foundation
30. PDI - Plumbing and Drainage Institute
31. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association. Inc.
32. STI - Steel Tank Institute
33. UL - Underwriters Laboratories Inc.

D. Standards referenced in this section:

1. ACI 614 - Recommended Practice for Measuring, Mixing and Placing of Concrete
2. ASTM D1557 - Standard Test Method for Moisture-Density Relations of Soils
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops
4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
5. D.O.T. - Standard Specifications for Road and Bridge Construction, State of Wisconsin, Dept. of Transportation
6. UL1479 - Fire Tests of Through-Penetration Firestops
7. UL723 - Surface Burning Characteristics of Building Materials

2.02 PERMITS

A. All permits and fees required by regulatory agencies or utilities for plumbing work shall be secured and paid for by the Plumbing Contractor.

2.03 DRAWINGS, COORDINATION, EXISTING CONDITIONS

A. Plans of piping and fixtures shown on scale drawings, are diagrammatic only. They are intended to indicate size and/or capacity where stipulated, approximate location and/or direction and approximate general arrangement of one phase of work to another, but not to the exact detail or arrangement of construction. Plans are based on equipment scheduled. Plumbing Contractor shall be responsible for changes resulting from equipment other than scheduled.

B. If it is found before installation, that a more convenient, suitable or workable arrangement for any or all phases of the project would result by varying or altering the arrangement indicated on the drawings, the Plumbing Contractor may change the location or arrangement of their work without additional cost to the owner but only after obtaining a written approval by the Architect/Engineer.

C. Mechanical systems are shown on drawings that were closely coordinated with the Architectural drawings; however, minor variations may occur. Plumbing Contractor shall verify dimensions, heights, door swings, window locations, and any other information critical to the placement of devices, with the architectural drawings to assure proper installation. Field measurements shall take precedence over drawing dimensions and shall be verified. Plans shall not be scaled to locate equipment.

D. All piping installations shall closely match the drawings as approved by the Department of Safety and Professional Services. Any variation from or additions to the piping arrangement will require a revision or be resubmitted to the Department of Safety and Professional Services at the Plumbing Contractor's expense.

E. It shall be the contractor's responsibility to visit the existing project site, become acquainted with all existing conditions, and ascertain the extent of work involved. The contractor shall provide all labor, materials, etc., required for the complete, new installation required for the completion of the project. By the act of submitting a price; or in the case of time and material project, begin work, the contractor shall be deemed to have performed such an examination, to have accepted such conditions, and to have made allowances therefore preparing their price and resolving questions regarding work required.

F. The contractor installing material and equipment shall coordinate the installation with all other trades prior to installation. Additional project cost is not justified due to lack of coordination or due to material fabrication without field measurements. Any coordination problems shall be brought to the attention of the engineer before installation or fabrication. Any work installed that is not coordinated and that interferes with other contractor's work shall be removed or relocated at installing contractor's expense.

G. All project conditions shall be verified prior to performing any work. All accessible elevations and inverts shall be immediately verified. Hidden or inaccessible elevations or inverts important to the installation of plumbing systems shall be investigated after obtaining approval from the owner to excavate or demolish surfaces or structure required for such investigation, but prior to performing any related work. Promptly report findings to the engineer who shall assist the contractor in determining if revisions, if any, are required to the scope of the contractor work.

H. It is the Plumbing Contractor's responsibility to become acquainted with fixtures/equipment installation manuals before proceeding with the installation of that fixture/equipment. Any variation from drawing conditions and manufacturer's installation instructions shall be reported to the engineer before installing equipment.

2.04 MATERIALS

A. Each major component of the equipment shall have the manufacturer's name, address, catalog, and serial number permanently attached in a conspicuous place.

B. The same brand or manufacturer shall be used for each specific application of fixtures, pumps, valves, fittings, controls, and other equipment.

C. All materials shall be new and of the quality specified and meet approval as per SPS 384.10 (2).

D. All products must be lead free as required by the lead-free law "Federal Safe Drinking Water Act."

E. All equipment shall be listed, approved, or rated by a nationally recognized testing and rating bureau or the recognized manufacturers association responsible for setting industry standards. All electrical equipment and apparatus shall be U.L. listed. Examples of recognized associations are:

1. American Concrete Pipe Association
2. American Gas Association
3. American Pipe Fitting Institute
4. American Water Works Association
5. Plastic Pipe Institute
6. Thermal Insulation Manufacturers Association

2.05 SUBSTITUTIONS

A. It is the intent of this specification to permit the use of the materials of any nationally recognized manufacturer so long as they are fully equal to the quality and performance of the named item in the opinion of the engineer. Materials or equipment of other manufacturers may be used upon the following conditions:

1. The proposed substitute is equal in design, materials, construction, and performance in the opinion of the engineer. No compromise in quality level will be allowed.

2. The service capabilities, availability of service parts and stability of the manufacturer are adequate in the opinion of the engineer.

3. The Plumbing Contractor assumes responsibility for any modifications required for the installation of substitute equipment and for the accommodation of such substitution by work of other contractors. Any additional expense on the part of other contractors or to the owner due to substitution of equipment shall be borne by the Plumbing Contractor making such substitution.

4. Substitute equipment/products shall fit into the space provided with adequate provisions for service and maintenance and must meet product approval as per SPS 384.10 (2). Any substitute equipment that causes variation of or deviation from original piping arrangement may require a revision to be submitted to the Department of Safety and Professional Services at the Plumbing Contractor's expense.

B. The Plumbing Contractor may submit catalog data on material proposed for substitution to the engineer for evaluation up to 10 days prior to the date for opening bids. The engineer will render an opinion on whether the material can be bid as a substitute based on the information received. Final approval for the use of substitute equipment will not be given until complete shop drawings, samples or other information deemed necessary by the engineer has been submitted.

C. Where several manufacturer’s names are specified for a given item the product of these manufacturers only will be accepted. Requests for substitutions will not be granted. Materials by the first manufacturer named are used in design and scheduled. Materials by the other name manufacturers shall be of equal quality, capacity, design, and function and shall be adaptable into the system without alteration to the system.

2.06 EXECUTION

A. Workmanship. All work shall be done by qualified licensed plumbers that are knowledgeable and experienced in the operations they are performing. Fabrications and installation methods, procedures and materials shall be in accordance with accepted industry practice and with the standard of manufacturing and contracting associations applicable to the work. All work shall be neatly done with special emphasis on the appearance of work exposed to view. All piping shall be run plumb and square unless otherwise required for a functional reason. Gradients of pitched lines shall be continuous.

B. Painting. Furnish all equipment completely finished unless specifically noted otherwise. Touch up all abrasions, nicks, scratches, or other paint defects to restore equipment to its original condition. Severely marred equipment shall be factory refinished if so desired by Architect/Engineer. All surfaces shall be clean, rust free, and suitable for painting, on all piping and equipment furnished which are to be painted. All roof and/or wall piping penetrations that are visible shall be primed and painted. All painting of plumbing related items is responsibility of Plumbing Contractor, who may use project Painting Contractor as their subcontractor for this work. Coordinate color with Architect.

C. Excavation and Backfill

1. Refer to Division 31 "Earthwork" which is applicable; especially note references to "Site Information, Protection, Excavation, Unforeseen Obstacles, Filling and Grading, Compaction Tests, Disposal of Excess and Waste Materials, Dewatering, Etc.

2. The Plumbing Contractor shall perform all excavation required for related underground piping inside building and for all exterior underground piping. Include all necessary clearing of excavated area, and all trenching, tunneling, sheet piping, shoring, underpinning, pumping, bailing, transportation of earth, fill and backfilling.

3. Reference is made to the Working Drawings for subsurface soil data, contours, site conditions, etc.

4. Excavate whatever material is encountered to depth required. Excavation shall extend one foot out from each side of pipe. Bottom of trench or excavation shall be level and solidly compacted to assure firm foundation.

5. All excavated materials shall be removed from site or deposited as directed by the General Construction Contractor.

6. Protect excavation from caving or washing and erect necessary barricades, complying with regulations set forth in General Orders on "Safety in Construction" and Tunneling, Caisson and Trench Construction", issued by the State Department of Safety and Professional Services or other governing authority.

7. Lay all piping in open trenches unless Architect/Engineer gives written approval for tunneling.

8. Trenches:

   a. Trenches for sewers and water shall have a minimum of 8ft of space between each service.

   b. Water and sewer lines may be laid in the same trench as per SPS 382.40 (8) (b).

   c. All underground piping shall be supported on a bedding of sand or granular material at least 4” thick.

9. Backfill with sand to one foot above top of piping and thoroughly compacted with earth free of cinders, stones, and debris. Remove forms, shoring, etc., as backfill is placed. All backfilling under footings must be compacted within 8ft of all footings.

10. When running a pipe below a footing and parallel to it, same shall in all cases be at least one foot greater in distance away from footing than below its bottom. Where possible, run lines at center point between two parallel footings and maintain above-mentioned distances at minimum. When running under a footing, disturb as little of the soil under footing as possible. Provide concrete fill under all footings where excavations wider than 18” are required.

11. Backfilling shall not be placed until the work has been inspected, tested and approved.

D. Lubrication. All lubrication fittings shall be accessible for maintenance. Lubrication lines shall be extended to accessible points and terminated with lubrication fittings where necessary. All equipment shall be properly lubricated before running. Lubricate all equipment immediately before turning over to the Owner. Provide the Owner with a list of proper lubricants to be used in all bearings. Provide the Owner with one year’s supply of any special lubricants required.

E. Cutting and Patching. Skilled tradesmen shall be employed to do cutting and patching. Each Contractor shall be responsible for cutting and patching new openings for their use, in existing or previously constructed walls, ceilings, floors, roofs, etc., unless otherwise designated. Provide personnel protection under coring operations in occupied areas. Submit methods of supporting and sealing floor sleeves for approval. Holes cut in roof and exterior wall shall be weatherproofed immediately. Provide temporary dust barriers for cutting operations in occupied spaces. Refer to Architectural drawings for lintels provided by General Contractor. When lintels are not indicated in other divisions of the work, they shall be provided by the contractor requiring the opening. All piping penetrations through masonry structure shall be drilled or core drilled. All penetrations for access panels, etc. shall be saw cut before removal. Jack hammering without saw cutting is prohibited.

F. Access. All plumbing fixtures and/or equipment shall be located so that parts requiring service and/or adjustment, fixture traps and valves shall be readily accessible. Provide access doors or panels to make service convenient. Doors by Acudor, Milcor or as per architectural specifications. Provide by Plumbing Contractor unless designated otherwise.

G. Plumbing piping and equipment located between finish floor and 7'-6" shall have a resilient material (foam rubber, etc.) attached to all potentially dangerous edges.

H. Blocking. Plumbing Contractor is responsible for any additional blocking materials required for the attachment or suspending of plumbing related piping, components, fixtures, equipment related to plumbing work. Reference Division 06 - Rough Carpentry.

2.07 SLEEVES AND INSERTS

A. At all fire rated penetrations only use UL listed, tested, and approved materials and methods that meet Department of Safety and Professional Services Plumbing Approval. (Division 07 - Fire stopping.)

B. All pipes passing through masonry walls, floors, ceilings, or partitions shall be provided with sleeves having internal diameters at least 1/4” greater than the outside diameter of un-insulated pipes and/or outside diameter of the insulation of insulated piping. Sleeves for pipes passing through fire rated floor slabs and fire rated walls shall be schedule 40 steel pipes extending 1” above the finished slab and sealed. If holes must be cut through finished construction, they must be core drilled to avoid damage to construction. Exterior wall sleeves shall be caulked weather tight. Sleeves through equipment room also shall be filled with glass fiber insulation. Where chases are formed for passage of several pipes, they shall have a 1” high curb above finished slab and sealed. Whenever sleeves occur as penetrations of rated construction, the void space shall be sealed with U.L. rated sealant similar to Bio Fireshield Firestop Products; Chase Foam, CTC PR855; 3M Fire Barrier Caulk CP25 and putty 303; Dow Corning Fire Stop 2000 or Specified Technologies, Inc. Spec Seal Firestop Products installed in strict accordance with the manufacturer's instructions. Use sealant thickness as required to provide the full fire protection rating of the structure. Insulation shall not pass through rated assemblies. Insulation shall butt tight against the rated assembly after the sealant is installed and inspected. Refer to section SPS 351.049 (1)(3) of the Wisconsin Building Heating, Ventilating and Air Conditioning Code.

C. Inserts in floor slabs shall be galvanized individual type with accommodation for removable nuts and threaded rods up to 3/4” diameter, permitting lateral adjustment. Any fastener in a beam shall be midway above the bottom of the beam.

D. Piping that passes through outside walls below grade and above grade shall be permanently sealed with watertight rubber compression seal between the pipe and the sleeve equal to Link-Seal modular wall and casing seal as manufacturer by Thunderline Corporation. The pipe sleeve and seal must meet UL listed, tested, and approved materials and methods that meet Department of Safety and Professional Services Plumbing Approval.

E. Sleeves through equipment room walls shall be filled with pre-compressed, self-expanding, polyurethane acoustic foam equal to Illbruck insulation.

2.08 MOUNTING PADS

A. Floor mounted plumbing equipment shall be set on reinforced concrete pads 4” high and extending 4” beyond the equipment base on all sides. Mounting pads to be installed by the General Contractor unless otherwise specified. See drawings for specific requirements. Plumbing Contractor shall coordinate size and location with General Contractor.

2.09 ESCUTCHEONS

A. Escutcheons shall be installed on all exposed pipes wherever they pass through floors, ceilings, walls, or partitions.

B. Escutcheons for pipes passing though floors in unfinished areas shall be split hinged type designed to fit the pipe and to cover the projecting pipe sleeve. Escutcheons for pipes exposed to view in finished areas shall be chrome-plated brass.

C. Escutcheons shall be properly sized to fit snugly around the pipe and shall be sized to completely cover the wall or floor opening.

2.10 FROST PROTECTION - SANITARY SEWERS

A. Piping shall be protected per SPS 382.30 (11) (b) and tables 382.30-5, 383.30-6 and 382.30-7.

B. The insulation shall be built up with 1” extruded polystyrene insulation to required thickness with staggered joints.

2.11 HORIZONTAL SANITARY PIPING

A. Lines shall pitch down a minimum of 1/8” per foot in the direction of flow, or as indicated on the drawings. Soil and waste branch piping shall pitch down 1/4” per foot. All vent piping shall drip back into waste piping. Stacks shall be run vertically. Changes of direction 45° or more from vertical to horizontal shall be made with long sweep elbows. Horizontal changes in direction shall be made with "Y" or "Y" and 1/8 bend combination fitting.

2.12 TRAPS

A. Every fixture and floor drain shall be provided with a proper trap placed near the outlet and properly vented. Traps shall be cast iron hub and spigot when used in soil pipe or no hub with approved stainless-steel couplings. Traps for threaded pipe shall be screwed drainage pattern cast iron "P" traps. Where approved, PVC traps with adjustable compression fittings may be used. All exposed traps for sinks, lavatories and similar fixtures shall be chrome plated "P" traps, or as specified with the fixture trim. All traps shall have a minimum seal of 2”.

2.13 SAFING

A. Provide and install floor drains where shown and size indicated on the drawings of the type listed below. Floor drains shall be set level and at the proper elevation to drain the surrounding floor area. All floor drains set in floors above habitable space shall be equipped with 4# per square foot sheet lead safing or approved vinyl type extending a minimum of 18” beyond rim of floor drain in all directions. Based on product by Zurn.

B. Shower Drains. Floor drains used in constructed shower stalls shall have water safing extended 6" up shower walls.

C. Where it is impossible to use safing - use a Portland cement type of latex patching compound to seal between floor and drain body. The patching compound to be equal to the following manufacturers and material shall meet SPS Product Approval Requirements:

1. Ventonite, Inc. - Atlanta, Georgia.
2. ACD Pourable Underlayment, International, Inc. - Pittsburgh, PA
3. Ardex V-800, Levelcrete by Ardex, Inc. - Pittsburgh, PA
4. Latex Cement by Master Builders/Martin Marretta - Cleveland, OH

2.14 REQUIREMENTS FOR SUBSTANTIAL COMPLETION

A. Cleaning Equipment and Premises

1. Thoroughly clean all parts of the piping, valves, and fixtures. Exposed parts which are to be painted shall be thoroughly cleaned of cement, plaster and other materials and all oil and grease spots removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.

2. Remove all construction debris, excess materials, and equipment.

3. Caulk around all plumbing fixtures at walls and around base of water closets, service sinks, etc.

B. Operating and Maintenance Manuals

1. The Plumbing Contractor shall furnish to the Engineer a pdf file format or two operating manuals of furnished plumbing equipment. Information sheets shall be bound in standard 3-ring binders labeled to show the contractor's name, address, regular business phone number, emergency phone number, email address, and date. Operating manuals shall be submitted prior to completion of the work to allow time for review.

2. The manual shall contain the following information:

   a. Provide a warranty letter on the plumbing contractor's letterhead stating that, "*All material and workmanship shall be guaranteed for a period of one year after substantial completion.*"

   b. The Certification of Tests and Adjustments completed and signed.

   c. Completed and signed plumbing punch lists.

   d. A list (keyed with identification numbers used) of each item of equipment, which requires service, giving the name of the item, model number, manufacturer's name and address and the name address and phone number of the nearest representative or authorized service organization.

   e. A copy of the stamped reviewed shop drawings for each fixture, equipment and plumbing specialties installed.

f. Provide installation and service manuals for all plumbing specialties, equipment, and fixtures, with all model numbers and options highlighted.

g. A complete operating and maintenance manual with parts listed, wiring diagrams, lubrication requirements, and service instructions for each major item including faucet and mixing valve repair.

h. Complete control diagrams with description of all operating sequences and control devices.

i. Properly executed and registered manufacturer's warranties for all products installed.

j. A copy of valve chart.

k. Provide a signed letter by plumbing contractor and owner maintenance staff on contractor's letter head stating completion of a minimum of one hour training on operating and maintenance of major equipment.

l. Provide Record Drawings: Accurately record locations of field changes on a set of drawings and deliver to Architect/Engineer upon substantial completion. State approved plumbing plans are not to be used for Record Drawings!

2.15 TESTS AND ADJUSTMENTS

A. The Plumbing Contractor shall conduct tests of systems as required by codes, regulatory agencies, and this specification. Tests shall be made with the medium and under pressure as stated in the test requirements. Notify the Engineer and/or regulatory agencies prior to conducting tests. The Plumbing Contractor shall complete the attached certification form and submit to the Engineer when tests have been completed and include in O&M Manuals.

B. Testing Requirements:

1. Building sanitary piping system.

   a. Water test – Minimum of 10-foot head on each joint for a minimum of 15 minutes with no head loss.

   b. Air test – Uniform gauge pressure of 3 psig for a minimum of 15 minutes without adding air.

2. Water Service and Building Distribution Piping.

   a. Water test – 100 psi gauge pressure for a two-hour period.

3. Compressed Air Piping.

   a. Air test – Maintain twice the reduce pressure

4. The pressure in pounds per square inch, or inches of vacuum, gauge, are given as an initial pressure to be applied to lines being tested, together with test medium. Tests are to be applied for a minimum period of four (4) hours and until tests are complete. Final pressures at the end of test period may vary only by that caused by expansion of the test medium due to temperature changes.

5. Check of systems during application of test pressures should include visual check for water medium leakage, soap bubble or similar for air and nitrogen medium.

6. Start-Up of Piping Systems. Potable water system shall be cleaned and disinfected in accordance with state and local codes or in the absence of such codes shall be treated by accepted methods to provide a system free of harmful contaminants and acceptance to regulatory agencies. All lines shall be thoroughly flushed to remove dirt and construction debris. See SPS 382.40(8) (I).

7. Reduced Pressure Principle Backflow Preventers (RPZ valves) are required to be tested prior to being put into service and annually in accordance with SPS 382.41 (b), Wisconsin Administrative Code. Plumbing Contractor shall have valve tested and registered with DSPS before valve is put into operation. Provide owner with test certificate. Start-up: At initial installation and after servicing, bleed all air from RPZ valve per manufacturer's requirements.

2.16 CERTIFICATION OF TESTS AND ADJUSTMENTS - PLUMBING

A. Project Name: _____

B. Project Number: _____

C. Plumbing Contractor Name: _____

The Plumbing Contractor named above certifies that the tests and adjustments indicated below have been completed in accordance with the specifications on the date indicated. Also include attachments of all test reports.

	TESTS	DATE
D.	Building Sanitary Sewers, Branches, Drains, Stacks and Vent Piping.	_____
E.	Building Domestic Water Service.	_____
F.	Building Water Distribution Piping.	_____
G.	Compressed Air Piping.	_____
H.	Test RPZ Valve per Manufacturer's Manual, Bleed Air from unit and Provide Test Report in O&M Manual.	_____
I.	Flushing and Disinfection of Potable Water System.	_____
J.	Start-up of Domestic Water Circulation Pump and Balancing of Hot Water Return Piping System.	_____
K.	Start-up of Air Compressor, Air Dryer, and all related equipment.	_____

Contract _____

Signed By Plumbing Contractor _____

Date _____

Signed By Project Manager _____

Date _____

2.17 GUARANTEE

A. All material and workmanship shall be guaranteed for a period of one year after substantial completion. Where warranties are required, they shall be provided by the manufacturer or contractor as specified.

END OF SECTION

SECTION 22 05 19

METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

C. Water Meter.

1.02 RELATED SECTIONS

A. Section 22 05 00 - Common Work Results for Plumbing.

B. Section 22 10 05 - Plumbing Piping.

1.03 REFERENCES

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.

B. ASTM E 1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2005.

C. ASTM E 77 - Standard Test Method for Inspection and Verification of Thermometers; 1998 (Reapproved 2003).

D. AWWA C700 - Cold Water Meters -- Displacement Type, Bronze Main Case; American Water Works Association; 2002 (ANSI/AWWA C700).

1.04 SUBMITTALS

A. See Section 22 05 00 - Submittals.

B. Product Data: Provide list that indicates use, operating range, total range, and location for manufactured components.

1.05 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:
   1. H.O. Trerice Co.: www.trerice.com.
   2. WIKA Instrument Corp.: www.wika.com.
   3. Dwyer Instruments, Inc: www.dwyer-inst.com.
   4. Moeller Instrument Co., Inc: www.moellerinstrument.com.
   5. Omega Engineering, Inc: www.omega.com.
   6. Winters Instruments: www.wekslerglass.com.
   7. Substitutions: See Section 22 05 00 - Substitutions.

B. Pressure Gauges: ASME B40.100, drawn steel case, phosphor bronze bourdon tube, rotary brass movement with 1% - 2% accuracy, ¼" brass socket, 2-1/2" diameter case with black PSI scale on white background.
   1. Trerice 800B
   2. WIKA 11.10.
   3. Winters PEM214

2.02 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. H.O. Trerice Co.: www.trerice.com.
   2. WIKA Instrument Corp.: www.wika.com.
   3. Dwyer Instruments, Inc: www.dwyer-inst.com.
   4. Omega Engineering, Inc: www.omega.com.
   5. Weksler Glass Thermometer Corp: www.wekslerglass.com.
   6. Winters Instrumente: www.wekslerglass.com.
   7. Substitutions: See Section 22 05 00 - Substitutions.

B. Thermometers - Adjustable Angle: 9" scale, black Fahrenheit scale on white background with blue or red - appearing non-toxic liquid with 2% accuracy per ASTM E 77, in clear glass or acrylic; ASTM E 1; lens front tube, cast aluminum case with epoxy finish, 3-1/2" aluminum stem, cast aluminum adjustable joint with positive locking device; adjustable 360° in horizontal plane, 180° in vertical plane.
   1. Trerice BX9-1403-06-SPB.
   2. WIKA TI.901
   3. Winters TIM104A

2.03 WATER METERS

A. Furnished by City. Meter is remote read. Plumber to provide and install wiring conduit from water meter to remote read dial and to be mounted 48" above finish grade or as directed by City Water Department. Furnish and install foundation or other wall sleeves for conduit as required.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size valve bypass with globe valve for liquid service meters.

C. Provide one pressure gauge at the water service meter.

D. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45° off vertical.

3.02 SCHEDULES

A. Pressure Gauges, Location and Scale Range:
   1. Water service meter, 0 to 150 psi.
   2. Expansion tanks, 0 to 100 psi.

B. Stem Type Thermometers, Location and Scale Range:
   1. Water heaters hot outlet, 30° to 180° F.
   2. Hot water return pumps, 30° to 180° F.

END OF SECTION

This Page Left Blank Intentionally

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.02 RELATED SECTIONS

A. Section 09 90 00 - Painting and Coating: Identification painting.

1.03 REFERENCES

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.04 SUBMITTALS

A. See Section 22 05 00 - Submittals.

B. List: Submit list of wording, symbols, letter size, and color-coding for plumbing identification.

C. Product Data: Provide manufacturer’s catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Inc: www.bradyid.com.
B. Brimar Inc: www.brimar.com.
C. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
D. Marking Services, Inc.: www.markerv.com.
E. Seton Identification Products: www.seton.com/aec.
F. Substitutions: See Section 22 05 00 Substitutions.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/2”.
   3. Background Color: Black.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2” diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2” diameter with smooth edges.

C. Chart: Typewritten letter size list in anodized aluminum frame.

D. Chart: Copy of valve chart included in O&M manuals.

2.04 STENCILS

A. Stencils: With clean-cut symbols and letters of following size:

   1. ¾” to 1-1/4” Outside Diameter of Insulation or Pipe: 8” long color field, 1/2” high letters.

   2. 1-1/2” to 2” Outside Diameter of Insulation or Pipe: 8” long color field, 3/4” high letters.

   3. 2-1/2” to 6” Outside Diameter of Insulation or Pipe: 12” long color field, 1-1/4” high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to ASME A13.1.

2.05 PIPE MARKERS

A. Comply with ASME A13.1. and ASME Pipe Marker Guidelines for proper identification including, but not limited to, letter heights, marker size, color, wording legend, flow direction arrows, and proper placement.

B. Snap-on Plastic Pipe Markers: Factory fabricated, flexible, cylindrical self-coiling semi-rigid plastic, preformed to fit around pipe or pipe covering held tightly in place without the use of adhesive, tape or straps; information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6” wide by 4 mil thick, manufactured for direct burial service.

2.06 CEILING TACKS

A. Description: Steel pushpin with color-coded head.

B. Color code as follows:

1. Green - Plumbing valves
2. Silver - Plumbing equipment
3. Yellow - HVAC equipment
4. Red - Fire dampers/smoke dampers
5. Blue - Heating/cooling valves

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 90 00 for stencil painting.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners in lieu of adhesive whenever possible. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain and/or S-hook.

C. Apply stencil painting in accordance with Section 09 90 00.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6” to 8” below finished grade, directly above buried pipe.

G. Identify water heaters and pumps with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

H. Identify thermostats relating to terminal boxes or valves with nameplates.

I. Identify valves in main and branch piping with tags.

J. Valve tags shall state valve number, valve location, and describe valve function.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed or exposed, with pipe markers or stencils. Identify service, flow direction, and, if required, pressure. Install in clear view and align with axis of piping. Locate identification in each room, or open area, not to exceed 20ft on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Installation of pipe identification shall be after piping is clean or required painting is performed, and before installation of finish ceiling.

M. Domestic hot water piping distributing 125º and higher hot water, or if there is multiple temperature hot water piping systems, the piping shall be labeled with distributing temperature.

N. Domestic hot water with a hot water return system shall be marked with directional arrows to indicate flow.

O. Label Non-Potable Water Systems. Apply labeling as per S.P.S. Plumbing Code.

P. Abandoned Piping: Provide Snap-On pipe markers for abandoned piping. Marker to be white with black lettering and include a black border. If abandoned piping is pressurized, or contains hazardous materials, the legend should indicate such.

Q. Valve tag chart shall be mounted in mechanical room in a place as directed by Architect.

R. Provide ceiling tacks to locate valves and plumbing equipment above T-bar type panel ceilings. Locate in corner of panel closest to valves and equipment.

S. Coordinate with owner on use and location of ceiling tacks.

T. Coordinate equipment and piping labels, and valve tag types with existing piping identifications. Valve tags shall be coordinated with existing tag numbers and the numbering shall be of continuation.

3.03 SCHEDULES

A. Identification Symbols:
1. Condensate drain
2. Domestic Cold Water
3. Domestic Hard Cold Water
4. Domestic Hot Water
5. Domestic Hot Water Recirculation
6. Non-Potable Water
7. Sanitary Sewer
8. Sanitary Vent
9. Compressed Air
10. Abandoned Piping

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED SECTIONS

A. Section 07 84 00 - Firestopping.

B. Section 09 90 00 - Painting and Coating: Painting insulation jacket.

C. Section 22 05 00 - Common Work Results for Plumbing

D. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCES

A. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar; 2003.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2006.

C. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2004.

D. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2000.

E. ASTM C 449/C 449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2000.

F. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

G. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2007.

H. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2005.

I. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2006.

J. ASTM C 552 - Standard Specification for Cellular Glass Thermal Insulation; 2003.

K. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2006.

L. ASTM C 585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System); 1990 (Reapproved 2004).

M. ASTM C 591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2005.

N. ASTM C 610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation; 2005.

O. ASTM C 795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2003.

P. ASTM D 1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2000.

Q. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2006.

R. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2007.

S. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

T. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

U. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

1.04 SUBMITTALS

A. See Section 22 05 00 - Submittals.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than five years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of documented experience.

C. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Project Engineer.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

B. General Requirements. The work covered by this specification consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of all insulation for the plumbing piping systems in strict accordance with the insulation for the plumbing piping systems in strict accordance with the insulation section of this specification and applicable drawings, subject to the terms and conditions of the contract. All insulation shall be installed in a skillful manner by skilled workers regularly engaged in this type of work.

1. All insulation shall have composite (insulation, jacket, or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM E84, NFPA 255, and UL 723 not exceeding: Flame spread 25; Smoke developed 50; fuel contributed 50; UL fire hazard classification 1. Accessories, such as adhesives, plastics, cements, taps or glass fabric for fittings shall be the same component ratings as listed above.
2. Insulation thickness specified herein is based on a conductivity of .22 BTU/SQ.Ft>/Deg. F/HR. at 75° F. mean temperature. If insulating materials with substantially different thermal properties are used the thickness of insulation shall be adjusted to provide the overall insulating efficiency of the material specified.

2.02 GLASS FIBER

A. Manufacturers:
   1. Knauf Fiber Glass: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.
   5. Substitutions: See Section 22 05 00 Substitutions.

B. Insulation: ASTM C 547; rigid molded, noncombustible.
   1. 'K' value: ASTM C 177, 0.24 at 75° F.
   2. Maximum service temperature: 850° F.
   3. Maximum moisture absorption: 0.2% by volume.

C. Insulation: ASTM C 547; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' value: ASTM C 177, 0.24 at 75° F.
   2. Maximum service temperature: 650° F.
   3. Maximum moisture absorption: 0.2% by volume.
   4. Preformed pipe insulation shall be two-piece or one-piece fiberglass composite with vinyl coated embossed vapor barrier laminate and pressure sealing lap. The insulation systems shall be suitable for piping operating between 50°F to 450°F. The insulation system shall be vermin-proof, rot-free, non-shrinking with a moisture absorption not exceeding .2% by volume after 96 hours at 120°F and 95% RH. Jacket permanence shall not exceed .2% perms and shall have a Beach puncture rating of at least 50 units.
   5. Fittings, valve bodies and flanges for pipe sizes 6” and smaller shall be finished with fiberglass inserts and PVC fitting covers. One (1) insert to be used for pipe insulation of 1” thickness. An additional insert to be used for each additional 1” or fraction thereof for pipe insulation above 1” thickness.

D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.

E. Tie Wire: 0.048” stainless steel with twisted ends on maximum 12” centers.

F. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

G. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Blanket: 1.0 lb/cu ft density.
   3. Weave: 5x5.

H. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Armacell International: www.armacell.com.
   2. Aeroflex: www.aeroflexusa.com.
   3. Substitutions: See Section 22 05 00 Substitutions.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40° F.
   2. Maximum Service Temperature: 220° F.
   3. Connection: Waterproof vapor barrier adhesive.

2.04 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com.
      b. Sproule Mfg. Co.: www.sproule-mfg.com.
      c. Substitutions: See Section 22 05 00 Substitutions.

   2. Jacket: One-piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0° F.
      b. Maximum Service Temperature: 150° F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E 96/E 96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.

   3. Covering Adhesive Mastic:
      a. Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140° F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC covers.

H. Inserts and Shields:
   1. Application: Piping 1” diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hangers, rolls, and inserts. Stainless steel shall be used in a high corrosive area.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6” long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10ft above finished floor): Finish with PVC jacket covers.

K. All exposed insulated piping located 10ft or less above finish floor shall be finished with PVC jacket covers.

L. All exposed insulated piping located in truck bays shall be finished with PVC jacket covers from fixture/equipment to elevation 10ft above finished floor. All seams, and joints to be sealed watertight.

M. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

N. Insulation on all cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal. Hangers, supports, anchor, etc. that is secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.

O. All insulation shall be continuous through walls and ceiling openings and sleeves where applicable.

P. Make adequate provisions for expansion of piping. Unions to be left uncovered and clean. Finished surfaces of insulation are to be suitable for painting.

Q. At no point taping of joints with duct tape, electrical tape, or other materials not designed for the insulation system be an acceptable method of attaching insulation; only use proper adhesives rated for that systems type of insulation material.

R. Circulated domestic hot water piping. Water distribution piping conveying circulated water shall be insulated to limit the heat loss at the external surface of the pipe insulation to a maximum of 25 BTUs per hour per square foot for above ground piping and 35 BTUs per hour per square foot for underground piping. The maximum heat loss shall be determined at a temperature differential, T, equal to the maximum water temperature minus a design ambient temperature no higher than 65° F.

S. Non-Potable Water Piping Systems. Insulation recommendations to insulate the same as domestic water piping, related to system temperature. Also label non-potable piping per code.

T. All exposed insulation shall be clean and free of tears, holes, dirt, oil, grease, fingerprints, etc. at time of completion of project.

U. Pipe insulation shall be protected with insulation saddles at pipe hangers or similar supports.

3.03 SCHEDULES

A. Insulation Protection
1. Insulation exposed to high moisture of interior areas shall be encased with 15 mil. vinyl film.
2. Insulation exposed above food processing areas shall be protected with 30 mil. vinyl film.
3. Insulation exposed to weather shall be encased with 20 mil. vinyl film.
4. All joints sealed as recommended by manufacturer.

B. Domestic Water Piping
1. Cold water above ground shall be insulated with 1” thick fiberglass insulation with ASJ jacket.
2. Hot water above ground shall be insulated with 1” thick fiberglass for sizes through 3” pipe and 1-1/2” thick fiberglass for sizes greater than 3” and with ASJ jacket. See hot water maintenance systems recommendations.
3. Hot water return above ground shall be insulated with 1” thick fiberglass for sizes through 2” pipe with ASJ jacket.
4. Hot and cold-water underground shall be insulated with 1/2” thick plastic foam.
5. Hot and cold-water branch piping concealed in walls or pipe chases may be insulated with 1/2” thick plastic foam.
6. Circulated hot water and hot water return piping concealed in walls or pipe chase shall be insulated with 1” fiberglass or 1” foam insulation.

END OF SECTION

This Page Left Blank Intentionally

SECTION 22 10 05

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary and vent.

B. Domestic water.

C. Air piping.

D. Condensate drain piping.

E. Flanges, unions, and couplings.

F. Pipe hangers and supports.

G. Valves.

H. Strainers.

1.02 RELATED SECTIONS

A. Section 31 23 16 – Excavation.

B. Section 31 23 23 – Fill.

C. Section 31 23 16.13 – Trenching.

D. Section 33 13 00 – Disinfecting of Water Utility Distribution.

E. Section 07 84 00 – Firestopping.

F. Section 08 31 00 – Access Doors and Panels.

G. Section 09 90 00 – Painting and Coating.

H. Section 22 05 00 – Common Work Results for Plumbing.

I. Section 22 05 53 – Identification for Plumbing Piping and Equipment.

J. Section 22 07 19 – Plumbing Piping Insulation.

K. Section 26 27 17 – Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCES

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 1999, and addenda A&B (R2004).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers; 2005.

C. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

D. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

E. ASTM A 74 - Standard Specification for Cast Iron Soil Pipe and Fittings; Latest Revision.

F. ASTM A 888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings, Latest Revision.

G. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.

H. ASTM B 302 - Standard Specification for Threadless Copper Pipe, Standard Sizes; 2002.

I. ASTM C 564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; Latest Revision.

J. ASTM C 1277 -Standard Specification for Standard Shielded Couplings Joining Hubless Pipe and Fittings, Latest Revision.

K. ASTM C 1460 - Standard Specification for Shielded Transition Couplings for Use with Dissimilar DWV Pipe & Ftg, Latest Revision.

L. ASTM C 1540 -Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Pipe & Fittings, Latest Revision.

M. ASTM D 1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2006.

N. ASTM D 2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2004.

O. ASTM D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.

P. ASTM D 2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2004.

Q. ASTM D 2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2007.

R. ASTM D 2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2003.

S. ASTM D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2002).

T. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2002.

U. ASTM F 708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2004).

V. ASTM F-1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007.

W. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2004 and errata.

X. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; 2005 (ANSI/AWWA C105/A21.5).

Y. AWWA C110/A21.10 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids; American Water Works Association; 2003.

Z. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2007 (ANSI/AWWA C111/A21.11).

AA. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2002 (ANSI/AWWA C151/A21.51).

AB. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 2005 (ANSI/AWWA C651).

AC. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute; Latest Revision.

AD. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; Cast Iron Soil Pipe Institute; Latest Revision.

AE. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2002.

AF. MSS SP-67 - Butterfly Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2002a.

AG. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

AH. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2006.

AI. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2005.

AJ. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2005a.

AK. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

AL. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2002.

AM. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

AN. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.

AO. NFPA 54 - National Fuel Gas Code; National Fire Protection Association.

AP. NFPA 58 - Liquefied Petroleum Gas Code; National Fire Protection Association.

1.04 SUBMITTALS

A. See Section 22 05 00 - Submittals.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturer’s catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with State of Wisconsin plumbing codes.
   1. Maintain one copy of approved plumbing plans on project site.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

D. Welders Certification: In accordance with ASME (BPV IX).

E. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

F. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 REGULATORY REQUIREMENTS

A. Perform work in accordance with State of Wisconsin plumbing code.

B. Conform to Wisconsin plumbing code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

1.09 EXTRA MATERIALS

A. See Section 01 60 00 - Project Requirements for additional provisions.

PART 2 PRODUCTS

2.01 SANITARY SEWER AND VENT PIPING, BURIED INTERIOR

A. Cast Iron Pipe and Fittings: ASTM A74, ASTM A888, CISPI 301, Cast iron Waste and Vent lines service weight. Pipe and fittings shall be marked with the above listings and listed by NSF. Acceptable: AB&I, Charlotte, Tyler Pipe.
   1. Hub and Spigot Compression Gaskets ASTM C564, ASTM C1563, one piece compression neoprene elastomeric gasket.
      a. AB&I, Charlotte, Tyler Pipe.
   2. Joint Seals: ASTM C-564, ASTM C1540, Heavy duty neoprene sleeve gasket with 316 stainless steel shield minimum thickness of 0.015 and a minimum of four screw 316 stainless steel bands. Bands to be torqued to 80-inch pounds.
      a. Husky CR 7000 series.

B. Cast Iron to PVC piping transitions: ASTM C1460, ASTM C654, Heavy duty neoprene sleeve gasket with 316 stainless steel shield minimum thickness of 0.015 and a minimum of four screw 304 stainless steel bands. Bands to be torqued to 80-inch pounds.
   1. Husky SD 4200

C. PVC solid wall plastic pipe, Schedule 40, Class 12454, per ASTM D1784, iron pipe size (IPS) conforming to NSF 14, ASTM D1785; PVC plastic drain, waste and vent pipe and fittings ASTM D2665; socket fitting patterns, ASTM D3311 and ASTM F1866; primer ASTM F656; solvent cement ASTM D2564. Acceptable Charlotte, Crestline, Spears.

D. Fittings required shall meet specifications for respective piping.

E. Provide cleanouts as required per SPS 382.35.

2.02 SANITARY SEWER AND VENT PIPING, ABOVE GRADE

A. PVC solid wall plastic pipe, Schedule 40, Class 12454, per ASTM D1784, iron pipe size (IPS) conforming to NSF 14, ASTM D1785; PVC plastic drain, waste and vent pipe and fittings ASTM D2665; socket fitting patterns, ASTM D3311 and ASTM F1866; primer ASTM F656; solvent cement ASTM D2564. Acceptable Charlotte, Crestline, Spears.

2.03 WATER SERVICE PIPING

A. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: AWWA C110, ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket with 3/4” diameter rods.

B. All pipe and fittings shall be installed per manufacturer's recommendations.

C. Thrust blocks or strapping shall be installed at each change in direction and at end of piping. Installed as per NFPA-24 Standards.

D. All outside water piping shall have a minimum burial of 7’-6” below finished grade.

2.04 WATER PIPING, BURIED INTERIOR

A. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: Ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, rubber gasket with 3/4” diameter rods.

B. All pipe and fittings shall be installed per manufacturer's recommendations.

C. Thrust blocks or strapping shall be installed at each change in direction and at end of piping. Installed as per NFPA-24 Standards.

2.05 WATER PIPING, ABOVE GRADE

A. Copper seamless water tube H (drawn) temper, type ‘L’ copper in accordance with ASTM B88 and ANSI/NSF 61. Acceptable: Cerrotube, JMF, Mueller Streamline, Wheatland tube.
   1. Wrought copper pressure fittings in accordance with ANSI B16.22 and ANSI/NSF 61.
      a. Lead free flux in accordance ASTM B813, and lead free solder with less than 0.2% lead in accordance ASTM B32.
   2. Lead free copper and copper alloy press fittings with EPDM seal element in accordance with ASME 16.51, NSF 61, UPC, NSF/ANSI 372. Acceptable: Apollo Press, Nibco Pressystem, Viega ProPress.

3. Copper mechanical grooved fittings and couplings on roll grooved pipe NSF/ANSI 61. Ductile iron couplings with copper colored alkyd enamel with offsetting angle-pattern bold pads ASTM A-536 Grade 65-45-12, and EPDM coupling gasket. Acceptable: Victaulic.

2.06 COMPRESSED AIR PIPING

A. Steel Pipe: ASTM A53 / A53M Schedule 40 black, type F, Grade A, Schedule 40 standard weight black stee pipe. Joints meeting ASME B31.1 for threaded, welding or press fittings following NFPA 54. Acceptable: Wheatland Tube,
   1. Fittings: ASTM A197/ANSI B16.3 class 150, black malleable iron threaded fittings for sizes ½" - 2" or ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.
   2. Press Fittings: Carbon Press designed to be used with schedule 10 – 40 steel pipe (black iron, epoxy coated and galvanized) ½" – 2" fittings and valves. Acceptable: Apollo Power Press, Viega ProPressG and MegaPressG.

B. Flex Connectors: ASTM/A 135, Grade 'E' (EPDM) o-ring to be used on air piping.
   1. Flexonics: 301 or 391.

2.07 CONDENSATE DRAIN PIPING

A. PVC Pipe: ASTM D 1785 Schedule 40, or ASTM D 2241 SDR 26 for not less than 150 psi pressure rating.
   1. Fittings: ASTM D 2466, PVC.
   2. Joints: Solvent welded, with ASTM D 2564 Solvent cement.

B. Discharge to floor drain or properly vented open site drain.

2.08 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3" and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
   3. PVC/CPVC pipe: ½ through 4-inch 235psi 6-inch 150psi @ 73° F with socket connections.

B. Flanges for Pipe Size Over 1" :
   1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
   3. PVC/CPVC Pipe: Class 150 socket welded flanges; 1/8" thick 70 durometer full-face neoprene gaskets.

2.09 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
   1. Anvil International: www.anvilintl.com.
   2. Champion Fiberglass : www.championfiberglass.com.
   3. Cooper B-Line: www.cooperbline.com.
   4. Elite Components: www.elitecomponents.com.
   5. Mason Industries: www.mason-ind.com.
   6. Substitutions: See Section 22 05 00 Substitutions.

B. Pipe Hangers - General
   1. Furnish and install suitable hangers and supports for all horizontal lines. Pipe sizes of 3" and larger shall be carried by pipe hangers supported by rods secured to structure. No piping shall be hung from other piping or ductwork. In no case shall hangers be supported by means of vertical expansion bolts. At no point shall hangers and pipe clamps break the insulation vapor barrier. Always provide proper saddle support and hanger/clamp support system for insulation materials.

   2. Support Spacing. Piping shall be supported at distances not to exceed those specified:
      a. Copper or Copper-Alloy Pipe: Horizontal Max: 12ft; Vertical Max - 10ft.
      b. Copper or Copper-Alloy Tubing
         1) Less than or equal to 1-1/4" diameter: Horizontal Max - 6ft; Min - 10ft.
         2) Greater than or equal to 1-1/2" diameter: Horizontal Max - 10ft; Min - 10ft.
      c. Ductile Iron: Horizontal Max - 5ft (a); Vertical Max - 15ft.

   NOTES: (a) is the maximum horizontal spacing for supports may be increase to 10ft when 10-foot lengths of pipe are employed. (b) is mid-story guide to be employed.

C. Plumbing Piping - Drain, Waste, and Vent:
   1. Conform to ASME B31.9 or MSS SP-69.
   2. Hangers for Pipe Sizes 1/2” to 1-1/2”: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2” and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3”: Cast iron hook.
   6. Wall Support for Pipe Sizes 4” and Over: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Plumbing Piping - Water:
   1. Conform to ASME B31.9 or MSS SP-69.
   2. Hangers for Pipe Sizes 1/2” to 1-1/2”: Malleable iron, adjustable swivel, split ring.

3. Hangers for Cold Pipe Sizes 2” and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2” to 4”: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
6. Wall Support for Pipe Sizes to 3”: Cast iron hook.
7. Vertical Support: Steel riser clamp.
8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.10 VALVES - GENERAL

A. Manufacturers:
1. Apollo Valve: www.apollovalves.com.
2. Jomar Valve: www.jomarvalve.com.
3. Kitz Valves: www.kitzus-kca.com.
4. Nibco, Inc: www.nibco.com.
5. Milwaukee Valve Company: www.milwaukeevalve.com.
6. Red-White Valve Corp. (RWV): www.redwhitevalvecorp.com.
7. Shurjoint: www.shurjoint.com.
8. Smith Cooper Valves: www.smithcooper.com.
9. Watts Water Technologies Inc.: www.watts.com.
10. Spears Manufacturing Company: www.spearsmfg.com.
11. Substitutions: See Section 22 05 00 Substitutions.

B. Valves shall be suitable for 125 PSIG working pressure unless otherwise specified.

C. A control valve for water supply piping 3/4” through 4” in diameter which serves 2 or more plumbing fixtures shall have a nominal diameter at least equal to the piping.

D. Valves for water supplies shall be lead free, as required by the Lead-Free Law.

2.11 BALL VALVES

A. Water Systems
1. MSS SP-110, 3" and smaller: Two-piece bronze body; sweat, threaded, press or ASTM F1960 joint connection ends, full port stainless steel ball and stem; glass filled Teflon seat; Teflon packing and threaded packing nut; blowout-proof stem; 600 psig CWP, WOG. Provide valve stem extensions for valves installed in all piping with insulation.
   a. Apollo 70LF-100 series
   b. Jomar T-200 series
   c. Milwaukee UPBA-100S series

B. Compressed Air Systems
1. 3" and smaller: Two-piece bronze body; threaded ends, chrome plated bronze ball; glass filled Teflon seat; Teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG.
   a. Apollo 70-100 series
   b. Milwaukee BA-100 series
   c. RWV 5080B
   d. Watts B-6000

2.12 GATE VALVES

A. Up To and Including 3":
   1. MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, threaded ends.
   2. ½" through 2-inch rated 200psi @ 73° F, 2-1/2" through 3 rated 150psi @ 73° F, PVC/CPVC body and trim, polypropylene solid wedge disc, non-rising handwheel, socket weld ends.
      a. Apollo 107T series.
      b. Jomar T351G
      c. RWV 208B

2.13 BUTTERFLY VALVES

A. Construction 1½" and Larger: MSS SP-67, 300 psi CWP, cast or ductile iron body, aluminum bronze disc, extended resilient replaceable EPDM seat, wafer or lug ends, extended neck, 10 position lever handle.
   1. Apollo LC149, LD141 and LD145 series.
   2. Jomar BFV Series
   3. Milwaukee CL Series
   4. RWV 937/938
   5. Shurjoint SJ-C300SJ-330N

B. Provide gear operators for valves 8" and larger, and chain-wheel operators for valves mounted over 8ft above floor.

2.14 SWING CHECK VALVES

A. Up to 2":
   1. MSS SP-80, Class 125, lead free bronze body and cap, bronze swing disc with rubber seat, solder, or threaded ends.
      a. Apollo 161S-LF/161T-LF.
      b. Jomar S-511G
      c. Milwaukee Valve UP509
      d. RWV 236BT

2.15 SPRING LOADED CHECK VALVES

A. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.
   1. Apollo 61/61LF series.

B. 300-psig, ductile iron body, stainless steel spring and shaft, suitable for vertical or horizontal installation.
   1. Apollo 910WB series.

2.16 BALANCE VALVES

A. Manufacturers:
   1. ThermOmegaTech: www.thermomegatech.com.
   2. Substitutions: See Section 22 05 00 Substitutions.

B. ANSI/AWWA C800; Thermostatically controlled recirculation valve will regulate the flow of recirculated domestic hot water based on water temperature entering the valve without additional piping or control mechanisms. Valve shall be set for 120° hot water return. Valve shall be equal to pipe size with 0.2 gpm minimum flow when 90% closed and rated to 200 PSIG maximum working pressure. Type 303 Stainless steel construction.
   1. Circuit solver CSUA-3/4 – 120 – CV1

2.17 RELIEF VALVES

A. Pressure Relief:
   1. Manufacturers:
      a. Apollo Valves: www.apollovalves.com
      b. Cla-Val Co: www.cla-val.com.
      c. Henry Technologies: www.henrytech.com.
      d. Watts Regulator Company: www.wattsregulator.com.
      e. Substitutions: See Section 22 05 00 Substitutions.

   2. AGA Z21.22 certified, bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated.

B. Temperature and Pressure Relief:
   1. Manufacturers:
      a. Apollo Valves: www.apollovalves.com
      b. Cla-Val Co: www.cla-val.com.
      c. Henry Technologies: www.henrytech.com.
      d. Watts Regulator Company: www.wattsregulator.com.
      e. Substitutions: See Section 22 05 00 Substitutions.

   2. AGA Z21.22 certified, lead free, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210° F, capacity ASME (BPV IV) certified and labeled.

2.18 STRAINERS

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com
   2. Armstrong International, Inc: www.armstronginternational.com.
   3. Green Country Filtration: greencountryfiltration.com.
   4. Jomar Valve: www.jomarvalve.com.
   5. Kitz Valves: www.kitzus-kca.com.
   6. Red-White Valve Corp. (RWV): www.redwhitevalvecorp.com.
   7. Spears Manufacturing Company: www.spearsmfg.com.
   8. WEAMCO: www.weamco.com.
   9. Substitutions: See Section 22 05 00 Substitutions.

B. Size 2" and Under:
   1. Threaded brass body for 175 psi CWP, Y pattern with 1/32" stainless steel perforated screen.
      a. Jomar T-651G
      b. RWV 380AB
   2. Class 150 threaded bronze body 300 psi CWP, Y pattern with 1/32" stainless steel perforated screen.

C. Size 1-1/2" to 4":
   1. Class 125, flanged iron body, Y pattern with 1/16" stainless steel perforated screen.
      a. Jomar F-651
      b. RWV 381

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever joining dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipes, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.

I. Establish elevations of buried piping outside the building to ensure not less than 5 ft of cover.

J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Provide support for utility meters in accordance with requirements of utility companies.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 22 05 00 - Execution.

N. Excavate in accordance with Division 31.

O. Backfill in accordance with Division 31.

P. Install bell and spigot pipe with bell end upstream.

Q. Install valves with stems upright or horizontal, not inverted.

R. Install water piping to ASME B31.9.

S. PVC Pipe: Make solvent-welded joints in accordance with ASTM D 2855.

T. Sleeve pipes passing through partitions, walls, and floors.

U. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4”.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above, flush with top of slab.

V. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F 708; and MSS SP-89.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2” space between finished covering and adjacent work.
4. Place hangers within 12” of each horizontal elbow.
5. Use hangers with 1-1/2” minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping OR sheet lead packing between hanger or support and piping.
9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 22 05 48.
11. Support cast iron drainage piping at every joint.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners in accessible locations.

1. Grooved joint couplings and fittings shall be installed in accordance with the manufacturer’s written installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be verified as suitable for the intended service prior to installation. Gaskets shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer’s representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install ball valves for throttling, bypass, or manual flow control services.

F. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

G. Provide spring loaded check valves on discharge of water pumps.

H. Provide balance valve in water recirculation systems where indicated.

3.05 ERECTION TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2” vertically of location indicated and slope to drain at minimum of 1/8” per foot slope.

B. Water Piping: Slope at minimum of 1/32” per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 33 13 00.

B. Prior to starting work, verify system is complete, flushed, and clean.

C. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form, throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15% of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 10% of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts, and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved water meter with by-pass valves.
   1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
   2. Provide 18-gauge galvanized sheet metal sleeve around service main to 6” above floor and 6ft minimum below grade. Size for minimum of 2” of loose batt insulation stuffing.

3. Remote read water meter wiring and remote reader shall be provided and installed by local water utilities. Plumbing Contractor shall provide and install wire conduit and wall/foundation sleeves, from water meter to remote read dial location at 48” above finish grade or as indicated by local water utilities standards. Plumbing Contractor shall provide and install all required water meter supports.

3.08 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2” to 1-1/4”:
         1) Maximum hanger spacing: 6.5 ft.
         2) Hanger rod diameter: 3/8”.
      b. Pipe size: 1-1/2” to 2”:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 3/8”.
      c. Pipe size: 2-1/2” to 3”:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 1/2”.
      d. Pipe size: 4” to 6”:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 5/8”.
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum hanger spacing: 6 ft.
         2) Hanger rod diameter: 3/8”.

END OF SECTION

SECTION 22 10 06

PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Garage catch basins.

B. Cleanouts.

C. Drains.

D. Trap guards.

E. Reduced pressure backflow preventers.

F. Water hammer arrestors.

G. Hose bibs.

H. Truck filling station

1.02 RELATED SECTIONS

A. Section 22 05 00 - Common Work Results for Plumbing.

B. Section 22 10 05 - Plumbing Piping.

C. Section 22 40 00 - Plumbing Fixtures.

D. Section 22 30 00 - Plumbing Equipment.

E. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCES

A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001 (R2007).

B. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2005 (ANSI/ASSE 1011).

C. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; American Society of Sanitary Engineering; 2002 (ANSI/ASSE 1012).

D. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers; American Society of Sanitary Engineering; 2005.

E. PDI-WH 201 - Water Hammer Arresters; Plumbing and Drainage Institute; 2006.

1.04 SUBMITTALS

A. See Section 22 05 00 - Submittals.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

E. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, and water hammer arrestors.

F. Operation Data: Indicate frequency of treatment required for interceptors.

G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Accept specialties on site in original factory packaging. Inspect for damage.

1.07 EXTRA MATERIALS

A. See Section 22 05 00 – Extra Materials, for additional provisions.

B. Supply for owners use in maintenance of project:
   1. Two hose end vacuum breakers for hose bibbs.

PART 2 PRODUCTS

2.01 GARAGE CATCH BASINS

A. Manufacturers:
   Basin:
   1. Crest Concrete, Inc., www.crestprecastconcrete.com.
   2. Jim Murray, Inc., www.jimmurrayinc.com.
   3. Topp Industries, Inc., www.toppindustries.com
   4. Wieser Concrete: www.wieserconcrete.com.
   5. Substitutions: See Section 22 05 00 Substitutions.

   Basin Cover:
   1. Neenah Foundry Company: www.nfco.com.

B. Catch Basin:
   1. Fiberglass basin, minimum code size 36 inch diameter x 48 inch deep. Provide push grommet, matching pipe size and number of inlets and outlet piping. Conforms to State of Wisconsin Uniform Plumbing code. See Schedule

C. Cover:
   1. Provide 6 inch pre-cast riser ring x 44 inch diameter with 27 inch round opening.
      a. Neenah Foundry Co. R-2540:

2.02 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com.
   2. Josam Company: www.josam.com.
   3. Wade: www.wadedrains.com.
   4. Watts: www.watts.com.
   5. Mifab: www.mifab.com.
   6. Sioux Chief: www.siouxchief.com.
   7. Zurn Industries, Inc: www.zurn.com.
   8. Substitutions: See Section 22 05 00 Substitutions.

B. FCO-1 Finish Floor Cleanout:
   1. ANSI A112.36.2M; Cast iron body with threaded top assembly. No-Hub or Neo-Loc outlet connection, Bronze or PVC plug. Round gasket scored medium traffic nickel bronze cover. Provide with anchor flange when required. Provide carpet flanges for carpeted areas.
      a. J.R. Smith 4020-PB or 4031-PB
      b. Josam 55000-2
      c. Wade 8000
      d. Watts CO-200-R
      e. Zurn ZN1400-NH or ZN1400-NL

C. FCO-2 Finish Floor Cleanout:
   1. ANSI A112.36.2M; Cast iron body with threaded top assembly. No-Hub or Neo-Loc outlet connection, Bronze or PVC plug. Round gasket scored heavy-duty nickel bronze cover rated for heavy loads. Provide with anchor flange when required.
      a. J.R. Smith 4100-PB or 4111-PB
      b. Josam 55000-5
      c. Wade 8000-X
      d. Watts CO-200-RX
      e. Zurn ZN1400-NH-HD or ZN1400-NL-HD

D. C.O. Cleanouts at Interior Unfinished Accessible Areas: Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.03 DRAINS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com.
   2. Josam Company: www.josam.com.
   3. Mifab: www.mifab.com.
   4. Sioux Chief: www.siouxchief.com.
   5. Wade: www.wadedrains.com.
   6. Watts: www.watts.com.
   7. Zurn Industries, Inc: www.zurn.com.
   8. Substitutions: See Section 22 05 00 Substitutions.

B. FD-1 Floor Drain:
   1. ASME A112.6.3; Cast iron body, drainage flange, weep holes, reversible clamping collar for high or low setting, 6" round nickel bronze adjustable heel-proof strainer.
      a. J.R. Smith 2005-NB-A
      b. Josam 30000-A
      c. Sioux Chief 863- NRD
      d. Wade 1100-A-1
      e. Watts FD-100-A
      f. Zurn Z415B-ZN

C. Open Site Drains:
   1. ASME A112.6.3; Provide and install a vented trap with inlet 1 inch above finished floor where shown. Sizes shown on plan, as 2 inch, 3 inch, 4 inch, etc. are sizes with an increaser of one pipe size larger opening extending above floor or as specifically noted.
      a. OS-1: hub section up 1 inch minimum above floor level, with full-sized deep seal P-trap as described above.

2.04 TRAP SEAL GUARDS

A. Manufacturers:
   1. JR Smith Quad Close: www.jrsmith.com.
   2. Jones Stephens Corp.: www.jonesstephens.com.
   3. ProSet Systems Trap Guard: www.trapguard.com.
   4. Sure Seal: www.thesureseal.com.
   5. Green Drain: www.greendrains.com.
   6. Zurn Industries, Inc: www.zurn.com.
   7. Substitutions : See Section 22 05 00 Substitutions.

B. Trap Guard: ASSE 1072, Flexible elastomeric PVC construction diaphragm trap guard prevent trap evaporation and waste backflow, shall be installed in all new and existing floor drains, open site drains, and trench drains. Exceptions are open site drains that will receive a high velocity discharge, similar to commercial dishwashers or clothes washers. Size trap guard as applicable to the drain outlet size, up to 4" size. Follow Manufacture instructions and specifications.

2.05 REDUCED PRESSURE BACKFLOW PREVENTERS

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com
   2. Conbraco Industries: www.conbraco.com.
   3. Watts Regulator Company: www.wattsregulator.com.
   4. Wilkins: www.wilkins.com.
   5. Substitutions: See Section 22 05 00 Substitutions.

B. Reduced Pressure Backflow Preventers:
   1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.
   2. Sizes 2½ to 10 inch - shall be of approved epoxy coated cast iron check valve bodies with bronze seats, approved epoxy coated cast iron relief valve with stainless steel trim.
   3. All sizes shall be furnished with bronze body ball valve test cocks.
   4. All R.P.Z. shall be equipped with quarter-turn, full port, resilient seated ball valve shut-offs before and after units.
   5. Provide a bronze strainer for sizes ¾ thru 2 inch and approved epoxy coated cast iron strainer for sizes 2½ thru 10 inch.
   6. Extend an air-gapped drain pipe from R.P.Z. valve to floor drain or open site drain.
   7. Install a minimum 12 inch long flexible pipe section on supply side of R.P.Z. valve to prevent system vibrations.
   8. Install a soft seated check valve within 6” on supply side of R.P.Z. valve to prevent R.P.Z. valve from loosing water prime.
   9. Install a water hammer arrestor unit on supply side of R.P.Z. valve, matching size of piping for W.H.A. size.
   10. Identify all piping, valves, or faucets on discharge side of valve as "Non-Potable Water" per SPS 382.40 (3)(b) 2.

2.06 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com.
   2. Josam: www.josam.com.
   3. Precision Plumbing Products: www.pppinc.net.
   4. Sioux Chief: www.siouxchief.com.
   5. Wade: www.wadedrains.com.
   6. Watts Regulator Company: www.wattsregulator.com.
   7. Zurn Industries, Inc: www.zurn.com.
   8. Substitutions: See Section 22 05 00 Substitutions.

B. Water Hammer Arrestors:
   1. ASSE 1010, ANSI A112.26.1M; Lead free copper construction, piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.
   2. Provide water hammer arrestors on hot and cold water piping where shown on drawings, any device or piece of equipment that has a solenoid control valve must have a water hammer arrestors on the supply piping installed. Water hammer arrestors must be installed on flush valve type fixtures.
   3. Water hammer arrestors shall be sized and located in accord with the hydraulic design of the piping system served and to the manufacturer's recommendations.
   4. Mechanical water hammer arrestors shall be accessible. Provide and install access panels in chase walls at location of water hammer arrestors.
   5. Arrestors manufactured by Amtrol, Diatrol Series: with bladder and air adjustable valve is the only acceptable water hammer arrestor on multiple flush valve applications. Set pressure of diaphragm shock arrestor to 5 psi below operating pressure.
   6. Arrestor Models:
      a. Watts LF15M2.
      b. Zurn 1250.
   7. Arrestor Sizing Table:
      a. PDI Unit A: Fixture Units - 1-11; Plan Symbol – “WHA-A.”
      b. PDI Unit B: Fixture Units - 12-32; Plan Symbol – “WHA-B.”
      c. PDI Unit C: Fixture Units - 33-60; Plan Symbol – “WHA-C.”
      d. PDI Unit D: Fixture Units - 61-113; Plan Symbol – “WHA-D.”

2.07 HOSE BIBBS

A. Manufacturers:
   1. Chicago Faucet Company: www.chicagofaucets.com.
   2. Jay R. Smith Manufacturing Company: www.jrsmith.com.
   3. Prier: www.prier.com
   4. Watts Regulator Company: www.wattsregulator.com.
   5. Woodford: www.woodfordmfg.com.
   6. Zurn Industries, Inc: www.zurn.com.
   7. Substitutions: See Section 22 05 00 Substitutions.

B. HB-1 Hose Bibb:
   1. ASME / ANSI A112.21.3M, ASSE 1052; ¾ inch lead free chrome plated brass faucet with wheel handle and vacuum breaker with ¾ inch male hose thread.
      a. Prier C-365NP.75
      b. Woodford 26
      c. Zurn Z1341XL

2.08 TRUCK FILLING STATION

A. Manufacturers:
   1. Potter Roemer: www.potterroemer.com.
   2. Substitutions: See Section 22 05 00 Substitutions.

B. TF-1 Truck Fill Station
   1. Hard coated aluminum with 4” female national pipe thread end and 4” Storz fittings. Provided with cap and chain. Provide 4” butterfly control valve. Verify hose connection type with owner.
      a. Potter Roemer 5795-01 & 5799-01

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment where shown on plan drawings and as scheduled.

B. Install in accordance with manufacturer's instructions.

C. Extend cleanouts to finished floor or wall surface. Clean outs shall be full size thru 6 inch, 8 inch and larger shall be 6 inch. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

D. Install new floor cleanouts and floor drains at elevation to accommodate finished floor, coordinate finish floor elevation with General Contractor.

E. Adjust existing floor cleanouts and floor drains to elevation to accommodate new finished floor, coordinate new finish floor elevation with General Contractor.

F. Manufacturers of floor drains and floor clean outs that offer protective covers to allow protection of drain grates and clean out covers from damage during pouring and troweling of concrete in lieu of using duct tape or other methods are acceptable, providing they meet requirements as specified for each type drain and cleanout mentioned above.

G. Wall cleanout covers, floor cleanouts and floor drains shall be cleaned, polished and free of nicks, scratches, tape residue or any other defects at completion of project.

H. Trap Guards: Flexible elastomeric PVC construction diaphragm trap guard for installation in new and existing floor drains, open site drains, and trench drains. Trap guard to prevent trap evaporation and waste backflow. Size as applicable to the drain outlet size, up to 4” size. Manufacturer by: Sure Seal, JR Smith Quad Close, or approved equal.

I. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; example, boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

J. Pipe relief from backflow preventer to nearest drain.

K. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to washing machine outlets, urinals, and truck fill.

L. Water hammer arrestors located in plumbing chase or in walls, shall be provided with access door/panel at that location. See specifications for access door.

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ejector Pump.

B. Water Softener.

C. Gas Fired Water Heater.

D. Fuel Gas Venting.

E. Expansion Tank.

F. Domestic Water Circulator Pumps.

G. Compressed Air Equipment.

1.02 RELATED SECTIONS

A. Section 22 05 00 - Common Work Results for Plumbing.

B. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

C. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCES

A. ANSI Z21.10.1 - Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less; 2004 (with Addendum B).

B. ANSI Z21.10.3 - Gas Water Heaters - Volume III - Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters; 2004.

C. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2007.

D. UL 1738 - Venting Systems for Gas-Burning Appliances, Categories II, III, and IV, specifies safety and performance requirements for flue gas venting systems. The UL Standards and Engagement; 2023.

1.04 SUBMITTALS

A. See Section 22 05 00 - Submittals.

B. Product Data:
1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
2. Indicate pump type, capacity, power requirements.
3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
4. Provide electrical characteristics and connection requirements.

C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in owners name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitations, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

D. Fuel Gas Venting: The installer shall be experienced in the installation of UL 1738-certified venting systems and follow the manufacturer's certified installation instructions. The installation shall comply with all applicable local, state, and federal codes, including the National Fuel Gas Code (NFPA 54/ANSI Z223.1). Do not mix pipe, fittings, solvents, or joining methods from different manufacturers.

1.06 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1 or ANSI Z21.10.3, as applicable, in addition to requirements specified elsewhere.

C. Fuel Gas Venting: UL listed and labeled to UL 1738.

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

E. Approved by state and/or local agencies.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum three year manufacturer warranty for domestic water heaters.

1.09 MAINTENANCE PRODUCTS

A. Supply two 50 pound bags of water softener salt.

PART 2 PRODUCTS

2.01 EJECTOR PUMP

A. Manufacturers:
1. F.E. Myers: www.femyers.com.
2. Goulds Pumps: www.goulds.com.
3. Hydromatic Pumps: www.hydromatic.com.
4. ITT Bell & Gossett: www.bellgossett.com.
5. Liberty Pumps: www.libertypumps.com.
6. Weil Pump Co.: www.weilpump.com
7. Zoeller Pump Company: www.zoeller.com.
8. Substitutions: See Section 22 05 00 Substitutions.

B. Performance: See Schedule.

C. Pump: Two heavy duty submersible with cast iron body, cast iron impeller, stainless steel pump and motor shaft, factory sealed, grease lubricated ball bearings, mechanical seal, capable of passing 1¼" inch solids. Motor is hermetically sealed capacitor start with built-in overload protection. Provide PVC coated cable of sufficient length for connection to junction box.

D. Discharge: 1½ inch I.P.S. threaded opening

E. Control/Alarm:
1. Manufacturers:
   a. Aleron Industries; Model 2012294, (GO2T1D230H20+4AGHWP20): www.alderonind.com.
   b. Liberty Pumps; www.libertypumps.com.
   c. SJE Rhombus; www.sjerhombus.com.
   d. Zoeller Pump Company; www.zoeller.com.
   e. Substitutions: See Section 22 05 00 Substitutions.

2. Performance:
   a. Panel to alternately control on and off for two single-phase pumps. Override control for pump failure. Audible and illuminated high water warning alarm, U.L. listed.
   b. 120V primary power. Float switches located in ejector basin.
   c. Mercury float switches to be mounted on float rod.

d. Properly secure wires at pump and along wall in a neatly workmanship manor.
e. Audible and illuminated high water warning device, U.L. listed, 120V primary power with battery backup and low battery indicator. Float switch located in ejector basin

F. Power supplied by electrical contractor, Division 26.

G. Basin:
1. Manufacturers:
a. A.K. Industries: www.akindustries.com.
b. Topp Industries Inc.: www.toppindustries.com
c. Jackel Inc.: www.jackelinc.com
d. Liberty Pumps: www.libertypumps.com.
e. Substitutions: See Section 22 05 00 Substitutions.

2. Performance: 36 inch inside diameter fiberglass reinforced plastic tank, with ¼ inch duplex steel cover.

2.02 WATER SOFTENER

A. Manufacturers:
1. Culligan International Company: www.culligan.com.
2. Hellenbrand Inc: www.hellenbrand.com.
3. Water Control Corporation: www. watercontrolinc.com.
4. Watersoft Inc: www.watersoftinc.com.
5. Substitutions: See Section 22 05 00 Substitutions.

B. Performance: See Schedule.

C. Testing: Provide water sample from water sources at the site for testing to finalize the required mineral needed for softener unit.

D. Tanks: Electrical welded pressure vessel quality low carbon steel construction rated for 100 psig working pressure with access openings for mineral filling and inspection. NSF approved and rated for 100 psig working pressure. Mount slotted lateral hub PVC distributor in tank with under bedding gravel.

E. Mineral: High capacity ion exchange mineral, FDA approved, Sybron/Ionac, Rohm & Haas, Resintech or Puralite. Uniform beads rated for removal of 30,000 grains of hardness as calcium carbonate when regenerated with 15 lbs. of salt. Design for minimum 50% resin bed freeboard. Water sample to be provided for testing to provide proper mineral setup for this application.

F. Valve: Top mount all brass valve with fully automatic multiport diaphragm type motor drive, hydraulically balanced piston, seal and spacers, adjustable brine flow control, backwash flow control, adjustable capacity and regeneration settings. Provide bypass ball valve arrangement.

G. Controls: Factory wired and tested controls with fully integrated programmable micro-processor driven electronic controller shall automatically cycle the main operating valve through the regeneration sequence.

H. Brine Tank: High-density polyethylene brine tank with high salt platform, PVC brine measuring and float valve, PVC injector. Tank shall be topped off with salt at completion of project.

I. Electrical: 120/60/1 electrical, Electrical Contractor shall provide outlet.

J. Flow Sensor: Unit shall be equipped with a water meter sensor with flow transducer interconnected to system controller.

K. Accessories: Flexible braided stainless steel pipe connectors for tanks over 24 inch diameter. Inlet and outlet sampling valves, inlet and outlet pressure gauges with shutoff valve. Resin defoliant system with chemical metering pump, tubing and 4 month supply of chemical cleaner for iron and bacteria fouling.

2.03 GAS FIRED WATER HEATER

A. Manufacturers:
1. A.O. Smith Water Products Co: www.hotwater.com.
2. Bock Water Heaters, Inc: www.bockwaterheaters.com.
3. Bradford White: www.bradfordwhite.com.
4. Heat Transfer Products Inc: www.htproducts.com.
5. Hubbell Heaters: www.hubbellheaters.com.
6. Lochinvar: www.lochinvar.com.
7. PVI Industries, Inc.: www.PVI.com.
8. Rheem Manufacturing Company: www.rheem.com.
9. Rinnai America Corp.: www.rinnai.us.
10. State Industries: www.statewaterheaters.com.
11. Substitutions: See Section 22 05 00 Substitutions.

B. Performance: See Schedule.

C. Tank: Vertical glass lined welded steel or 316L stainless-steel non-ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs Maximum working pressure of 150 psig.

D. Combustion: Minimum 94% efficient sealed combustion natural gas fired. Corrosive resistant 90/10-cupronickel heat exchanger. UL1738 listed intake and exhaust venting as per manufacture specifications using concentric vent. Provide muffler for noise reduction on exhaust and intake as per manufacture specifications. Provide isolation mounts when anchoring vent piping.

E. Accessories: Brass water connections and dip tube drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.

F. Certification: As automatic storage water heater and automatic circulating tank water heater for operation at 180 degrees F.

G. Controls: Automatic water thermostat with temperature range adjustable from 110 to 180 degrees Fahrenheit, LCD display read out with self-diagnostic control, detailed status information and temperature control.

2.04 FUEL GAS VENTING

A. Materials: Category II, III and IV condensing gas fire appliances intake/vent non-metallic materials to be PVC, CPVC that shall meet ANSI/UL1738 certification along with primer and cement. Materials must be rated for maximum flue gas temperatures produced by the appliance. Pipes and fittings shall be labeled that indicate the product is UL1738 certified and the certification agency.
   1. All system components (pipe, fittings, cement, primer, terminations) must be from the same manufacturer to ensure compatibility and system integrity.

   2. Pipe and fittings shall be color-coded for UV protection and clearly marked with orange or black print lines to distinguish them from standard plumbing pipe.

B. Solvent cement and primer: Use only the manufacturer's certified cements and primers. The cement shall contain an optical brightener for inspection purposes. Use primer for installations below 32°F (0°C).

C. Termination: Install intake and vent termination as per manufacturer specifications with UL1738 certified materials. Installation to meet clearance requirements from windows, doors, and fresh-air intakes.

2.05 EXPANSION TANK

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com.
   2. Apollo Valves: www.apollovalves.com
   3. ITT Bell & Gossett: www.bellgossett.com.
   3. Watts: www.watts.com.
   4. Substitutions: See Section 22 05 00 Substitutions.

B. Performance: See Schedule.

C. Construction: Welded steel, tested and stamped in accordance with non-ASME; supplied with National Board Form U-1, rated for working pressure of 150 psig and operating temperature of 200°F, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

D. Accessories: Pressure gauge and air-charging fitting, tank drain; pre-charge to 40 psig, Check valve in cold water supply before tank.

2.06 IN-LINE CIRCULATOR PUMP

A. Manufacturers:
   1. Armstrong Pumps Inc: www.armstrongpumps.com.
   2. Bell and Gossett: www.xylem.com/bellgossett
   3. Grundfos Pumps Corp.: www. grundfos.com/web/homeus.nsf
   4. Taco Inc.: www.tacocomfort.com.
   5. Substitutions: See Section 22 05 00 Substitutions.

B. Performance: See Schedule

C. Body: Horizontal, quiet operation with overload protection. Lead free stainless steel casing, rated for maximum 150 psig working pressure, with stainless steel rotor assembly. Steel shaft supported by permanently lubricated, sealed ball bearings. Seal to be carbon on silicon carbide.

D. Controls:
   1. Manufacturers:
      a. Honeywell: www.honeywell.com.
      b. Intermatic: www.intermatic.com.
      c. Paragon Electrical: www.paragontimecontrols.com.
      d. Substitutions: See Section 22 05 00 Substitutions.

   2. Performance:
      a. Aquastat on hot water return line, to control circulator pump. Aquastat settings for pump on when water temperature below 110°F and pump off when water temperature reaches 120°F.
         1) Honeywell L4006A1017
      b. Digital 7 Day time control to override aquastat control of circulation pump during building non-occupancy. Set time clock days/hours as directed by owner.
         1) Intermatic ET1700 Series
         2) Paragon Electrical; EC7000/120V
      c. Control wiring by and installed by plumbing contractor. 115 volt wiring and power by electrical contractor division 26.

2.07 COMPRESSED AIR EQUIPMENT

A. Manufacturers:
   1. DeVilbiss Air Power Co.: www.devap.com.
   2. Ingersoll-Rand Co.: www.air.ingersollrand.com.
   3. Quincy Compressor: www.quincycompressor.com.
   4. Worthington Division: www. worthingtonparts.com/html/compressors.html.
   5. Substitutions: See Section 22 05 00 Substitutions.

B. Air compressor relocated and installed by Plumbing Contractor.

C. Air Dryers. Furnish and install air dryers on all air compressors. Based on Product by Norgren refrigerated air dryer, air cooled. Dryer shall include automatic drain, refrigerant suction pressure gauge, power on light, and on-off switch. Provide wall bracket and frame for wall mounting on wall above compressor. Zurn, Worthington, Curtis and Dayton equals are acceptable. Provide a valve bypass around air dryer. Provide isolation pad mountings. Provide flexible pipe connections.

D. Air Pressure Regulators:
   1. Manufacturers:
      a. Fisher: www.fisherregulators.com.
      b. Norgren Ltd: www.norgren.com/usa
      c. Parker Hannifin Corp.: www.parker.com/pneumatics
      d. Substitutions: See Section 22 05 00 Substitutions.

   2. Performance: Standard air line regulator, size as per use requirements. Zinc die cast body, nylon reinforced Buna-N-Diaphragm, and pressure gauge with range of 0-150 psi.
      a. Parker/Pneumatics 07R421A

E. Flexible Connectors:
   1. Manufacturers:
      a. Flexonics: www.flexonics.com.
      b. Substitutions: See Section 22 05 00 Substitutions.

   2. Performance: Pipe connection to air compressors shall be bronze corrugated flexible metal hose with #301 hose type up to 2" diameter and #391 hose type up to 4" diameter with union or flanged ends.

F. System Filter:
   1. Manufacturers:
      a. Speedaire: www.speedaire.com.
      b. Substitutions: See Section 22 05 00 Substitutions.

   2. Performance: Heavy-duty general filter for water and particle removal down to 5 microns. Unit with metal bowl and sight glass and ¼ turn drain. Provide wall-mounting bracket.
      a. Speedaire 4ZL09, ¾ ” size or 4ZL10, 1” size

G. AH-1: Air Hose Connection.
   1. Manufacturers:
      a. Midland Industries.: www.midlandindustries.com.
      b. Substitutions: See Section 22 05 00 Substitutions.

   2. Performance: Couplers, Male or Female, manual retract for connecting and disconnecting, Brass body and valves, six steel locking balls, stainless steel springs and NBR seal. Maximum working pressure 250 psi. Coordinate connection type with owner.

H. Hose Reel:
   1. Manufacturers:
      a. Reelcraft Products: www.reelcraft.com.
      b. Substitutions: See Section 22 05 00 Substitutions.

   2. Performance: Wall, floor, or ceiling mounted auto retractable hose reel. Vibration proof self-locking latch. Permanently lubricated bearings and swivels. Low pressure (300 psi maximum pressure). 50 feet of 1/2 inch I.D. hose with 1/2 inch M.F.T. outlet. Quick disconnect fittings by Owner.
      a. Reelcraft 7850 OLP

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. All equipment startups shall be performed by factory or factory authorized representatives per manufacturer requirements. Manufacturers that do not require or include factory startups, Plumbing Contractor shall follow all required steps for startup as outlined by manufacturer specifications.

C. Coordinate with plumbing piping and related electrical work to achieve operating system.

D. All condensate piping from equipment to open site drain or floor drain shall be ridged PVC piping.

E. Water Softener:
1. Install and all water softener, brine, controllers and related lines and fittings as per manufacturer’s instructions.
2. Mount softener controller in accessible location for programming and monitoring system.
3. Install piping adjacent to equipment to allow service and maintenance. Install shutoff valves and unions on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers. Install drains as indirect waste to open site drain. Install a vacuum break between the softener and the potential cause of a vacuum anytime a vacuum situation may occur.
4. Electirical to connect wiring related wiring and required grounding. Coordinate with Electrical Contractor.
5. perform field test and adjust controls and safeties as required per manufacturer specifications. Repair any leaks in the system.

F. Pumps:

1. Domestic Hot Water Return Pump: Provide line sized isolating valve and strainer on suction and line sized, soft seated check valve and balancing valve on discharge. Install Aquastat and adjust temperature. Adjust balancing valves through domestic hot water return piping.

2. Sump Pumps: Ensure length of chord allows sump pumps to be located minimum 6 inches clearance from bottom of sump pit.

G. Water Heater/Storage Tank Safety Devices:

1. Must be approved for use in the State of Wisconsin

2. All pressurized storage-type water heaters and unfired hot water storage tanks shall be equipped with one or more combination temperature and pressure relief valves. The temperature steam rating of a combination temperature and pressure relief valve or valves shall equal or exceed the energy input rating in BTU per hour of the water heater. No shut off valve or other restricting device may be installed between the water heater or storage tank and the combination temperature and pressure relief valve.

3. Temperature and pressure relief valves shall be installed so that the sensing element of the valve extends into the heater or tank and monitors the temperature in the top 6 inches of the heater or tank.

4. All domestic hot water storage tanks/water heaters will be equipped with a drain valve at the lowest point of unit or on cold water inlet near bottom of unit if not equipped with factory drain valve. Plumbing Contractor to install drain valve if not factory equipped. Drain valve shall meet SPS 384.20 (5) (p) water heaters section and conform to ASSE 1005.

5. Relief Valve:
   a. Every relief valve, which is designed to discharge water or steam, shall be connected to a discharge pipe.
   b. The discharge pipe and fittings shall have a diameter not less than the diameter of the relief valve outlet.
   c. The discharge pipe may not be trapped.
   d. No valve may be installed in the discharge pipe.
   e. The discharge pipe shall be installed to drain by gravity flow to a floor served by a floor drain or to a receptor in accordance with SPS 382.33 (8). The outlet of the discharge pipe shall terminate within 6 inches over the floor or receptor, but not less than a distance equal to twice the diameter of the outlet pipe. The outlet of the discharge pipe may not be threaded.
   f. The discharge pipe for a water heater shall terminate within the same room or enclosure within which the water heater or hot water storage tank is located.

6. Safety Devices:
   a. Relief valves shall be listed by the American Gas Association, Underwriters Laboratories, Inc. or American Society of Mechanical Engineers when the heat input to a water heater is less than or equal to 200,000 BTU per hour.
   b. Relief valves shall be listed by the American Society of Mechanical Engineers when the heat input to a water heater exceeds 200,000 BTU per hour.
   c. Pressure relief valves shall be set to open at either the maximum allowable working pressure rating of the water heater or storage tank or 150 psig, whichever is smaller.
   d. Temperature and pressure relief valves shall be set to open at a maximum of 210° F. and in accordance with code.

H. Fuel Gas Venting:
1. Intake/exhaust vent system shall be UL1738 Certified and follow the appliance manufacturer specifications for materials, pipe sizing and installation for a proper operating system. Follow the vent system manufacturer’s installation instructions along with NFPA 54 and IFGC
2. Follow the vent systems manufacturer's certified installation instructions precisely.
3. Install horizontal vent runs with a minimum slope of 1/4 inch per foot (1°) back toward the appliance to allow for condensate drainage.

4. The vent system shall be routed for zero clearance to combustibles as specified by the manufacturer. Vent Installation shall conform to the manufacturer's installation instructions, its UL listing and state/local codes. The vent system and breechings shall be inspected and cleaned before the final connection to the appliances.
5. Install and space hangers and supports according to the manufacturer's specifications to prevent sagging and ensure stability.

I. Expansion Tank:
1. Install on cold water supply at water heater.
2. Install check valve on cold water supply upstream of expansion tank.

END OF SECTION

This Page Left Blank Intentionally

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tank type water closets.

B. Stall urinals.

C. Wall hung lavatories.

D. Showers.

E. Sinks.

F. Laundry tubs

G. Requirements for Appliances/Equipment furnished by others

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Product requirements for owners furnished fixtures.

B. Section 06 41 00 - Architectural Wood Casework: Preparation of counters for sinks; lavatory tops.

C. Section 07 90 05 - Joint Sealers: Seal fixtures to walls and floors.

D. Section 22 05 00 - Common Work Results for Plumbing.

E. Section 22 10 05 - Plumbing Piping.

F. Section 22 10 06 - Plumbing Piping Specialties.

G. Section 22 30 00 - Plumbing Equipment.

H. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997 (Reaffirmed 2002).

B. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2005.

C. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers; 1994 (R2004).

D. ASME A112.19.2 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2003.

E. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; The American Society of Mechanical Engineers; 1994 (R2004).

F. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers; 2005.

G. ASSE-1016 – Individual thermostatic, pressure balancing and combination pressure Balancing and thermostatic control valves for individual showers.

1.04 SUBMITTALS

A. See Section 22 05 00 - Submittals.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in owners name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 REGULATORY REQUIREMENTS

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.08 WARRANTY

A. See Section 22 05 00 - Closeout Submittals, for additional warranty requirements.

1.09 EXTRA MATERIALS

A. See Section 01 60 00 - Project Requirements, for additional provisions.

B. Supply two sets of faucet washers.

1.10 FIXTURES AND TRIM

A. This section of the work includes plumbing fixtures furnished and installed by the Plumbing Contractor.

B. All vitreous china fixtures shall be of the best quality conforming in all respects to classification "Regulation Selection" in accord with the uniform grading rules of "Vitreous China."

C. All products must be lead free as required by the lead free law "Federal Safe Drinking Water Act."

D. All similar fixtures, faucets, and trim shall be of same manufacturer throughout project.

E. Fixtures and trim of equal quality as listed by other manufacturers may be submitted.

F. Fixture support. Provide and install proper supports and carriers for plumbing fixtures as scheduled or required for the application. Carriers shall be set in accordance with manufacturer's recommendations with adequate anchors and fasteners to provide required support. Wall hung water closet outlets shall be fully grouted for support in masonry walls.

1.11 PLUMBING FIXTURES LIST

A. Manufacturers: Fixture descriptions establish fixture type, quality, materials, features and size. Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted. For substitutions, see Section 22 05 00 Substitutions.

1. China Water Closets, Urinals and Lavatories Fixtures
   a. American Standard Inc: www.americanstandard.com.
   b. Kohler Company: www.kohlerco.com.
   c. Sloan Valve Company: www.sloanvalve.com.
   d. Toto USA Inc.: www.totousa.com.
   e. Zurn Industries, Inc.: www.zurn.com.
   f. Mansfield Plumbing Products: www.mansfieldplumbing.com.

2. Flush Valves
   a. American Standard Inc: www.americanstandard.com.
   b. Delta Faucet Company: www.specselect.com.
   c. Sloan Valve Company: www.sloanvalve.com.
   d. Zurn Industries, Inc: www.zurn.com.

3. Water Closet Seats
   a. American Standard Inc: www.americanstandard.com.
   b. Bemis Manufacturing Company: www.bemismfg.com.
   c. Church Seat Company: www.churchseats.com.
   d. Comfort Seats: www.comforttoiletseats.com.
   e. Kohler Company: www.kohlerco.com.
   f. Zurn Industries, Inc: www.zurn.com.

4. Faucets
   a. American Standard Inc: www.americanstandard.com.
   b. Bradley Corporation: www.bradleycorp.com.
   c. Chicago Faucet Company: www.chicagofaucets.com.

d. Elkay Manufacturing Company: www.elkay.com.
e. Kohler Company: www.kohlerco.com.
f. Sloan Valve Company: www.sloanvalve.com.
g. Symmons Industries: www.symmons.com.
h. T&S Brass Inc.: www.tsbrass.com.
i. Union Brass Manufacturing Company: www.unionbrass.com.
j. Zurn Industries, Inc: www.zurn.com.

5. Shower Controls
   a. American Standard Inc: www.americanstandard.com.
   b. Chicago Faucet Company: www.chicagofaucets.com.
   c. Leonard Valve Company: www.leonardvalve.com.
   d. Speakman Company: www.speakmancompany.com.
   e. Symmons Industries: www.symmons.com.
   f. T&S Brass Inc.: www.tsbrass.com.
   g. Zurn Industries, Inc: www.zurn.com.

6. Sinks
   a. Acorn Engineering Company: www.acorneng.com.
   b. American Standard Inc: www.americanstandard.com.
   c. Elkay Manufacturing Company: www.elkay.com.
   d. Just Manufacturing Inc.: www.justmfg.com.
   e. Kohler Company: www.kohlerco.com.

7. Laundry Trays
   a. Fiat Products: www.fiat.ca.
   b. E.L. Mustee & Sons, Inc.: www.mustee.com.
   c. Zurn Industries, Inc: www.zurn.com.

8. Carriers and Supports
   a. Jay R. Smith Manufacturing Company: www.jrsmith.com.
   b. Josam Company: www.josam.com.
   c. Mifab Inc.: www.mifab.com.
   d. Wade: www.wadedrains.com.
   e. Watts Water Technologies Company: www.watts.com.
   f. Zurn Industries, Inc: www.zurn.com.

9. Drains and Traps
   a. BrassCraft Company.: www.brasscraft.com.
   b. Chicago Faucet Company: www.chicagofaucets.com.
   c. Keeney Manufacturing Company: www.keeneymfg.com.
   d. McGuire Manufacturing: www.mcguiremfg.com.
   e. Zurn Industries, Inc: www.zurn.com.

10. Stops and Supplies
    a. BrassCraft Company.: www.brasscraft.com.
    b. Chicago Faucet Company: www.chicagofaucets.com.
    c. McGuire Manufacturing: www.mcguiremfg.com.
    d. Zurn Industries, Inc: www.zurn.com.

11. Under Lav Protection
    a. McGuire Manufacturing: www.mcguiremfg.com.
    b. Plumberex Specialty Products, Inc: www.plumberex.com.
    c. Truebro IPS Corporation: www.truebro.com.
    d. Zurn Industries, Inc: www.zurn.com.

PART 2 PRODUCTS

2.01 TANK TYPE WATER CLOSETS

A. WC-1 Water Closet (ADA):

1. Fixture Tank and Bowl: ASME A112.19.2; Vitreous china, elongated bowl, close coupled 17 inch floor mounted, floor outlet, 1.6 gallon siphon jet water closet, tank and cover, backflow preventer water control, anti-siphon float valve and bolt caps water guard. Left hand flush handle on tank.
   a. American Standard 215AA.004
   b. Kohler K-3979
   c. Zurn Z5551-K
   d. Mansfield 384-386-LT

2. Supplies: ½ inch compression chrome plated cast brass angle stop with brass stem and loose key handle, 3/8" chrome plated flexible copper tube riser and chrome escutcheon.
   a. BrassCraft SCR-1912-C
   b. McGuire LF2166CCLK
   c. Zurn Z8804-CR-LK

3. Seat: Extra heavy white solid plastic open front seat with check hinge for elongated bowl.
   a. American Standard 5901100SS
   b. Bemis 1955SSCT
   c. Beneke 523
   d. Church 295CT
   e. Kohler K-4670-C
   f. Zurn Z5955SS-EL

4. Note: As per ADA code, flush handle must be located on accessible side of fixture.

B. WC-2 Water Closet (ADA):

1. Fixture Tank and Bowl: ASME A112.19.2; Vitreous china, elongated bowl, close coupled 17 inch floor mounted, floor outlet, 1.6 gallon siphon jet water closet, tank and cover, backflow preventer water control, anti-siphon float valve and bolt caps water guard. Right hand flush handle on tank.
   a. American Standard 215AA.005
   b. Kohler K-3979-R
   c. Zurn Z5551-K-RH
   d. Mansfield 384-386-RH

2. Supplies: ½ inch compression chrome plated cast brass angle stop with brass stem and loose key handle, 3/8" chrome plated flexible copper tube riser and chrome escutcheon.
   a. BrassCraft SCR-1912-C
   b. McGuire LF2166CCLK
   c. Zurn Z8804-CR-LK

3. Seat: Extra heavy white solid plastic open front seat with check hinge for elongated bowl.
   a. American Standard 5901100SS
   b. Bemis 1955SSCT
   c. Beneke 523
   d. Church 295CT
   e. Kohler K-4670-C
   f. Zurn Z5955SS-EL

4. Note: As per ADA code, flush handle must be located on accessible side of fixture.

2.02 STALL URINALS

A. U-1 Urinal:
   1. Fixture: ASME A112.19.2; Vitreous china, one gallon per flush stall urinal with integral flushing rim and ¾ inch top inlet. Fill between urinals by General Contractor.
      a. Kohler K-25039-T
      b. American Standard 6400.001

   2. Strainer: Chrome plated brass flat grid strainer.
      a. McGuire 1233

   3. Flush Valve: ASME A112.18.1; Battery powered, multi-directional, sensor activated, quiet diaphragm type, one gallon per flush valve, chrome plated, override button for manual flushing, a low battery indicator light, range adjustment screw, range indicator light, and 24 hour auto-flush feature, complete with handle cap, ¾ inch screwdriver back-check angle stop with cap, tailpiece, vacuum breaker flush connection and spud coupling for ¾ inch top spud. Provide batteries as per valves specifications.
      a. American standard 6145SM101.002
      b. Sloan Royal 186-1-SFSM
      c. Zurn ZER-6003AV-WS1-CPM

2.03 WALL HUNG LAVATORIES

A. L-1 Lavatory:
   1. Fixture: ASME A112.19.2; White 20"x18" vitreous china wall mounted lavatory with 4 inch faucet centers, front overflow.
      a. American Standard 0355.012.020
      b. Kohler K-2032
      c. Zurn Z5364
      d. Mansfield 2018HB-4

   2. Faucet: ASME A112.18.1; Lead free chrome plated cast brass, ADA compliant single lever handle faucet, ceramic disc cartridge and temperature limit stop, with 4 inch centers and 0.5 gpm aerator, no lift rod hole.
      a. American Standard 6114.116
      b. Chicago 420-E2805ABCP
      c. Elkay LK422L4

d. T&S Brass B-2711-WS
e. Symmons S9612G
f. Zurn Z81000-XL

3. Supplies: ½ inch compression lead free chrome plated cast brass angle stop with brass stem and loose key handle, 3/8” chrome plated flexible copper tube riser and chrome escutcheon.
   a. BrassCraft SCR-1912AX C
   b. McGuire LF2165CCLK
   c. Zurn Z8804-XL-LRLK-PC

4. Drain: 17 gauge, cast brass, chrome plated offset lavatory drain with perforated strainer with 1¼ inch tailpiece.
   a. Keeney 5700PC
   b. McGuire 155WC-ECO
   c. Zurn Z8746

5. Trap: 1¼" x 1½", 17 gauge, cast brass chrome plated, adjustable ground joint 'P' trap with cleanout plug and chrome plated escutcheon.
   a. Keeney 5311XPC
   b. McGuire 8912CBECO
   c. Zurn Z8701-9B

6. Under Lav Protection: Handicap lavatory P-trap and angle valve assemblies shall be insulated with white color fully molded insulation kit.
   a. Truebro 103 E-Z
   b. McGuire PW 2000 WC
   c. Plumberex X4444

7. Carrier: ASME A112.6.1M; Cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.
   a. J.R. Smith 700 for masonry, 700-M31 for metal stud walls
   b. Josam 17100
   c. Watts TCA-411
   d. Zurn Z-1231-EZ

8. Note: Refer to architectural plans for mounting height.

2.04 SHOWERS

A. SH-1 Shower:
   1. Fixture: Built in shower stall by general contractor.

   2. Faucet: ASME A112.18.1, ASSE 1016; ADA, Lead free Thermostatic pressure balancing mixing valve, integral temperature limit stops, blade handle, chrome handheld shower with 69 inch hose, vacuum breaker and 30 inch slide/grab bar, all finishes to be polished chrome.
      a. Acorn 538-LVR-H-DIV-FX-SB
      b. Bradly 1C-TMV-A24
      c. Chicago SH-TP1-00-024
      d. Speakman SLV-5080-ADA w/CPV-TP

3. Drains: ASME A112.6.3; 2 inch outlet cast iron body and 5 inch diameter nickel bronze adjustable strainer head.
   a. Josam 30000-A-5A
   b. J.R. Smith 2010-A or 2005-A
   c. Watts FD-102-A5
   d. Zurn Z-415 w/Type B Strainer

4. Note: Install shower trim as per architectural shower detail.

2.05 SINKS

A. S-1 Sink:
1. Fixture: ASME A112.19.3; Self rimming, double compartment 33" x 21" x 7-1/2" deep, 18 gauge type 304 satin finish stainless steel sink, sound dampening undercoat with 3½ inch drain openings, faucet holes to match selected faucet.
   a. Elkay LR3321
   b. Just DL-2133-A-GR

2. Faucet: ASME A112.18.1; Lead free, polished chrome plated brass 8 inch deck faucet with 8 inch rigid/swing gooseneck spout and quarter turn ceramic disc cartridges. Vandal resistant 4 inch color coded metal wrist blade handles and 1.5 gpm vandal resistant aerator.
   a. American Standard 6409.170
   b. Chicago 1100-GN8AE35-317AB
   c. Elkay LK810GN08T4
   d. T&S Brass B-1120-135X-WH4-CR w/B-0199-07-WS
   e. Zurn Z871C4-XL

3. Supplies: ½ inch compression lead free chrome plated cast brass angle stop with brass stem and wheel handle, 3/8” chrome plated flexible copper tube riser and chrome escutcheon.
   a. BrassCraft OCR-1912AX C
   b. McGuire LF2165CC
   c. Zurn Z8804–XL-LR-PC

4. Drain: Heavy gauge stainless steel drain outlet with stainless basket strainer, lift-up knob with neoprene stopper and 1½ inch chrome tailpiece.
   a. Keeney 1438-PC
   b. Kohler K-8801-PC
   c. McGuire 151
   d. Zurn Z8740-PC

5. Waste: double bowl, 1½ inch chrome plated 17 gauge end or center outlet with 1½ inch 17 gauge chrome tailpiece.
   a. Keeney 1816ASN
   b. McGuire 111C21G17
   c. Zurn Z8754

6. Trap: 1½" x 1½", 17 gauge, cast brass chrome plated, adjustable ground joint 'P' trap with cleanout plug and chrome plated escutcheon.
   a. Keeney 5307XPC
   b. McGuire 8912CBECO
   c. Zurn Z8702-9B

2.06 LAUNDRY TUBS

A. LT-1 Laundry Tub:

1. Fixture: ANSI Z124.6; Floor mounted, single compartment 23" x 23½" x 13" deep, molded stone and polyester resin sink, 1½ inch molded drain assembly, faucet holes to match selected faucet. Adjustable leg levelers.
   a. Fiat FL-1
   b. Mustee 17F
   c. Zurn MS-2620-F

2. Faucet: ASME A112.18.1; Lead free, polished chrome plated brass 4 inch deck faucet with 8 inch reach, 9" high arc spout. Vandal resistant 2½ inch color coded metal lever handles and 2.2 gpm vandal resistant aerator.
   a. Chicago W4D-L9E1-369AB
   b. Elkay LK406AT10L2
   c. T&S Brass B-1112-CR

3. Supplies: ½ inch compression lead free chrome plated cast brass angle stop with brass stem and wheel handle, 3/8” chrome plated flexible copper tube riser and chrome escutcheon.
   a. BrassCraft OCR-1912AX C
   b. McGuire LF2165CC
   c. Zurn Z8804–XL-LR-PC

4. Trap: 1½" x 1½", 17 gauge, cast brass chrome plated, adjustable ground joint 'P' trap with cleanout plug and chrome plated escutcheon.
   a. Keeney 5307XPC
   b. McGuire 8912CBECO
   c. Zurn Z8702-9B

2.07 REQUIREMENTS FOR APPLIANCES/EQUIPMENT FURNISHED BY OTHERS

Plumbing contractor shall rough-in and make final connections to all appliances and/or equipment as shown or scheduled, that are provided by owner, suppliers or contractors. Appliances and/or equipment shall be unloaded, assembled and set in place by persons furnishing the appliance and/or equipment. Rough-in drawings shall be furnished to the plumbing contractor by the appliance and/or equipment supplier immediately after contract is set to assure proper rough-in locations.

A. Manufacturers:

1. Fixture:
   Supplied by owner or appliances/equipment supplier. Coordinate rough-in and final connection time frame with owner or appliance/equipment supplier.

2. Outlet Box:
   a. IPS Corporation: www.ipscorp.com.
   b. Sioux Chief Manufacturing: www.siouxchief.com.
   c. Oatey: www.oatey.com.

3 Connector:
a. Brass Craft: www.brasscraft.com.
b. Keeney Manufacturing Co.: www.keeneymanufacturing.com.

4. Substitutions: See Section 22 05 00 Substitutions.

B. ACW-1 Automatic Clothes Washer:
1. Outlet Box: ASME A112.18.1; Flush wall mounted polystyrene box with ½ inch cold and hot water connection, ¼ turn brass valve, and ¾ inch male hose thread outlet connection.
a. Oatey 38540
b. Sioux Chief 696-2313MF

2. Connector: ASME A112.18.6; Flexible reinforced stainless steel braided connector hose, chrome plated brass ¾ inch female hose thread fittings at both ends and 48 inch in length. Verify and adjust length of connector as required with owner. Verify size and type of connection to equipment.
a. Brass Craft BL12-48WA
b. Keeney PP23821

3. Sanitary waste standpipe open site drain with air break connection per detail.

4. Provide water hammer arrestor WHA-A.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes and locations indicated in fixture rough-in drawings.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid where exposed or flexible supplies in cabinets to fixtures with loose key or wheel handle stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Architectural specifications, color to match fixture.

F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

G. Equipment shall be suitably protected against damage before and after installation. Any damaged plumbing fixture or piece of equipment shall be replaced at the expense of the plumbing contractor. All fixtures to be acceptable for final inspection shall be free of chips, flaws, scratches, abrasions, discolorations or any defect, which, in the opinion of the Engineer would classify the fixture as unsuitable for use intended.

H. All exposed trim including pipe nipples to plumbing fixtures shall be chromium plated and shall be completely free of tool marks, abrasions, or flattening of tubing, etc. All fixtures included in this specification and shown on the drawings shall be completed by the plumbing contractor together with all necessary hangers, bolts, anchors and brackets.

I. All fixture heights, spacing apart and distances from walls shall be in accordance with Architectural details, floor plans and elevation. Deviation may necessitate alteration to comply with plans. Verify dimensions with General Contractor.

J. Repair all leaks, dripping or running fixtures, faucets, etc. Regulate flow to water closets, showers, etc., for proper operation. Provide shutoffs at all individual fixtures.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow. Repair any leaks, dripping or running fixtures.

3.06 CLEANING

A. Clean plumbing fixtures and equipment at end of project.

END OF SECTION

This Page Left Blank Intentionally

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Continuity of Existing Services
   7. Protection of Finished Surfaces
   8. Sleeves and Openings
   9. Sealing and Firestopping
   10. Equipment Substitutions
   11. Submittals
   12. Off-site Storage
   13. Certificates and Inspections
   14. Operating and Maintenance Data
   15. Training of Owner Personnel
   16. Record Drawings

C. PART 2 - Products
   1. Access Panels and Doors
   2. Identification
   3. Sealing and Firestopping

D. PART 3 - EXECUTION
   1. Demolition
   2. Cutting and Patching
   3. Building Access
   4. Equipment Access
   5. Coordination
   6. Identification
   7. Lubrication
   8. Sleeves and Openings
   9. Sealing and Firestopping
   10. Temperature Control
   11. Cleaning Equipment, Ductwork, and Premises
   12. Guarantee
   13. Focus on Energy
   14. Certification of Tests and Adjustments

1.02 RELATED WORK

A. Section 23 05 13 - Common Motor Requirements for HVAC
B. Section 23 33 00 - Air Duct Accessories

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in other sections are as follows:

AABC	Associated Air Balance Council
ABMA	American Boiler Manufacturers Association
ADC	Air Diffusion Council
AGA	American Gas Association
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
CGA	Compressed Gas Association
CTI	Cooling Tower Institute
EPA	Environmental Protection Agency
GAMA	Gas Appliance Manufacturers Association
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
MCA	Mechanical Contractors Association
MICA	Midwest Insulation Contractors Association
MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
UL	Underwriters Laboratories Inc.
ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
UL1479	Fire Tests of Through-Penetration Firestops
UL723	Surface Burning Characteristics of Building Materials

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

B. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

1.06 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from the Owner. When interruption is required, coordinate the down time with the Owner to minimize disruption to their activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

1.07 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1, General Requirements, Protection of Finished Surfaces.

B. Furnish one can of touch up paint for each different color factory finish which is to be the final finished surface of the product. Deliver touch up paint with other "loose and detachable parts" as covered in the General Requirements.

1.08 SLEEVES AND OPENINGS

A. Refer to Division 1, General Requirements, Sleeves and Openings.

1.09 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations.

1.10 EQUIPMENT SUBSTITUTIONS

A. Contractors and/or manufacturers may submit catalog data on material proposed for substitution to the engineer for evaluation up to 10 days prior to the date for opening bids. The engineer will render an opinion on whether or not the material can be bid as a substitute based on the information received. Final approval for the use of substitute equipment will not be given until complete shop drawings, samples or other information deemed necessary by the engineer has been submitted.

1.11 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.

C. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Starters and disconnects which are not explicitly defined as the responsibility of any contractor shall be provided by the Division 23 contractor. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the motor starter schedule are in agreement or indicate any discrepancies. See related comments in Section 23 05 13 in Part 1 under Electrical Coordination.

D. Include wiring diagrams of electrically powered equipment.

E. Submit sufficient quantities of shop drawings to allow the following distribution:
- Operating and Maintenance Manuals 3 copies
- Testing, Adjusting and Balancing Contractor 1 copy
- A/E 1 copy

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.12 OFF-SITE STORAGE

A. Prior approval by General Contractor/Construction Manager and the A/E will be needed.

B. Generally, ductwork, metal for making ductwork, duct lining, sleeves, pipe/pipe fittings and similar rough in material will not be accepted for off-site storage. For material that can be stored off site, no material will be accepted for off-site storage unless shop drawings for that material have been approved.

1.13 CERTIFICATES AND INSPECTIONS

A. Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

B. Contractors installing heating, ventilating, and air conditioning systems or equipment in the State of Wisconsin must be licensed. The contractor must provide proof of current and valid license upon request and maintain license through project completion.

C. Obtain and pay for all required State installation inspections except those provided by the Architect/Engineer in accordance with Wis Adm Code SPS 302. Deliver originals of these certificates to the A/E. Include copies of the certificates in the Operating and Maintenance Instructions.

D. All utility connection fees shall be paid by the respective contractor.

1.14 OPERATING AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

B. Assemble material in three ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
- Copies of all approved shop drawings
- Manufacturer's wiring diagrams for electrically powered equipment
- Records of tests performed to certify compliance with system requirements

- Certificates of inspection by regulatory agencies
- Temperature control record drawings and control sequences
- Parts lists for manufactured equipment
- Valve schedules
- Lubrication instructions, including list/frequency of lubrication done during construction
- Warranties
- Additional information as indicated in the technical specification sections
- A copy of signed Certification of Tests and Adjustments Form
- Final Testing, Adjusting, and Balance Report

1.15 TRAINING OF OWNER PERSONNEL

A. Instruct Owner personnel in the proper operation and maintenance of systems and equipment provided as part of this project. Include not less than 2 hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.

1.16 RECORD DRAWINGS

A. Refer to Division 1, General Requirements, Record Drawings.

B. In addition to the data indicated in the General Requirements, maintain temperature control record drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

PART 2 - PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. LAY IN CEILINGS: Removable lay in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Section 09500 are sufficient; no additional access provisions are required unless specifically indicated.

2.02 IDENTIFICATION

A. STENCILS: Not less than 1 inch high letters/numbers for marking equipment.

B. SNAP-ON PIPE MARKERS: Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without the use of adhesive, tape or straps. Follow ANSI/ASME Pipe Marker Guidelines for proper identification including, but not limited to, letter heights, marker size, color, wording legend, flow direction arrows, and proper placement. W.H. Brady, Seton, Marking Services, or equal.

1. ABAONDONED PIPING: Provide Snap-On pipe markers for abandoned piping. Marker to be white with black lettering and include a black border. If abandoned piping is pressurized, or contains hazardous materials, the legend should indicate such.

C. ENGRAVED NAME PLATES: White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by Marking Services, or W. H. Brady.

D. VALVE TAGS: Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1 1/4 inch minimum diameter, with brass jack chains or brass "S" hooks around the valve stem, available from EMED Co., Seton Name Plate Company, Marking Services, or W. H. Brady.

2.03 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:

1. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with UL & ASTM.

2. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

B. NON-RATED PENETRATIONS:

1. Pipe Penetrations Through Below Grade Walls: In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water-stop type wall sleeve.

2. Pipe Penetrations: At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

3. Duct Penetrations: Annular space between duct (with or without insulation) and the non-rated partition or floor opening shall not be larger than 2". Where existing openings have an annular space larger than 2", the space shall be patched to match existing construction to within 2" around the duct.

4. Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

PART 3 - EXECUTION

3.01 DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe or duct is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

B. All pipe, wiring and associated conduit, insulation, ductwork, and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor. All piping and ductwork specialties are to be removed from the site by the Contractor unless they are dismantled and removed or stored by the Owner. All designated equipment is to be turned over to the Owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

C. Mechanical systems are shown on drawings that were coordinated with the existing conditions; however, variations may occur. Contractor shall verify dimensions, heights, door swings and any other information critical to the placement of devices with the drawings and existing conditions to assure proper installation. Field measurements shall take precedence over drawing dimensions and shall be verified. Plans shall not be scaled to locate equipment.

D. It shall be the contractor's responsibility to visit the existing project site, become acquainted with all existing conditions, and ascertain the extent of work involved in installing equipment, ductwork, air distribution devices, piping, controls and all other appurtenances pertaining to the above. The contractor shall provide all labor, materials, etc., required for the complete, new installation required for the completion of the project. By the act of submitting a price; or in the case of time and material project, begin work, the contractor shall be deemed to have performed such an examination, to have accepted such conditions, and to have made allowances therefore preparing his price and resolving questions regarding work required.

3.02 CUTTING AND PATCHING

A. Refer to Division 1, General Requirements, Cutting and Patching.

3.03 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.04 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Mechanical Contractor and installed by the General Contractor.

B. For equipment that is accessed above acoustical lay in ceilings or access doors, label the ceiling tile grid at the ceiling tile that is to be removed for access to the equipment or the access door. The label shall be pre-printed using clear polyester tape with black bold 28 size font for ceilings under 12 feet. For ceilings over 12 feet high, use bold 40 size font. For accessible ceilings, use an arrow to point at ceiling tile to be removed for access. Label shall match equipment tag designation used on mechanical plans.

C. Ductwork, equipment, and piping below 7'-6" above finished floor shall have a resilient material (foam rubber, etc.) attached to all potentially dangerous edges.

D. Suspended equipment in public motor vehicle areas to be mounted a minimum of 8' above finished floor or 12" higher than tallest vehicle garage door opening; whichever is greater, unless equipment is protected from motor vehicle impact.

E. A guard or fall protection is required on roof mounted equipment, including exhaust fans, located within 10' of roof edge and containing an open side that is greater than 30” above the floor, roof, or grade below. Guard must be at least 30” beyond side of unit.

3.05 COORDINATION

A. Mechanical systems are shown on drawings that were coordinated with the architectural drawings; however, variations may occur. Contractor shall verify all information critical to the placement of devices with the architectural drawings to assure proper installation. Field measurements shall take precedence over drawing dimensions and shall be verified. Plans shall not be scaled to locate equipment. It shall be the contractor's responsibility to become acquainted with all conditions, and ascertain the extent of work involved in installing equipment, ductwork, air distribution devices, piping, controls and all other appurtenances pertaining to the above. The contractor shall provide all labor, materials, etc., required for the complete, new installation required for the completion of the project. By the act of submitting a price; or in the case of time and material project, begin work, the contractor shall be deemed to have performed such an examination, to have accepted such conditions, and to have made allowances therefore preparing his price and resolving questions regarding work required.

B. Plans of piping and ductwork shown on scale drawings are diagrammatic only. They are intended to indicate size and/or capacity where stipulated, approximate location and/or direction and approximate general arrangement of one phase of work to another, but not the exact detail or arrangement of construction. Plans are based on equipment scheduled. Contractor shall be responsible for changes resulting from equipment other than scheduled.

C. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi recessed heating and/or cooling terminal units installed in/on architectural surfaces.

D. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

E. Cooperate with the test and balance agency in ensuring compliance. Verify system completion to the test and balance agency (flushing, pressure testing, clean filters, duct and pipe systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Install dampers, shutoff valves, temperature controls, etc., required for functional and balanced systems. Demonstrate the starting, interlocking and control features of each system so the test and balance agency can perform its work.

3.06 IDENTIFICATION

A. Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.

B. Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

C. Identify piping not less than once every 30 feet, not less than once in each room, adjacent to valves and flanges, adjacent to directional changes, adjacent to each access door or panel, and on both side of the partition where piping passes through walls, floors or roofs. Place flow directional arrows at each pipe identification location. Provide Snap-On pipe markers as specified in Part 2 – Products.

D. Identify valves with brass tags bearing a system identification and a valve sequence number. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device or located in another room not visible from the terminal unit. Provide a typewritten valve schedule indicating the valve number and the equipment or areas supplied by each valve; locate schedules in each mechanical room and in each Operating and Maintenance manual. Schedules in mechanical rooms to be framed under clear plastic.

E. All valves, coils, controls, and other equipment requiring service located above ceilings, shall have the ceiling tile directly below identified with a colored tack inserted into the tile.

F. Use engraved name plates to identify control equipment.

G. Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly adjacent to access doors using a minimum of 0.5 inch height lettering reading, “SMOKE DAMPER” or “FIRE DAMPER”. Smoke and combination fire smoke dampers shall also include a second line listing the individual damper tag. The tags must be coordinated with the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible from the ceiling access point. **

3.07 LUBRICATION

A. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

3.08 SLEEVES AND OPENINGS

A. PIPE SLEEVES:

1. Pipe penetrations in new poured concrete horizontal construction requiring F and T rating: Form opening using hole form or core drill opening. Alternatively provide cast in place fire stopping devices/sleeves.

2. Pipe penetrations in new poured concrete horizontal construction requiring F rating but no T rating: Same as pipe penetrations in new poured concrete construction requiring F and T ratings except that schedule 40 steel sleeves may also be used.

3. Pipe penetrations in new poured concrete horizontal construction that do not require F or T ratings: Provide schedule 40 steel pipe sleeve, form opening using hole form or core drill opening.

4. Where penetrating pipe or conduit weight is supported by floor, provide manufactured product or structural bearing collar designed to carry load.

B. DUCT SLEEVES:

1. Duct sleeves are not required in non-rated partitions or floors.

2. Provide sleeve required for fire dampers in fire-rated partitions and floors. Reference fire damper details on drawings.

3.09 SEALING AND FIRESTOPPING

A. FIRE AND/OR SMOKE RATED PENETRATIONS:

1. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with UL & ASTM.

B. NON-RATED PARTITIONS:

1. At all interior walls and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

2. Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or mineral wool insulation fill for spaces that include laboratories, clean rooms, animal rooms, kitchens, cart wash rooms, classrooms, janitor closets, toilet rooms, mechanical rooms, conference rooms, private consultation rooms, where ducts are exposed and where noted on drawings elsewhere.

C. PENETRATIONS SUBJECT TO WATER INTRUSION:

1. For penetrations (both rated and non-rated) in floors subject to water intrusion or in rooms housing electrical equipment (but not within walls) provide one of the following:
    - Pipe penetration where steel pipe sleeve is used extend steel sleeve 2” above the floor.
    - Pipe penetration where cast in place fire stopping device/sleeve is used, extend device/sleeve 2" above the floor (provided it meets the device’s UL listing).
    - Pipe penetration where there is no steel sleeve or cast in place fire stopping device/sleeve, provide 2” x 2” x 1/8” galvanized steel angles fastened to floor surrounding the penetration or group of penetrations to prevent water from getting to penetration. Provide urethane caulk between angles and floor and fasten angles to floor minimum 8” on center. Seal corners water tight with urethane caulk.
    - Duct penetrations. Provide 2” x 2” x 1/8” galvanized steel angles fastened to floor surrounding the penetration or group of penetrations to prevent water from getting to penetration. Provide urethane caulk between angles and floor and fasten angles to floor minimum 8” on center. Seal corners water tight with urethane caulk.

2. Floors subject to water intrusion or rooms housing electrical equipment include the following locations:
    - Laundries
    - Restrooms
    - Locker/Shower Rooms
    - Janitor Rooms w/ Sinks
    - Mechanical/Plumbing Equipment Rooms
    - Vehicle Storage

3. Provide waterproof caulk sealant top coating on fire stopping system (or other approved means to protect the fire stopping system from water) in areas subject to wash down such as Food Service and Dish Washing Areas.

3.10 TEMPERATURE CONTROL

A. All wall mounted temperature control devices such as thermostats, fan switches, etc. shall be installed in or on flush outlet boxes with all terminations made within junction or device box. Devices shall be located at a maximum of 48” above the finished floor.

B. All temperature control conductors shall be supported by metallic hanger straps secured to the building structure, intervals not exceeding 5 feet on center. Above accessible ceilings, conductors shall be secured not less than 8” above ceiling tiles to allow for tile removal, and conductors shall not be allowed to lie directly on ceiling tiles. All control wiring in all areas below finished ceiling shall be in conduit.

C. All line voltage conductors shall be installed in raceways. All raceways shall comply in all aspects to the provision of Division 26, including materials and installation.

D. All line voltage terminations made by this contractor shall be made in complete compliance with the requirements of Division 26 specifications, the National Electrical Code, and all local codes having jurisdiction. Where installed in raceway, all splices, fittings, and terminations in temperature control conductors shall be made within the device or in junction boxes. Boxes shall be accessible from the finished surface of the facility.

3.11 CLEANING EQUIPMENT, DUCTWORK AND PREMISES

A. Thoroughly clean all parts of the piping, valves, ductwork, grilles and equipment. Exposed parts which are to be painted shall be thoroughly cleaned of cement, plaster and other materials and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.

B. Clean filters shall be installed in all equipment specified with filters.

C. Remove all construction debris, excess materials and equipment.

3.12 GUARANTEE

A. All materials and workmanship shall be guaranteed for a period of one year after substantial completion. Where extended warranties are required, they shall be provided by the manufacturer or contractor as specified, in the equipment specification.

3.13 FOCUS ON ENERGY

A. The Mechanical Contractor shall work with the Owner and Focus on Energy to fill out all applicable forms and provide all required documentation to obtain all possible rebates for the new and remodeled mechanical systems on this project. Rebates shall include, but not be limited to, boilers, furnaces, air conditioners, VFDs, etc.

3.14 CERTIFICATION OF TESTS AND ADJUSTMENTS

A. Contractor _____

B. Division of Work _____

C. Project Name _____

D. Project Number _____

E. The Contractor named above certifies that the tests and adjustments indicated below have been completed in accordance with the specifications on the date indicated. Start-up of all HVAC equipment installed in this project is the responsibility of this Contractor unless otherwise indicated.

F. Tests: Date

1. Fuel Gas Piping Leakage Test _____
2. Duct Leakage and Structural Tests _____
3. Start-up of Air Systems _____
4. Refrigeration Piping _____
5. Ductless Split System AC/HP Unit(s) Start-up _____
6. Testing and Balancing _____
7. Temperature Control Commissioning _____

G. Contact _____

H. Signed By _____

I. Date _____

END OF SECTION

This Page Left Blank Intentionally

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes requirements for single and three phase motors that are used with equipment specified in other sections. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Submittals
   7. Operation and Maintenance Data
   8. Electrical Coordination
   9. Product Criteria

C. PART 2 - Products
   1. Three Phase, Single Speed Motors
   2. Single Phase, Single Speed Motors

D. PART 3 - EXECUTION
   1. Installation

1.02 RELATED WORK

A. Section 23 05 14 - Variable Frequency Drives
B. Section 23 09 14 - Pneumatic and Electric Instrumentation and Control Devices for HVAC
C. Division 26 - Electrical

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. ANSI/IEEE 112 Test Procedure for Polyphase Induction Motors and Generators
B. ANSI/NEMA MG-1 Motors and Generators
C. ANSI/NFPA 70 National Electrical Code

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Include with the equipment which the motor drives the following motor information: motor manufacturer, horsepower, voltage, phase, hertz, rpm, full load efficiency. Include project wiring diagrams prepared by the contractor specifically for this work.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

B. In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. Lubrication instructions, including list/frequency of lubrication.

2. Table noting full load power factor, service factor, NEMA design designation, insulation class and frame type for each motor provided.

1.08 ELECTRICAL COORDINATION

A. All starters, overload relay heater coils, disconnect switches and fuses, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the control of motors or electrical equipment are furnished and installed by the Electrical Contractor, except as specifically noted elsewhere in this division of specifications.

B. Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be found for any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the architect/engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this contractor will be the responsibility of this contractor. See related comments in Section 23 05 00 - Common Work Results for HVAC, under Shop Drawings.

C. Electrical Contractor will provide all power wiring and control wiring, except temperature control wiring.

D. Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

1.09 PRODUCT CRITERIA

A. Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.

B. Select motors for conditions in which they will be required to perform; i.e., general purpose, splashproof, explosion proof, standard duty, high torque or any other special type as required by the equipment or motor manufacturer's recommendations.

C. Furnish motors for starting in accordance with utility requirements and compatible with starters as specified.

PART 2 - PRODUCTS

2.01 THREE PHASE, SINGLE SPEED MOTORS

A. Use NEMA rated, three phase, 60 hertz motors for all motors 3/4 HP and larger unless specifically indicated.

B. Use NEMA general purpose, continuous duty, Design B, normal starting torque, T-frame or U-frame motors with Class B or better insulation unless the manufacturer of the equipment on which the motor is being used has different requirements. Use open drip-proof motors unless totally enclosed fan-cooled, totally enclosed non-ventilated, explosion-proof, or encapsulated motors are specified in the equipment sections.

C. Use grease lubricated anti-friction ball bearings with housings equipped with plugged/capped provision for relubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at the end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

D. All open drip-proof motors to have a 1.15 service factor. Other motor types may have minimum 1.0 service factors.

E. All motors 1 HP and larger, except specially wound motors and inline pump motors 56 frame and smaller, to be high efficiency design with full load efficiencies which meet or exceed the values listed below when tested in accordance with NEMA MG 1.

FULL LOAD NOMINAL MOTOR EFFICIENCY BY MOTOR SIZE AND SPEED			
Open Drip Proof Motors			
	Nominal Motor Speed		
MOTOR HP	1200 RPM	1800 RPM	3600 RPM
1	82.5	85.5	77.0
1½	86.5	86.5	84.0
2	87.5	86.5	85.5

FULL LOAD NOMINAL MOTOR EFFICIENCY BY MOTOR SIZE AND SPEED			
Totally Enclosed Fan-Cooled Motors			
	Nominal Motor Speed		
MOTOR HP	1200 RPM	1800 RPM	3600 RPM
1	82.5	85.5	77.0
1½	87.5	86.5	84.0
2	88.5	86.5	85.5

2.02 SINGLE PHASE, SINGLE SPEED MOTORS

A. Use NEMA rated 115 volt, single phase, 60 hertz motors for all motors 3/4 HP and smaller.

B. Use electronically commutated motor, permanent split capacitor or capacitor start, induction run motors, as indicated, equipped with permanently lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount motors on a rigid base designed to accept a motor, using shims if required under each mounting foot to get a secure installation.

B. When motor will be flexible coupled to the driven device, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Using a dial indicator, check angular misalignment of the two shafts; adjust motor position as necessary so that the angular misalignment of the shafts does not exceed 0.002 inches per inch diameter of the coupling hub. Again, using the dial indicator, check the shaft for run-out to assure concentricity of the shafts; adjust as necessary so that run-out does not exceed 0.002 inch.

C. When motor will be connected to the driven device by means of a belt drive, mount sheaves on the appropriate shafts in accordance with the manufacturer's instructions. Use a straight edge to check alignment of the sheaves; reposition sheaves as necessary so that the straight edge contacts each sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so that the belt(s) can be added and tighten the base so that the belt tension is in accordance with the drive manufacturer's recommendations. Frequently recheck belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

D. Verify the proper rotation of each three-phase motor as it is being wired or before the motor is energized for any reason.

E. Lubricate all motors requiring lubrication. Record lubrication material used and the frequency of use. Include this information in the maintenance manuals.

END OF SECTION

SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes valve specifications for all HVAC systems except where indicated under Related Work. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Quality Assurance
   5. Submittals
   6. Operation and Maintenance Data
   7. Design Criteria

C. PART 2 - Products
   1. Manufacturers
   2. Natural Gas Systems
      a. Shut-off Valves
      b. Gas Pressure Regulators

D. PART 3 - EXECUTION
   1. General
   2. Shut-off Valves
   3. Gas Pressure Regulators

1.02 RELATED WORK

A. Section 23 05 15 - Piping Specialties
B. Section 23 09 14 - Pneumatic and Electric Instrumentation and Control Devices for HVAC

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.05 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Contractors shall submit a schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.07 DESIGN CRITERIA

A. Where valves are specified for individual mechanical services (i.e. hot water heating, chilled water, steam, etc.) all valves shall be of the same manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Anvil, Apollo, Armstrong, Bell & Gossett, Crane, Danfoss-Flomatic, DeZurik, Durco, Fisher, Grinnell, Griswold, Hoffman, Kitz, Kunkle, Leslie, Lunkenheimer/Cincinnati, Metraflex, Milwaukee, Mueller, Newco, Nexus, Nibco, Red-White Valve Corp, Sarco, Stockham, Taco, Thrush-Amtrol, Victaulic, Watts, or approved equal.

2.02 NATURAL GAS SYSTEMS

A. Shut Off Valves:

1. 2" and smaller: Ball valve, bronze body, threaded ends, chrome-plated bronze or stainless steel ball, full or conventional port, teflon seat, blowout-proof stem, two-piece construction, suitable for 150 psig working pressure, U.L. listed for use as natural gas shut-off.

2. 2-1/2" through 4": Cast iron body, flanged ends, bronze bearings, electroless nickel-plated cast iron plug with Hycar resilient plug seal, Buna-N stem seal packing, lever actuator, 175 psi W.O.G., U.L. listed for use as natural gas shut-off.

3. 5" and larger: Cast iron body, flanged ends, stainless steel bearings, resilient faced plugs, totally enclosed hand wheel actuators, 175 psi W.O.G., U.L. listed for use as natural gas shut-off.

4. DeZurik, Homestead, Rockwell, Walworth.

B. Gas Pressure Regulators: 2" and smaller: Cast iron body, aluminum spring and diaphragm, Nitrile diaphragm, threaded ends, 150 psi W.O.G., -20°F to 150°F.

PART 3 - EXECUTION

3.01 GENERAL

A. Properly align piping before installation of valves in an upright position; operators installed below the valves will not be accepted.

B. Install valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

C. Install all temperature control valves.

D. Install all valves with the stem in the upright position. Valves may be installed with the stem in the horizontal position only where space limitations do not allow installation in an upright position or where large valves are provided with chain wheel operators. Where valves 2-1/2" and larger are located more than 12'-0" above mechanical room floors, install valve with stem in the horizontal position and provide a chain wheel operator. Valves installed with the stems down, will not be accepted.

E. Install stem extensions when shipped loose from valve.

F. Prior to flushing of piping systems, place all valves in the full-open position.

3.02 SHUT-OFF VALVES

A. Install shut-off valves at all equipment, at each branch take-off from mains, and at each automatic valve for isolation or repair.

3.03 GAS PRESSURE REGULATORS

A. When the gas pressure regulator is equipped with a vent connection, run a connection size vent to outside air in accordance with codes. Use a larger size vent when required by the manufacturer's installation instructions.

END OF SECTION

This Page Left Blank Intentionally

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes specifications for supports of all HVAC equipment and materials as well as piping system anchors. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Description
   7. Submittals
   8. Design Criteria

C. PART 2 - Products
   1. Pipe Hanger and Support Manufacturers
   2. Structural Supports
   3. Pipe Hangers and Supports
   4. Wood Structure Supports
   5. Beam Clamps
   6. Roof Mounted Supports
   7. Equipment Curbs
   8. Pipe Penetrations through Roof
   9. Corrosive Atmosphere Coatings

D. PART 3 - EXECUTION
   1. Installation
   2. Hanger and Support Spacing
   3. Vertical Riser Clamps
   4. Roof Mounted Supports
   5. Equipment Curbs
   6. Pipe Penetration through Roof

1.02 RELATED WORK

A. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment
B. Section 23 07 00 - HVAC Insulation

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture.
B. MSS SP-59 Pipe Hangers and Supports - Selection and Application.

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 DESCRIPTION

A. Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for pressure piping.

B. Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.

C. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

D. Protect insulation at all hanger points; see Related Work above.

1.07 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Schedule of all hanger and support devices indicating shields, attachment methods, and type of device for each pipe size and type of service. Reference section 23 05 00.

1.08 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.

B. Piping supported by lying on the bottom chord of joists or trusses will not be accepted.

C. Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

D. Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

PART 2 - PRODUCTS

2.01 PIPE HANGER AND SUPPORT MANUFACTURERS

A. Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut, or approved equal. Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

2.02 STRUCTURAL SUPPORTS

A. Provide all supporting steel required for the installation of mechanical equipment and materials, whether or not it is specifically indicated or sized, including angles, channels, beams, etc. to suspend or floor support tanks and equipment.

2.03 PIPE HANGERS AND SUPPORTS

A. Hangers for Steel Pipe Sizes 1/2" through 2": Carbon steel, adjustable, clevis, black finish. Anvil figure 65 or 260.

B. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods if calculations are submitted.

C. Wall Support:

1. Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

2. Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with interlocking, split type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type AS200 H with AS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil cushion clamp assembly.

D. Vertical Riser Support: Carbon steel riser clamp, copper plated when used with copper pipe. Anvil figure 261 for steel pipe, figure CT121 for copper pipe.

E. Floor Support for Pipe Sizes through 4": Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

F. Copper Pipe Support: Carbon steel ring, adjustable, copper plated or polyvinylchloride coated.

G. Insulation Protection Shields: Galvanized carbon steel of not less than 18 gauge for use on insulated pipe 2-1/2" and larger. Minimum shield length is 12". Equal to Anvil figure 167.

H. Steel Hanger Rods:

1. Threaded both ends, threaded one end, or continuous threaded, black finish.

2. Size rods for individual hangers and trapeze support as indicated in the following schedule.

3. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

4. Provide rods complete with adjusting and lock nuts.

2.04 WOOD STRUCTURE SUPPORTS

A. Carbon steel pipe short strap for piping ½" through 2". Fastened with two No. 24 x 2 (minimum size) wood screws. Anvil Figure 262.

B. Carbon steel coach screw rods machine threaded on opposite ends, minimum 3/8" diameter. Anvil Figure 142.

C. Carbon steel side beam bracket with minimum 3/8" rod size and fastened with minimum ½" x 3" lag screws. Anvil Figure 207.

2.05 BEAM CLAMPS

A. MSS SP-69 Type 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick for single threaded rods of 3/8", 1/2", and 5/8" diameter, for use with pipe sizes 4" and less. Furnish with a hardened steel cup point set screw. Anvil figure 86.

B. MSS SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2" diameter but limited in application to pipe sizes 8" and less without prior approval. Anvil figure 228.

2.06 ROOF MOUNTED SUPPORTS

A. Height of Supports: Based on the length of the longest main support member, the height of the support member above the roof deck to be as follows:

Length of Longest Support Member (inches)	Min. Height of Support Above Finished Roof
Up to 36"	18"
37" and Over	36"

B. Supports 18" or Less in Height:

1. Prefabricated Metal Sleeper Curb:

2. Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load with no penetrations through the curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counter flashing with metal receiver cap Attach a galvanized steel channel track for securing pipe or duct roller and roller support. Do not use built-in metal base flashings or cants.

3. Wood Build Sleeper Curb:

    a. Constructed of wood blocking anchored to the deck. The curb must be structurally capable of supporting the intended load with no penetrations through the curb flashing. Galvanized steel counter flashing with metal receiver cap. Attach a steel channel track for securing pipe or duct roller support. Do not use built-in metal base flashings or cants.

    b. Use galvanized structural steel members supported by pipe supports and use pipe or duct rollers fastened to the structural member. Pipe supports to be secured to the roof structure and sealed per pipe penetrations through roof specifications as specified in this section.

C. Supports 36" or More in Height:

1. Roof Support Stand/Equipment Roof Support Stand:

2. Use galvanized structural steel members supported by pipe supports and use pipe or duct rollers fastened to the structural member. Pipe supports to be secured to the roof structure and sealed per pipe penetrations through roof specifications as specified in this section.

2.07 EQUIPMENT CURBS

A. Prefabricated Metal Curb: Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load with no penetrations through the curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counter flashing. Do not use built-in metal base flashings or cants. Use 18" high equipment curbs where the curb completely surrounds the perimeter of the equipment and there is no roof exposed to the weather.

B. Wood Build Sleeper Curb: Constructed of wood blocking and anchored to the deck. The curb must be structurally capable of supporting the intended load with no penetrations through the curb flashing. Galvanized steel counter flashing. Do not use built-in metal base flashings or cants. Use 18" high equipment curbs where the curb completely surrounds the perimeter of the equipment and there is no roof exposed to the weather.

2.08 PIPE PENETRATIONS THROUGH ROOF

A. Single Pipe Penetrations:

1. A stack flashing penetration may be utilized for single pipe penetrations through built up roofs and single ply membrane roofs. Utilize high temperature sealant for all high temperature applications. This includes but is not limited to steam condensate vent piping, steam safety relief piping, and flues.
2. A single pre-manufactured boot may be utilized for single pipe penetrations through single ply membrane roofs only.

2.09 CORROSIVE ATMOSPHERE COATINGS

A. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface, each side. Mechanical galvanize threaded products, ASTM B695 Class 150, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

B. Corrosive atmospheres include the following locations:

- Exterior locations

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install supports to provide for free expansion of the piping and duct system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

B. Piping shall be supported independently from ductwork and all other trades.

C. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes for the supporting steel.

D. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.

3.02 HANGER AND SUPPORT SPACING

A. Place a hanger within 12" of each horizontal elbow, valve, strainer, or similar piping specialty item.

B. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

C. Support riser piping independently of connected horizontal piping.

D. Adjust hangers to obtain the slope specified in the piping section of this specification.

E. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Horizontal Max. Spacing	Vertical Max Spacing
Steel	1/2" through 1-1/4"	6'-6"	15’-0"
Steel	1-1/2" through 6"	10'-0"	15’-0"
Copper	1/2" through 1-1/4"	5'-0"	10’-0"
Copper	1-1/2" and larger	8'-0"	10’-0"

3.03 VERTICAL RISER CLAMPS

A. Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor. Mid-story supports may be necessary to meet the requirements listed above.

3.04 ROOF MOUNTED SUPPORTS

A. Use for all pipe and ductwork on roof. Secure bottom of support flat on roof deck. Apply two coats of zinc rich paint to cut edges of all galvanized steel elements. Flashing and counterflashing by the General Contractor.

3.05 EQUIPMENT CURBS

A. Secure bottom of support flat on roof deck. Secure equipment to curb in accordance with equipment manufacturer's instructions. Flashing and counterflashing by the General Contractor.

B. Fill the entire void space with compressible fiberglass insulation.

3.06 PIPE PENETRATION THROUGH ROOF

A. Install at points where pipes penetrate roof. Install as shown on the drawings, as detailed and according to the manufacturer's installation instructions. Flashing and counterflashing by the General Contractor.

END OF SECTION

This Page Left Blank Intentionally

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes specifications for vibration isolation material for equipment, piping systems, and duct systems. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Quality Assurance
   5. Design Criteria
   6. Submittals

C. PART 2 - Products
   1. Materials
   2. Vibration Isolation Manufacturers
   3. Type 2: Neoprene Pad
   4. Type 5: Spring Hanger with Neoprene
   5. Performance

D. PART 3 - EXECUTION
   1. Installation
   2. Air Handling Units and Centrifugal Fans

1.02 RELATED WORK

A. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
B. Section 23 12 13 - Facility Fuel-Oil Pumps
C. Section 23 21 23 - Hydronic Pumps
D. Section 23 33 00 - Air Duct Accessories
E. Section 23 34 00 - HVAC Fans
F. Section 23 73 13 - Modular Indoor Central-Station Air-Handling Units

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.05 DESIGN CRITERIA

A. Isolate all motor driven mechanical equipment from the building structure and from the systems which they serve to prevent equipment vibrations from being transmitted to the structure. Consider equipment weight distribution to provide uniform isolator deflections.

B. For equipment with variable speed capability, select vibration isolation devices based on the lowest speed.

C. Credit will be given for the inherent flexibility and vibration absorption characteristics of mechanical grooved pipe connections providing that supporting calculations are submitted for approval.

D. Coordinate the selection of devices with the isolator and equipment manufacturers.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Include isolator type, materials of construction, isolator free and operating heights, and isolation efficiency based on the lowest operating speed of the equipment supported.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use materials that will retain their isolation characteristics for the life of the equipment served. Use industrial grade neoprene for elastomeric materials.

B. Treat all isolators to resist corrosion. For isolation devices exposed to the weather or used in high humidity areas, hot dip galvanized steel parts, apply a neoprene coating on all steel parts, or use stainless steel parts; include limit stops to resist wind.

C. Provide pairs of neoprene side snubbers or restraining springs where side torque or thrust may develop.

D. Use isolators with a ratio of lateral to vertical stiffness not less than 1.0 or greater than 2.0.

2.02 VIBRATION ISOLATOR MANUFACTURERS

A. Mason Industries, Amber/Booth Co., Vibration Mounting & Controls, Peabody Noise Control, or approved equal.

2.03 TYPE 2: NEOPRENE PAD

A. Double deflection neoprene mount having a minimum static deflection of 0.35 inches. Cover all metal surfaces with neoprene to resist corrosion. Include friction pads on both top and bottom surfaces so mounts need not be bolted to the floor but include bolt holes for those areas where bolting is required. For equipment such as small vent sets and close coupled pumps, include steel rails for use between the isolator and the equipment to accommodate equipment overhang.

2.04 TYPE 5: SPRING HANGER WITH NEOPRENE

A. Vibration hanger with a steel spring and 0.3" deflection neoprene element in series. Use neoprene element molded with a rod isolation bushing that passes through the hanger box. Select spring diameters and size hanger box lower holes large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Select springs so they have a minimum additional travel to solid equal to 50% of the rated deflection.

2.05 PERFORMANCE

A. Select vibration isolation devices as indicated below or to provide not less than 95% isolation efficiency, whichever is greater.

TYPE OF EQUIPMENT	Floor Span or Column Spacing							
	On Grade		**20 Feet**		**30 Feet**		**40 Feet**	
	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.
Tubular Centrifugal and Axial Fans:								
Suspended	Use type 5-T hangers with deflection from blower minimum deflection guide. Type T needed only when air thrust exceeds 10% of equipment weight.							
Cabinet Fans and Fan Sections of Air Handling Units:								
Suspended	Type 5-T supports with deflection from blower minimum deflection guide. Type T needed only when air thrust exceeds 10% of equipment weight.							

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install vibration isolation devices for motor driven equipment in accordance with the manufacturer's installation instructions.

B. Do not allow installation practices to short circuit any isolation device.

3.02 AIR HANDLING UNITS AND CENTRIFUGAL FANS

A. Attach horizontal thrust restraints at the centerline of thrust and symmetrically on either side of the unit. Thrust restraints are not required when the fan section is not isolated from the remainder of the air handling unit by means of duct flexible connections.

END OF SECTION

This Page Left Blank Intentionally

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes air and water testing, adjusting and balancing for the entire project. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Description
   6. Quality Assurance (Qualifications)
   7. Pre-Installation Meeting and Scheduling
   8. Pre-Balance Conference
   9. Submittals

C. PART 2 - Products
   1. Instrumentation

D. PART 3 - EXECUTION
   1. Daily Reports
   2. Preliminary Procedures
   3. Performing Testing, Adjusting, and Balancing
   4. Deficiencies

1.02 RELATED WORK

A. Section 23 05 00 Common Work Results for HVAC
B. Section 23 07 00 HVAC Insulation
C. Section 23 09 14 Pneumatic and Electric Instrumentation and Control Devices for HVAC
D. Section 23 09 23 Direct Digital Control System for HVAC
E. Section 23 09 24 Direct Digital Control System for HVAC (Informational Purposes Only)
F. Section 23 09 25 Direct Digital Control System for HVAC Integrated Terminal Units

1.03 REFERENCE

A. Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. AABC National Standards for Total System Balance, Sixth Edition, 2002.

B. ASHRAE ASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing.

C. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005.

D. TABB Tab Procedural Guide, First Edition, 2003.

1.05 DESCRIPTION

A. The Contractor will separately contract with an independent test and balance agency to perform all testing, adjusting, and balancing of air and hydronic systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by the installing mechanical contractor is specified in other section of these specifications.

B. Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air distribution, adjustment of new systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical equipment, all in accordance with standards published by AABC, NEBB, or TABB.

C. Test, adjust and balance all air systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.

D. Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy of major buildings, occupancy of one building when the project involves many buildings, and completion of the entire project in the time stated in the Instruction to Bidders and in accordance with the completion schedule established for this project.

E. Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If problems are found, handle as specified in Part 3 under Deficiencies.

1.06 QUALITY ASSURANCE (QUALIFICATIONS)

A. An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 5 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally related to HVAC work other than that specifically related to installing Testing and Balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.

B. A certified member of AABC or certified by NEBB or TABB in the specific area of work performed. Maintain certification for the entire duration of the project.

C. Technicians on this project must have satisfactorily completed work on a minimum of (5) five projects of at least 50% in size, and of similar complexity. Size is defined as the quantity of each specific individual item requiring testing and balancing such as, but not limited to, equipment, devices, terminal devices, and grilles/diffusers.

D. Submit Qualifications of firm and project staff to A/E upon request.

1.07 PRE-INSTALLATION MEETING AND SCHEDULING

A. The test and balance agency is required to attend a pre-installation meeting with all other project contractors before the construction process is started. The test and balance agency shall give the Lead Contractor a detailed schedule of testing and balancing tasks for incorporation into the project schedule.

1.08 PRE-BALANCE CONFERENCE

A. 90 days prior to beginning testing, adjusting and balancing, schedule and conduct a conference with the Architect/Engineer, Owner's Project Representative and the mechanical system and temperature control system installing Contractors. Provide A/E with a complete copy of the TAB plan for the project. The objective is final coordination and verification of system operation and readiness for testing, adjusting and balancing procedures and scheduling procedures with the above-mentioned parties. Indicate work required to be completed prior to testing, adjusting, and balancing and identify the party responsible for completion of that work.

1.09 SUBMITTALS

A. See also Related Work in this section.

B. Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB, AABC, or TABB Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed and are operating; and are an accurate record of all final quantities measured to establish normal operating values of the systems.

1. Submission:

   a. Distribute electronic copies of the Report to the Mechanical Contractor and the Prime A/E.

   b. Provide three (3) hard copies of Final Report to be included in O&M Manuals.

2. Format: Cover page identifying project name, project number and descriptive title of contents. Divide the contents of the report into the below listed divisions:

   - General Information
   - Summary
   - Air Systems
   - Special Systems

3. Contents: Provide the following minimum information, forms and data:

   a. General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.

   b. Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.

   c. The remainder of the report to contain the appropriate standard NEBB, AABC, or TABB forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.

PART 2 - PRODUCTS

2.01 INSTRUMENTTION

A. Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB, AABC, or TABB Standards and instrument manufacturer's specifications.

B. All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by A/E upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB, AABC, or TABB Standards.

PART 3 - EXECUTION

3.01 DAILY REPORTS

A. Submit to Owner's Project Representative daily work activity reports for each day on which testing and balancing work is performed. Reports shall include description of day's activities and description of any system deficiencies.

3.02 PRELIMINARY PROCEDURES

A. Review preconstruction meeting report, applicable construction bulletins, applicable change orders and approved shop drawings of equipment, outlets/inlets and temperature controls.

B. Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, and temperature controls for completion of installation.

C. Notify Owner's Project Representative on a daily basis during balancing. Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

3.03 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.

B. Unless specifically instructed in writing, all work in this specification section is to be performed during the normal workday. Coordinate with Mechanical Contractor for phasing requirements. Entire project is to be completed in (2) two phases.

C. In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is such that access panels are required for the work of this section and the panels have not been provided, inform the owner's project representative.

D. Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.

E. In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.

F. Measure and record system measurements at the fan to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Perform terminal balancing to specified flows balancing branch dampers prior to adjustment of terminals.

G. Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.

H. Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data. Balance variable air volume systems at maximum air flow rate, full cooling, and minimum flow rate, full heating; record all data.

I. Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.

J. Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent spaces, as indicated by the design air quantities, require special attention. Adjust fan drives, distribution dampers, terminals and controls to maintain indicated pressure relationship.

K. Final air system measurements to be within the following range of specified cfm:

Fans	0% to +10%
Supply grilles, registers, diffusers	0% to +10%
Return/exhaust grilles, registers	0% to -10%
Room pressurization air	-5% to +5%

L. Contact the Mechanical Contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.

M. Permanently mark equipment settings, including damper positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.

N. Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

O. Verify and record, in the T&B Report, values of damper positions and fan speeds.

P. Coordinate air handling unit minimum outside air set points with the Temperature Control Contractor.

3.04 DEFICIENCIES

A. Division 23 00 00 contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the Owner's Project Representative of these items and instructions will be issued to the Division 23 00 00 contractor for correction of the deficient work. All corrective work to be done at no cost to the Owner. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

END OF SECTION

SECTION 23 07 00
HVAC INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Description
   7. Definitions
   8. Submittals
   9. Operation and Maintenance Data
   10. Environmental Requirements

C. PART 2 - Products
   1. Materials
   2. Insulation Types
   3. Adhesives, Mastics, Sealants, and Reinforcing Materials
   4. Jackets
   5. Insulation Inserts and Pipe Shields
   6. Accessories

D. PART 3 - EXECUTION
   1. Examination
   2. Installation
   3. Protective Jacket Installation
   4. Piping, Valve and Fitting Insulation
   5. Piping Protective Jackets
   6. Pipe Insulation Schedule
   7. Duct Insulation
   8. Ductwork Protective Coverings
   9. Duct Insulation Schedule

1.02 RELATED WORK

A. Section 23 05 00 - Common Work Results for HVAC
B. Section 23 11 00 - Facility Fuel Piping
C. Section 23 21 13 - Hydronic Piping
D. Section 23 22 13 - Steam and Condensate Heating Piping
E. Section 23 24 00 - Internal-Combustion Engine Piping
F. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
G. Section 23 31 00 - HVAC Ducts and Casings

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate
ASTM C165	Test Method for Compressive Properties of Thermal Insulations
ASTM C177	Heat Flux and Thermal Transmission Properties
ASTM C195	Mineral Fiber Thermal Insulation Cement
ASTM C240	Cellular Glass Insulation Block
ASTM C302	Density of Preformed Pipe Insulation
ASTM C303	Density of Preformed Block Insulation
ASTM C355	Test Methods for Test for Water Vapor Transmission of Thick Materials
ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulation Cement
ASTM C518	Heat Flux and Thermal Transmission Properties
ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534	Preformed Flexible Elastomeric Thermal Insulation
ASTM C547	Mineral Fiber Preformed Pipe Insulation
ASTM C552	Cellular Glass Block and Pipe Thermal Insulation
ASTM C553	Mineral Fiber Blanket and Felt Insulation
ASTM C578	Preformed, Block Type Cellular Polystyrene Thermal Insulation
ASTM C591	Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C610	Expanded Perlite Block and Thermal Pipe Insulation
ASTM C612	Mineral Fiber Block and Board Thermal Insulation
ASTM C921	Properties of Jacketing Materials for Thermal Insulation
ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
ASTM D1000	Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
ASTM D1621	Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
ASTM D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
ASTM D1940	Method of Test for Porosity of Rigid Cellular Plastics
ASTM D2126	Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
ASTM E84	Surface Burning Characteristics of Building Materials
ASTM E814	Standard Test Method for Fire Tests of Penetration Firestop Systems
ASTM E2336	Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
MICA	National Commercial & Industrial Insulation Standards
NFPA 225	Surface Burning Characteristics of Building Materials
UL 723	Surface Burning Characteristics of Building Materials

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

B. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

C. Insulation systems shall be applied by experienced contractors. Within the past five (5) years, the contractor shall be able to document the successful completion of a minimum of five (5) projects of at least 50% of the size and similar scope of the work specified in this section.

1.06 DESCRIPTION

A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
   - Pipe Insulation
   - Duct Insulation

B. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications.

1.07 DEFINITIONS

A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

1.08 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

1.09 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.

B. Protect installed insulation work with plastic sheeting to prevent water damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: Armacell, CertainTeed, Manson, Childers, Dow, Extol, Fibrex, Halstead, Foster, Imcoa, ITW, Johns Manville, Knauf Insulation, Owens-Corning, Pittsburgh Corning, VentureTape or approved equal.

B. Materials or accessories containing asbestos will not be accepted.

C. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exception:

   1. Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 450 when tested in accordance with UL 723 and ASTM E84.

2.02 INSULATION TYPES

A. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

B. Flexible Fiberglass Insulation: Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.3 at 75 degrees F, rated for service to 250 degrees F.

C. Rigid Fiberglass Insulation: Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75°F mean temperature, 0.25 at 125°F, 0.27 at 150°F, 0.29 at 200°F, 0.32 at 250°F, minimum compressive strength of 25 PSF at 10% deformation, rated for maximum service temperature of 450°F.

D. Semi-Rigid Fiberglass Insulation: Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75°F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450°F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.

E. Elastomeric Insulation: Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75°F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor permeability of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20°F to 220°F on piping and 180°F where adhered to equipment.

F. Polyolefin Insulation: Flexible closed cell, minimum nominal density of 1.5 lbs. per cu. ft., thermal conductivity of not more than 0.24 at 75°F, minimum compressive strength of 5 psi at 25% deformation, maximum water vapor permeability of 0.0 perm inch, maximum water absorption of 0% by weight and volume, rated for service range of -165°F to 210°F.

2.03 ADHESIVES, MASTICS, SEALANTS, AND REINFORCING MATERIALS

A. Products shall be compatible with surfaces and materials on which they are applied and shall be suitable for use at operating temperatures of systems to which they are applied.

B. Fiberglass Insulation Adhesive: Must comply with ASTM C916, Type II: Foster 85-60, Childers CP-127, Duro Dyne SSG.

C. Vapor Retarding Mastic: For below ambient equipment/piping use a water-based mastic with a water vapor permeance of less than 0.04 perms at 40 mils dry film thickness per ASTM E 96: Childers CP-34, Foster 30-65 Vapor-Fas, Knauf Insulation, KI-900 or KI-905, Vimasco 749.

D. For below ambient equipment/piping use water-based, anti-fungal mastic that meets ASTM D 5590 with a 0 growth rating (AF) and a water vapor permeance that is less than 0.013 perms at 43 mils dry film thickness per ASTM E 96 Procedure B: Foster 30-80AF Vapor Safe Mastic or equal.

E. Anti-fungal mastic to be used in the following locations:

- Locker/shower rooms
- Vehicle garages

F. Weather Barrier Breather Mastic: For above ambient equipment/piping use water based mastic with a permeance greater than 1.0 perms at 1/16" dry film thickness per ASTM E96. Foster 46-50 Weatherite, Childers Vi-Cryl CP-10/CP-11, Vimasco WC-5, Knauf Insulation KI-700 or KI-705.

G. Lagging Adhesive/Coatings: For all indoors applications used in conjunction with canvas/glass cloth: Foster 30-36, Childers CP-50A MV1, Vimasco 713.

H. For all indoor applications used in conjunction with canvas/glass cloth: the coating must be anti-fungal and shall meet ASTM D 5590 with 0 growth rating (AF): Foster 30-36 AF Seal Fas, Childers CP-137 AF Chil-Seal.

I. Anti-fungal adhesive/coating to be used in the following locations:
   - Locker/shower rooms
   - Vehicle garages

J. Reinforcing Mesh: Use Foster 42-24 Mast A Fab, Childers Chil Glas #10 or Pittsburgh Corning PC 79.

K. Metal Jacketing Sealant for all Aluminum Jacketing: Metal jacketing sealants to be non-shrinking and permanently flexible. Use Foster 95-44 Elastolar, Childers CP-76 Chil-Byl, Pittsburgh Corning 727. For Polystyrene use Foster 30-45N, or Childers CP-70.

L. Insulation Joint Sealant: Joint sealants to be non-shrinking and permanently flexible.

   - Used on all below ambient piping to prevent moisture ingress.
   - For Cellular Glass, Polyisocyanurate, Phenolic use Foster 95-44 Elastolar, Childers CP-76 Chil-Byl, Pittsburgh Corning CW Sealant.
   - For Polystyrene use Foster 30-45N, Childers CP-70.For Elastomeric use Armaflex 520 or equal.

2.04 JACKETS

A. PVC Fitting Covers and Jackets (PFJ): White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be minimum 30 mil unless otherwise noted.

B. All Service Jackets (ASJ Max): Heavy duty, poly-encapsulated, fire retardant material with white kraft reinforced foil vapor barrier, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

C. Foil Scrim All Service Jackets (FSJ): Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms and minimum beach puncture resistance of 25 units.

D. Vapor Retarding Jackets (VRJ).

1. Polyvinylidene chloride (PVDC) vapor retarding jacket material with minimum 6 mils material thickness and maximum permeance of 0.01 perms. Material shall not support the growth of mold or mildew. Dow Saran or equivalent.

2. Vapor retarding tape shall be specifically designed and manufactured for use with the vapor retarding jacket specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor retarding tapes used with vapor retarding jackets shall have a maximum permeance of 0.01 perms.

2.05 INSULATION INSERTS AND PIPE SHIELDS

A. Manufacturers: B-Line, Pipe Shields, Value Engineered Products.

B. Construct inserts with calcium silicate or polyisocyanurate (service temperatures below 300°F only), minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

C. Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to preengineered/premanufactured product described above. On low temperature systems, high density rigid polyisocyanurate may be substituted for calcium silicate provided insert and shield length and shield gauge are increased to compensate for lower insulation compressive strength.

D. Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of the same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x6" block for piping through 2-1/2" and three 1"x6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to preengineered/premanufactured product described above.

E. Wood blocks will not be accepted.

2.06 ACCESSORIES

A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

C. Insulation bands to be 3/4" wide, constructed of aluminum or stainless steel. Minimum thickness to be .015" for aluminum and .010" for stainless steel.

D. Tack fasteners to be stainless steel ring grooved shank tacks.

E. Staples to be clinch style.

F. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

G. Finishing cement to be ASTM C449.

H. Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

I. Fungicidal water base duct liner coating (Foster 40-20 or equal) to be compatible with vapor retarding coating. This product must be EPA registered to be used inside HVAC ducts. Coating must comply with ASTM D 5590 with 0 growth rating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.

B. Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

3.02 INSTALLATION

A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry.

B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

C. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.

D. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2".

E. Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

F. All pipe and duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor barriers shall be maintained continuous through all penetrations.

G. Provide a continuous unbroken moisture vapor barrier on insulation applied to systems noted below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.

H. Provide a complete vapor barrier for insulation on the following systems:
- Refrigerant
- Insulated Duct
- Equipment, ductwork or piping with a surface temperature below 65°F

3.03 PROTECTIVE JACKET INSTALLATION

A. PVC Fitting Covers and Jackets (PFJ): Lap seams and joints a minimum of 2" and continuously seal PVC with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor barrier is not required and jacket requires routine removal, tack fasteners may be used. Secure PVC fitting covers with tack fasteners. For systems requiring a vapor barrier, apply a 1-1/2" band of mastic over ends, throat, seams and penetrations.

B. All Service Jackets (ASJ) and Foil Scrim Kraft Jackets (FSK): Install according to manufacturer's recommendations using factory supplied lap seals and butt strip seals. In addition to factory adhesive, secure lap seals and tape with clinch type staples

C. Fabric Reinforced Mastic Jackets (FMJ): Glass fiber fabric shall be fitted without wrinkles. Glass fiber fabric shall be sized immediately upon application with lagging adhesive and shall be capable of drying within 6 hrs. Apply adhesive and coating in accordance with manufacturer's recommendations. All seams shall overlap not less than 2".

D. Vapor Retarding Jackets (VRJ): Piping with vapor retarding jackets (VRJ) shall have elbows, fittings, valves and butt joints wrapped with 2 layers of vapor retarding tape. For piping without a (PFJ) jacket, wrap jacket with 1" wide vapor retarding tape at 12" centers with a 25% overlap. Piping with a PVC jacket (PFJ) installed over the vapor retarding jackets (VRJ) may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves under the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

3.04 PIPING, VALVE, AND FITTING INSULATION

A. General:

1. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket seams and 3" tape on butt joints, firmly cemented with lap adhesive unless otherwise noted. Additionally, secure with clinch style staples along seams and butt joints.

2. On systems requiring a vapor retarding jacket, seal off all raw ends of insulation and butt joints with vapor retarding mastic at intervals of not more than 20 feet on piping to create a vapor dam. Also provide a vapor dam on each side of valves, unions, and tees. Coat staples, longitudinal and transverse seams with vapor retarding mastic and on systems requiring vapor retarding jacket, coat insulated elbows, fittings, and valves with vapor retarding mastic.

3. Where insulated piping is installed on hangers and supports, the insulation shall be installed continuous through the hangers and supports. High density inserts shall be provided as required to prevent the weight of the piping from crushing the insulation. Pipe shields are required at all support locations. The insulation shall not be notched or cut to accommodate the supporting channels.

4. On low temperature systems, use premanufactured insulated pipe riser clamps such as Pipe Shields E1000 and E 2000 series.

B. Insulation Inserts and Pipe Shields:

1. Provide pipe shields at all hanger and support locations. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Quantity and placement of inserts shall be according to the manufacturer's installation instructions, however the inserts shall be no less than 12" in length. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required for system.

2. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

C. Elastomeric and Polyolefin: Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. For elastomeric insulation, apply full bed of adhesive to both surfaces. For polyolefin, seal factory preglued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces. Cover elastomeric insulation on systems operating below 40°F with vapor barrier mastic.

3.05 PIPING PROTECTIVE JACKETS

A. In addition to the jackets specified in the pipe insulation schedule below the following protective jackets are required:

B. Provide a protective PVC jacket (PFJ) for the following insulated piping:

- Exposed refrigerant piping.

3.06 PIPE INSULATION SCHEDULE

A. Provide insulation on new and existing remodeled piping as detailed, as noted on plans, and as indicated in the following schedule:

Service	Insulation	Jacket	Insulation Thickness by Pipe Size				
			< 1"	1" < 2"	2" - <4"	4" < 8"	8" >
Refrig. Liquid (HP)	Elastomeric	None	0.5”				
Cooling Coil Condensate Drain	Rigid Fiberglass	ASJ	0.5"	0.5"	1"	1"	1"

B. Insulation on all steam distribution systems and high pressure steam pipe over 2" shall be installed in multiple layers not exceeding 3" in thickness.

C. The following piping and fittings are not to be insulated:
- Piping unions for systems not requiring a vapor barrier

D. For systems with fluid temperatures 65°F or less, furnish and install removable elastomeric insulation covers, plugs or caps for all mechanical equipment and devices that require access by balancing contractors or service and maintenance personnel. Examples include but are not limited to: flow sensing devices, circuit setters, manual ball valve air vents, drain valves, blowdown valves, pressure/temperature test plugs, grease fittings, pump bearing caps, equipment labels, etc. Covers shall be tight fitting to ensure a complete vapor barrier.

3.07 DUCT INSULATION

A. General:

1. Secure flexible blanket duct insulation on sides and bottom of ductwork over 24" wide with weld pins. Space fasteners 18" on center or less as required to prevent sagging. Compress insulation no more than 25%.

2. Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted as close as possible to the equipment surface. Pins shall be located a maximum of 3" from each edge and spaced no greater than 12" on center.

3. Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4" tape of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed with vapor retarding mastic.

4. Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation or jacket material.

5. External supply duct insulation is not required where ductwork contains continuous 1” acoustical liner, unless otherwise indicated. Provide 4" overlap of external insulation over ends of acoustically lined sections.

6. Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation.

7. Where insulated low temperature (below 45°F) ductwork is supported by steel metal straps or wire ropes that are secured directly to the duct, the straps or ropes shall be completely covered with insulation and sealed to provide a complete vapor barrier.

8. Where insulated duct risers are supported by steel channels secured directly to the duct, extend the insulation and vapor barrier jacketing to encapsulate the support channels.

B. Breeching: Fasten insulation over weld pins and secure with washers. Space fasteners not less than 3" from edge or corner and 12" on center longitudinally and 9" on center in the transverse direction. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4" tape of same material as jacket. Seal tape with plastic applicator and secure with staples.

3.08 DUCTWORK PROTECTIVE COVERINGS

A. In addition to the jackets specified in the duct insulation schedule below the following protective coverings are required:

B. Provide a protective covering of 2 coats of indoor/outdoor vapor retarding mastic with fibrous glass or canvas fabric covering (FMJ) or self-adhering jacket (SAJ) meeting 25/50 Flame Spread/Smoke Rating for the following ductwork:

- Insulated ductwork located in mechanical rooms, mezzanines, catwalks, or as otherwise noted on plans.
- Insulated ductwork located within 10’ of floor.

3.09 DUCT INSULATION SCHEDULE

A. Provide duct insulation on new and existing remodeled ductwork as detailed, as noted and scheduled on plans, and as indicated in the following schedule:

Service	Insulation Type	Jacket	Insulation Thickness
Outside air ducts	Rigid Fiberglass	FSK	2"
Mixed air ducts	Rigid Fiberglass	FSK	2"
Exposed supply ducts*	Rigid Fiberglass	FSK	2"
Concealed supply ducts	Flexible Fiberglass	FSK	2" (R6 min. installed)
Exhaust and Relief ducts downstream of backdraft dampers	Rigid Fiberglass	FSK	2"
Combustion air ducts	Rigid Fiberglass	FSK	2"
Exhaust ducts downstream of energy recovery units	Rigid Fiberglass	FSK	2"
Louver blank-off panels	Rigid Fiberglass	FSJ	2"

* Exposed supply branch ducts located in the space they are serving do not require insulation. Exposed supply main ducts running through spaces they serve shall be insulated as exposed supply ducts scheduled above.

END OF SECTION

This Page Left Blank Intentionally

SECTION 23 11 00
FACILITY FUEL PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section contains specifications for fuel pipe and fuel pipe fittings for this project. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Submittals
   7. Delivery, Storage, and Handling
   8. Design Criteria
   9. Welder Qualifications
   10. Natural Gas Service

C. PART 2 - Products
   1. Natural Gas
   2. Vents and Relief Valves
   3. Unions and Flanges

D. PART 3 - EXECUTION
   1. Erection
   2. Welded Pipe Joints
   3. Threaded Pipe Joints
   4. Natural Gas
   5. Vents and Relief Valves
   6. Unions and Flanges
   7. Piping System Leak Tests
   8. Piping System Test Report

1.02 RELATED WORK

A. Section 23 05 23 - General-Duty Valves for HVAC Piping
B. Section 23 05 15 - Piping Specialties
C. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
D. Section 23 25 00 - HVAC Water Treatment

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. ANSI B16.3 Malleable Iron Threaded Fittings
B. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
C. ASTM A74 Cast Iron Soil Pipe and Fittings
D. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
E. NFPA 54-2021 National Fire Protection Association - National Fuel Gas Code

1.05 QUALITY ASSURANCE

A. Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance with the appropriate ASTM specification.

B. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

C. TYPE E OR S STEEL PIPE: Mill certification papers, also known as material test reports, for the pipe furnished for this project, in English. Heat numbers on these papers to match the heat numbers stenciled on the pipe. Chemical analysis indicated on the mill certification papers to meet or exceed the requirements of the referenced ASTM specification.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

B. Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

1.08 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

B. Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

C. Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in occupied spaces and ventilation plenum spaces, including plenum ceilings.

D. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

E. Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

1.09 WELDER QUALIFICATIONS

A. Before any metallic welding is performed, the Contractor shall submit his Standard Welding Procedure Specifications, Procedure Qualification Records and Qualification Test Records for each Welder along with associated continuity records to demonstrate compliance with ASME Section IX, paragraph QW-322.

B. The Contractor shall maintain a complete set of welder qualification documents at the jobsite, including Test Records and Continuity Records for each welder.

C. Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures in accordance with the Code of Federal Regulations, Title 49, Part 192, Section 192.285

D. The A/E reserves the right to test the work of any welder employed on the project, at the Contractor's expense. Testing will include a visual examination of the pipe and weld and may include radiography of any suspect welds. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project. Any welds deemed unacceptable will be repaired at the contractor’s expense.

1.10 NATURAL GAS SERVICE

A. All charges for the gas service as shown on the plans, including the connection from the main in the street or other location to the gas meter, shall be paid by this Contractor, including setting of gas meter(s) and all work performed by the gas company.

PART 2 - PRODUCTS

2.01 NATURAL GAS

A. 2" and Smaller: ASTM A53, type E or S, standard weight (schedule 40) black steel pipe with ASTM A197/ANSI B16.3 class 150 black malleable iron threaded fittings or ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

B. 2-1/2" and Larger: ASTM A53, type E or S, standard weight black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

2.02 VENTS AND RELIEF VALVES

A. Use pipe and pipe fittings as specified for the system to which the relief valve or vent is connected.

2.03 UNIONS AND FLANGES

A. 2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service but not less than 250 psi.

B. 2-1/2" and Larger: ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use raised face flanges ANSI B16.5 for mating with other raised face flanges on equipment with flat ring or full-face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

C. Provide ASTM A 193 B7 grade bolts and A 194 2H grade nuts & hardened washers for connections (Star washers for grounding.)

D. GASKETS:

1. Fuel Oil and Natural Gas Systems: Branded, compressed, non-asbestos sheet gaskets. Klingersil C4401, Garlock 3000, JM Clipper 978-C or approved equal.

PART 3 - EXECUTION

3.01 ERECTION

A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be rejected and removed from the job site immediately. Excluding minor surface rust, piping that exhibits significant oxidation or corrosion will be rejected.

B. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any item that is not clean.

C. Remove all lose dirt, scale, oil, chips, burrs and other foreign material from the internal and external surfaces of all pipe and piping components prior to assembly, including debris associated with cutting, threading and welding.

D. During fabrication and assembly, remove slag and weld spatter from internal pipe surfaces at all joints by peening, chipping and wire brushing.

E. During construction, until system is fully operational, keep all openings in piping and equipment closed except when actual work is being performed on that item of the system. Use plugs, caps, blind flanges or other items designed for this purpose.

F. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

G. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

H. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

I. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

J. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

K. Install all valves, control valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

3.02 WELDED PIPE JOINTS

A. Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable.

B. All pipe welding shall be completed by Qualified Welders in accordance with the Contractor's Procedure Specifications.

C. Contractor will ensure that these steps are followed where pipe sections will be joined by welding:

1. Cleaning – Welding surfaces will be clean and free of defects.

2. Alignment – Inside diameter of piping components will be aligned as accurately as possible. Internal misalignment shall not exceed 1/16".

3. Spacing – Pipe sections will be spaced to allow deposition of weld filler material through the entire weld joint thickness.

4. Girth Butt Welds:
   a. Girth butt welds shall be complete penetration welds.
   b. Concavity will not exceed 1/32"
   c. Under cuts will not exceed 1/32"
   d. As welded surfaces are permitted however surfaces will be free from coarse ripples, grooves, abrupt ridges and valleys.

D. Electrodes shall be Lincoln, or approved equal, with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

3.03 THREADED PIPE JOINTS

A. Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.04 NATURAL GAS

A. Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth dirt leg at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended. All branch connections to the main shall be from the top or side of the main.

B. Do not install gas pipe in a ventilation air plenum.

C. If an above ground vent terminates in an area subject to snow accumulation, terminate the line at least five feet above grade.

D. Install a shut off valve at each appliance. Provide a valved connection at the main for equipment and appliances furnished by others.

E. Piping through a roof shall be run through an approved roof penetration with flashing and counter flashing.

F. Each gas pressure reducing valve vent and relief valve vent shall be run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.

G. Clean all welded piping before all regulators and control valves. Test by placing target cloth over piping and blow with compressed air. Clean piping until target cloth is clean and free of debris.

3.05 VENTS AND RELIEF VALVES

A. Install vent and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item. In no event is a termination to occur less than six feet above a roof line.

3.06 UNIONS AND FLANGES

A. Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

B. GASKETS:

1. Store horizontally in cool, dry location and protect from sunlight, water and chemicals. Inspect flange surfaces for warping, radial scoring or heavy tool marks. Inspect fasteners, nuts and washers for burrs or cracks. Replace defective materials.

2. Align flanges parallel and perpendicular with bolt holes centered without using excessive force. Center gasket in opening. Lubricate fastener threads, nuts and washers with lubricant formulated for application.

3. Draw flanges together evenly to avoid pinching gasket. Tighten fasteners in cross pattern sequence (12 – 6 o’clock, 3 – 9 o’clock, etc.), one pass by hand and four passes by torque wrench at 30% full torque, 60% full torque and two passes at full torque per ASME B16.5.

3.07 PIPING SYSTEM LEAK TESTS

A. Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.

B. Provide all piping, fittings, blind flanges, and equipment to perform the testing.

C. Conduct pressure test with test medium of air or water unless specifically indicated. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the Owner or Owner's representative. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

D. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

E. For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. After testing is complete, slowly release the pressure in a safe manner.

System	Pressure	Medium	Duration
Natural Gas	100 psig	Air	24 hr

F. All pressure tests are to be documented on the form included in this specification.

G. On piping that cannot be tested because of connection to an active line, provide temporary blind flanges and hydrostatically test new section of piping. After completion of test, remove temporary flanges and make final connections to piping. Die penetrate test pass weld or x-ray the piping that was not hydrostatically tested up to the active system.

3.08 PIPING SYSTEM TEST REPORT

Date Submitted: _____

Project Name: _____

Location: _____ **Project No:** _____

Contractor: _____

❑ HVAC ❑ Refrigeration ❑ Controls
❑ Power Plant ❑ Plumbing ❑ Sprinkler

Test Medium: ❑ Air ❑ Water ❑ Other _____

Test performed per specification section No. _____

Specified Test Duration _____ Hours **Specified Test Pressure** _____ psig

System Identification: _____

Describe Location: _____

_____

Test Date: _____

Start Test Time: _____ **Initial Pressure:** _____ psig

Stop Test Time: _____ **Final Pressure:** _____ psig

Tested By: _____ **Witnessed By:** _____

Title: _____ **Title:** _____

Signed: _____ **Signed:** _____

Date: _____ **Date:** _____

Comments:

_____

END OF SECTION

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section contains specifications for all refrigerant piping and accessories for this project. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Submittals
   6. Quality Assurance
   7. Delivery, Storage, and Handling
   8. Design Criteria

C. PART 2 - Products
   1. Refrigerant Piping
   2. Refrigerant Piping Accessories

D. PART 3 - EXECUTION
   1. Preparation
   2. Erection
   3. Refrigerant Piping
   4. Refrigerant Piping Accessories
   5. Testing

1.02 RELATED WORK

A. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
B. Section 23 07 00 - HVAC Insulation
C. Section 23 62 13 - Packaged Air-Cooled Refrigerant Compressor and Condensing Units
D. Section 23 81 26 - Split-System Ductless Air Conditioners

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A.	ASHRAE 15	Safety Code for Mechanical Refrigeration
B.	ASME A13.1	Scheme for the Identification of Piping Systems
C.	ASME B16.15	Cast Copper Alloy Threaded Fittings: Classes 125 and 250
D.	ASME B16.22	Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
E.	ASME B16.24	Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves
F.	ASTM B88	Seamless Copper Water Tube
G.	ASTM B280	Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
H.	AWS A5.8M	Specification for Filler Metals for Brazing and Braze Welding

1.05 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

C. COPPER TUBE: Statement from manufacturer on his letterhead that the pipe furnished meets the ASTM specification contained in this section.

1.06 QUALITY ASSURANCE

A. Order all copper refrigeration tube with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier; with soft straight lengths or coils identified with a tag indicating that the product was manufactured in accordance with ASTM B280; and with each hard temper straight length identified throughout its length by a blue colored marking not less than 3/16 inch in height and a legend at intervals of not greater than three feet that includes the designation "ACR" and pipe outside diameter.

B. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

B. Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. If end caps are not present on tube bearing the "ACR" designation, clean and re-cap in accordance with ASTM B280. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

1.08 DESIGN CRITERIA

A. Use only new material, free of defects and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

B. Where ASTM B88, type L hard temper copper tubing is specified, ASTM B88, type K hard temper copper tubing may be substituted at Contractor's option.

PART 2 - PRODUCTS

2.01 REFRIGERANT PIPING

A. Refrigerant piping shall be ASTM B88 type L hard drawn copper tube, cleaned and capped in accordance with ASTM B280 and marked "ACR." Fittings shall be wrought copper or forged brass. Copper fittings shall comply with ASME B16.22 and brass fittings shall comply with ASME B16.15 or B16.24.

B. Pre-charged tubing line sets are acceptable if provided in the proper length by manufacturer.

2.02 REFRIGERANT PIPING ACCESSORIES

A. Provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 650 psig and a maximum working temperature of 225°F.

B. Flexible pipe connectors: Double braided bronze hose flexible pipe connectors with solder end connections.

C. Filter Dryers: For circuits 15 tons and over provide angle pattern filter dryers with replaceable core. For circuits below 15 tons provide straight pattern filter dryers without replaceable core.

D. Sight glasses: Two piece brass construction with solder end connections. Include color indicator for sensing moisture.

E. Solenoid Valves: Two way normally closed with two piece brass body, full port, stainless steel plug, stainless steel spring, teflon diaphragm and solder end connections. Provide replaceable coil assembly.

F. Thermostatic Expansion Valves: Brass body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

G. Charging Valves: Provide ¼" SAE brass male flare access ports with finger tight, quick seal caps. Provide 2" long copper extension sections.

H. Check valves: Spring loaded type with bronze body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

PART 3 - EXECUTION

3.01 PREPARATION

A. Remove all foreign material from interior and exterior of pipe and fittings.

3.02 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment. This requirement is based on NFPA 70, 2014 450-47.

C. Do not install piping running through any elevator shaft, public stairway, stair landing, or means of egress.

D. Refrigerant piping shall be identified in accordance with ASME A13.1. In spaces other than where the refrigeration equipment is located, place identification labels at intervals not exceeding 20 feet. Use a minimum letter height of 0.5 inches. Labels shall indicate the refrigerant name and safety group classification.

E. Labels for A2L and B2L refrigerants shall include the statement “WARNING–Risk of Fire. Flammable Refrigerant.” Labels for A2, A3, B2 and B3 refrigerants shall include the statement “DANGER–Risk of Fire or Explosion. Flammable Refrigerant.” Labels for any Group B refrigerant shall also include the statement “DANGER–Toxic Refrigerant.”

F. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

3.03 REFRIGERANT PIPING

A. Refrigeration piping to be installed by firms who are experienced in installation of such piping and in accordance with the requirements of the Wisconsin Administrative Code.

B. Tubing to be new and delivered to the job site with the original mill end caps in place.

C. All refrigerant piping joints shall be brazed. Clean and polish all joints before brazing. Brazing filler metals shall comply with AWS A5.8M/A5.8. Use an approved flux where required by the filler metal manufacturer. Purge all lines with oxygen-free nitrogen during brazing. Avoid prolonged heating and burning. Provide manual shut-off and check valves as required.

3.04 REFRIGERANT PIPING ACCESSORIES

A. Install all accessories in accordance with the manufacturer’s written instructions and recommendations.

3.05 TESTING

A. Test the high and low-pressure sides of the refrigeration system in accordance with the latest edition of ASHRAE Standard 15. Perform testing with oxygen-free nitrogen or premixed nonflammable oxygen-free nitrogen with a tracer gas of hydrogen or helium.

B. The test pressure shall be the lower of (a) the lowest design pressure for any component or (b) the lowest set pressure for any pressure relief device. Pressurize the system to not more than one-half of the test pressure, then increase the pressure in steps of one-tenth of the test pressure until the test pressure is reached.

C. Hold the test pressure for the time duration required by ASHRAE Standard 15 Table 9-13. A passing test shall show no loss in system pressure during the test.

D. Upon completion of pressure testing, evacuate the system to a vacuum of 0.0097 psi absolute or lower. Isolate the system from the vacuum pump for the time duration required by ASHRAE Standard 15 Table 9-13. A passing test shall show that the system pressure does not exceed 0.029 psi absolute.

E. The installing contractor or engineer of record shall issue a certification verifying successful leakage tests in accordance with ASHRAE Standard 15. The certification shall include the test date, a photograph of the pressure gauge at the test pressure, refrigerant name, test gas, and test pressure applied to the high and low-pressure sides of the system. Submit this certification to the authority having jurisdiction for all systems containing 55 pounds or more of refrigerant.

F. Charge refrigerant directly from original drums through a combination filter-drier. Each drier may be used for a maximum of three cylinders of refrigerant and then must be replaced with a fresh drier. Charge the system by means of a charging fitting in the liquid line. Weigh the refrigerant drum before charging so that an accurate record can be kept of the weight of refrigerant put in the system. If refrigerant is added to the system through the suction side of the compressor, charge in vapor form only.

END OF SECTION

This Page Left Blank Intentionally

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes specifications for all duct systems used on this project. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Submittals
   7. Design Criteria
   8. Delivery, Storage, and Handling
   9. Warranty

C. PART 2 - Products
   1. General
   2. Ductwork Pressure Class
   3. Materials
   4. Low Pressure Ductwork (Maximum 2 inch pressure class)
   5. Exhaust Duct (Moisture laden air)
   6. Duct Sealant
   7. Gaskets

D. PART 3 - EXECUTION
   1. Installation
   2. Ductwork Support
   3. Low Pressure Duct (Maximum 2 inch pressure class)
   4. Exhaust Duct (Moisture laden air)
   5. Cleaning
   6. Leakage Test
   7. Structural Test
   8. Duct Leakage Test Report
   9. Duct Structural Test Report

1.02 RELATED WORK

A. Section 23 01 30.51 - HVAC Air Duct Cleaning
B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC
C. Section 23 33 00 - Air Duct Accessories

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERNCE STANDARDS

A.	ANSI SS-EN 485-2	Aluminum and Aluminum Alloys-Sheet, Strip and Plate-Part 2: Mechanical Properties
B.	ASTM B209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate
C.	ASTM A90	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
D.	ASTM A167	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
E.	ASTM A623	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
F.	ASTM A527	Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
G.	ASTM 924	Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method
H.	ASTM C 1071	Specification for Fibrous Glass Duct Lining Insulation
I.	ASTM C 411	Test Method for Hot Surface Performance of High Temperature Thermal Insulation
J.	ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials
K.	ASTM C 1338	Test Method for Determining Fungal Resistance of Insulation Materials and Facings
L.	ASTM G 21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
M.	ASTM C 916	Standard Specification for Adhesives for Duct Thermal Insulation
N.	NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
O.	UL 181	Standard for Safety for Factory Made Air Ducts and Air Connectors

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Include manufacturer's data and/or Contractor data for the following:

- Fabrication and installation drawings.
- Schedule of duct systems including material of construction, gauge, pressure class, system class, method of reinforcement, joint construction, fitting construction, and support methods, all with details as appropriate.
- Duct sealant and gasket material.

1.07 DESIGN CRITERIA

A. Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.

B. Use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications, unless noted otherwise:

- HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005
- HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012
- HVAC Systems - Duct Design, 4th Edition, 2006
- Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004
- Round Industrial Duct Construction Standards, 2nd Edition, 1999
- Thermoplastic Duct (PVC) Construction Manual, 2nd Edition, 1995

C. Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.

B. Protect Ductwork against damage.

C. Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end caps/packaging are provided, take precautions so caps/packaging remain in place and free from damage.

D. Offsite storage agreements do not relieve the contractor from using proper storage techniques.

E. Storage and protection methods must allow inspection to verify products.

1.09 WARRANTY

A. All non-fibrous, closed cell, outdoor ductwork shall have a 10 year warranty against defects in workmanship and water leakage.

B. All fabric duct shall have a 5 year non-prorated warranty.

PART 2 - PRODUCTS

2.01 GENERAL

A. All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12” and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.

B. Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net, inside of liner.

2.02 DUCTWORK PRESSURE CLASS

A. Minimum acceptable duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1 inch W.G. positive or negative, depending on the application. Duct system pressure classes are indicated on the drawings.

2.03 MATERIALS

A. GALVANIZED STEEL SHEET: Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide “Paint Grip” finish or galvanneal sheet metal for ductwork that will be painted.

B. ALUMINUM SHEET: Use ANSI/ASTM B209 aluminum sheet, alloy 3003H-14, capable of double seaming without fracture.

2.04 LOW PRESSURE DUCTWORK (Maximum 2 inch pressure class)

A. Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as modified below.

B. Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.

C. Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.

D. Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00.

E. Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.

F. Button punch snaplock construction will not be accepted on aluminum ductwork.

G. Round ducts may be substituted for rectangular ducts if sized in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except as permitted by the Architect/Engineer.

H. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

2.05 EXHAUST DUCT (Moisture laden air)

A. Moisture laden ductwork systems include shower/locker rooms.

B. Exhaust ducts conveying moisture laden air, other than dishwasher exhaust, to be constructed of sheet aluminum in accordance with SMACNA standards.

C. Seal all joints and seams watertight.

2.06 DUCT SEALANT

A. Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal & Seal, Lockformer cold sealant, Mon-Eco Industries, United Sheet Metal, or approved equal. Silicone sealants are not allowed in any type of ductwork installation.

B. Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

2.07 GASKETS

A. 2" pressure class and lower: Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.

B. Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts, construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 4-8, Fig. E. In all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure or fume exhaust ductwork.

C. Test openings for test and balance work as required.

D. Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.

E. Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.

F. Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not contact each other by using proper seal or compound.

G. Install all motor operated dampers and connect to or install all equipment furnished by others. Blank off all unused portions of louvers, as indicated on the drawings, with 2" board insulation with galvanized sheet metal backing on both sides.

H. Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Provide adequate access to ductwork for cleaning purposes.

K. Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the ductwork.

L. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

M. Ductwork required to be prepared for painting:

1. Surface shall be clean, dry and free from manufacturer’s lubricants.

2. Remove dirt and grease from galvanized ductwork with VM&P, Naphtha, or water based commercial detergent and wipe dry with a clean cloth.

3. Surface shall be free of foreign materials that will be adversely affect adhesion or appearance of applied paint coating.

3.02 DUCTWORK SUPPORT

A. Support ductwork in accordance with SMACNA HVAC Duct Construction Standards, Figure 5-5, except supporting ductwork with secure wire method is not allowed.

B. Stainless steel air-craft cable hanging systems are allowed on round ductwork under 12" diameter if installed utilizing two fasteners with two cable loops. Support with 3/32", 7 x 7, stainless steel air-craft cable, with matching serrated spring loaded wedge mechanism fasteners rated for actual load. Comply with the manufacturer’s installation instructions.

3.03 LOW PRESSURE DUCT (Maximum 2 inch pressure class)

A. Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A"; all seams, joints, and penetrations shall be sealed.

B. Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.

C. Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheet metal screws or pop rivets. Trapeze hangers may be used at contractor's option.

3.04 EXHAUST DUCT (Moisture laden air)

A. Pitch duct to drain back to equipment or exhaust grille.

B. Provide water tight drain pan at low points or at locations where moisture may collect. Pipe drain pan to nearest floor drain.

3.05 CLEANING

A. Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.

B. Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

3.06 LEAKAGE TEST

A. Test all ductwork in accordance with test methods described in Section 5 of SMACNA HVAC Air Duct Leakage Test Manual. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

B. If excessive air leakage is found locate leaks, repair the duct in the area of the leak, seal the duct, and retest.

C. Leakage rate shall not exceed more than 5% of the system air quantity for low pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

D. Leakage rate shall not exceed more that 1% of the system air quantity for high pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

E. Leakage test for ductwork downstream of air terminal devices may be omitted but will not relieve the contractor from duct sealing requirements.

F. Submit a signed report to the Owner's Construction Representative, indicating test apparatus used, results of the leakage test, and any remedial work required to bring duct systems into compliance with specified leakage rates.

3.07 STRUCTURAL TEST

A. Random test all ductwork per A/E direction. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

B. Deflection limits shall not exceed those listed in accordance with Chapter 11 of SMACNA HVAC Duct Construction Standards, 3.0 Performance Requirements.

C. Submit a signed report to the Owner's Construction Representative, indicating test apparatus used, results of the structural test, and any remedial work required.

3.08 DUCT LEAKAGE REPORT

Date Submitted: _____

Project Name: _____

Location: _____ **Project No:** _____

Contractor: _____

System Data Fan No. _____ Leakage Class (C_L): _____

Fan Design Airflow: _____ CFM Duct Press. Class (P_C): _____

Test Pressure (P_T): _____

Test Equip. Mfgr. _____ Model No. _____ Serial No. _____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

Design Data							**Field Test Data**					
			Allowable Leakage		Diameter		Pressure (in. w.)					
Duct Section	Duct Shape	Duct Surface (ft^2)	Leakage Factor ($P^{.65}C_L$)	CFM for Section	Tube (D_1)	Orifice (D_2)	In Duct (P)	Across Orifice (P_{drop})	Date	Performed By	Observed By	Actual CFM

3.09 DUCT STRUCTURAL TEST REPORT

Date Submitted: _____

Project Name: _____

Location: _____ **Project No:** _____

Contractor: _____

System Data Fan No. _____

Description of Test Method: _____

_____

_____

Test Equip. Mfgr. _____ Model No. _____ Serial No. _____

Indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Design Data							Field Test Data							
Duct Test Location	Duct Shape		Duct Pressure Class	Allowable Ductwork Wall Deflection		Allowable Joint/ Reinforcement Deflection		Pressure in Duct (in. wc.)	Measured Ductwork Wall Deflection		Measured Joint/ Reinforcement Deflection		Date	Performed By	Witnessed By
	W	H		W	H	W	H		W	H	W	H			

END OF SECTION

This Page Left Blank Intentionally

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes accessories used in the installation of duct systems. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Submittals
   7. Operation and Maintenance Data

C. PART 2 - Products
   1. Manual Volume Dampers
   2. Turning Vanes
   3. Control Dampers
   4. Access Doors
   5. Flexible Duct
   6. Duct Lining
   7. Flashings
   8. Hoods for Intake and Exhaust
   9. Louvers

D. PART 3 - EXECUTION
   1. Manual Volume Dampers
   2. Turning Vanes
   3. Control Dampers
   4. Access Doors
   5. Flexible Duct
   6. Duct Lining
   7. Flashings
   8. Hoods for Intake and Exhaust
   9. Louvers

1.02 RELATED WORK

A. Section 23 05 29 - Hanger and Supports for HVAC Piping and Equipment
B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment
C. Section 23 31 00 - HVAC Ducts and Casings

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A.	NFPA 90A	Standard for Installation of Air Conditioning and Ventilating Systems
B.	SMACNA	HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition, 1995
C.	UL 214	
D.	UL 555(6th edition)	Standard for Fire Dampers and Ceiling Dampers
E.	UL 555S (4th edition)	Leakage Rated Dampers for Use in Smoke Control Systems

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.

C. Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.

D. Submit manufacturer's color charts where finish color is specified to be selected by the Architect/Engineer.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.01 MANUAL VOLUME DAMPERS

A. Manufacturers: Ruskin, Vent Products, Air Balance, Pottorff, or approved equal.

B. Dampers must be constructed in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.

C. Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48". Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

2.02 TURNING VANES

A. Manufacturers: Aero Dyne, Anemostat, Barber-Colman, Hart & Cooley, or approved equal.

B. Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 2-3 and Fig. 2-4 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Fig. 2-5 and Fig. 2-6.

2.03 CONTROL DAMPERS

A. Provide control dampers shown on the plans and as required to perform the specified functions. Dampers shall be rated for velocities that will be encountered at maximum system design and rated for pressure equal or greater than the ductwork pressure class as specified in Section 23 31 00 of the ductwork where the damper is installed.

B. Use only factory fabricated dampers with mechanically captured replaceable resilient blade seals, stainless steel jamb seals and with entire assembly suitable for the maximum temperature and air velocities encountered in the system.

C. Dampers in galvanized ductwork shall be constructed of galvanized steel and/or aluminum.

D. All dampers, unless otherwise specified, to be rated at a minimum of 180º F working temperature. Leakage testing shall be certified to be based on latest edition of AMCA Standard 500-D and all dampers, unless otherwise specified, shall have leakage ratings as follows:

Damper Class	Differential Pressure	Leakage
Class IA	1" w.g.	≤3 CFM/ft^2

E. Leakage rate dampers for differential pressures that they will encounter at maximum system design pressures.

F. Steel framed dampers: Nailor models 2010 & 2020; Greenheck models VCD-33 & VCD-42; Johnson Controls model V-1330; Ruskin Models CD60 & CD40; other approved equal.

G. Aluminum frame and blade dampers: Nailor models 2010EAF & 2020EAF; Greenheck model VCD-43; Ruskin model CD50; Arrow model AFD-20; other approved equal.

H. Dampers used as shut-off dampers in open-ended ductwork, louvers without duct connections, in exhaust fan inlets with no outlet ductwork or where indicated shall be aluminum frame with insulated aluminum blades: Nailor models 2010IB & 2020IB; Greenheck model ICD-44; Ruskin model CDTI50; Arrow model AFDTI-25; other approved equal.

I. Dampers used for directed mixing of airstreams, i.e. outside air and return air, to be parallel blade type and sized for an air velocity of 1800 to 2000 fpm with the damper blades shall be arranged so that the air streams are directed at one another to facilitate mixing. Dampers used for throttling or modulating applications other than air stream mixing to be opposed blade type. Two position dampers may be parallel or opposed blade type.

J. Dampers for applications other than fume exhaust to have frames of not less than 16 gauge galvanized steel or 12 gauge extruded aluminum. Blades to be two-ply steel airfoil of not less than 2 x 20 gauge galvanized steel (14 gauge equivalent) or extruded aluminum airfoil, with stainless steel, acetal, Celcon, bronze, or nylon bearings. Maximum allowable blade width is 8 inches. Use plated steel linkage hardware.

K. Maximum damper width is 48 inches; where required width exceeds 48 inches, use multiple damper sections. Inside frame free area shall be a minimum of 90% of total inside duct area.

L. Multiple width damper sections shall utilize jack shaft linkages unless noted below. Sections over 144 inches wide shall be actuated from two locations on the jack shaft. Double width damper sections for two-position operation may be actuated without jack shafts if each damper section is actuated separately. Dampers that have multiple width and multiple vertical sections shall have a jackshaft for each vertically stacked set of dampers and be provided with crossover linkages between jack shafts to transfer uneven loading.

M. Jack shafts shall be extended outside of the ductwork for external actuator mounting. Provide bearings on the point of exit for support of damper shafts to prevent wear on the shaft and the ductwork. If locating actuators out of the air stream is impossible, obtain mounting location approval from the designer unless the contract documents indicate in air stream mounting is acceptable. In no cases shall damper actuators for fume exhaust systems be located in the air stream or require entering the air stream to service an actuator.

N. Size operators for smooth and positive operation of devices served, and with sufficient torque capacity to provide tight shutoff against system temperatures and pressure encountered. For two-position electric actuation use 24 VAC for DDC controlled actuators, 120 VAC actuators may be used for hardwire interlocking. All electric actuators will be provided with overload protection to prevent motor from damage when stall condition is encountered. Equip operators with spring return or stored energy fail-safe return for applications involving fire, freeze protection, moisture protection or specified normally open/closed operation. Provide damper end switches with form “C” contacts where control sequences require damper position indication. End switches shall not contain mercury.

O. All power required for electric actuation shall be provided by this contractor.

P. Provide operators with linkages and brackets for mounting on device served.

2.04 ACCESS DOORS

A. Access door to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be steel full length continuous piano type. Doors in concealed spaces may be secured in place with cam sash latches. For both hinged and non hinged doors provide sufficient number of camp sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1” deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.

B. Use insulated, 2 hour UL 1978 listed and labeled access doors in kitchen exhaust ducts.

2.05 FLEXIBLE DUCT

A. Manufacturers: Anco Products, Clevaflex, Thermaflex, Flexmaster or approved equal.

B. Factory fabricated, UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and a smoke developed rating of 50 or under in accordance with NFPA 90A.

C. Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ±2" pressure class, depending on the application.

D. Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum construction may also be used.

E. Where duct is specified to be insulated, provide a minimum 1" fiberglass insulation blanket with maximum thermal conductance of 0.23 K (75°F) and vapor barrier jacket of polyethylene or metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

2.06 DUCT LINING

A. Manufacturers: Manville, Owens-Corning, Knauf, or approved equal.

B. 1" thick, flexible, mat faced insulation made from inorganic glass fibers bonded with a thermosetting resin with thermal conductivity of .25 Btu inch / hour sq.ft. deg F.

C. Meet erosion testing per UL 181 or ASTM C 1071 for 5000 fpm maximum air velocity. ASTM C 411 maximum operating temperature rating of 250°F. ASTM E84 flame spread less than 25 and smoke developed less than 50.

D. Meet requirements of ASTM C 1338 and ASTM G21 for fungi resistance.

E. Install liner using adhesive conforming to ASTM C 916.

2.07 FLASHINGS

A. Provide flashing to completely weatherproof connection of ductwork to louvers. Flashing to be constructed of material similar to louver material.

B. Flashing and counterflashing for roof curbs will be provided by others.

C. Flashing and curbs for duct and pipe penetrations of roof assemblies to be in accordance with details.

2.08 HOODS FOR INTAKE AND EXHAUST

A. Manufacturers: Acme, Ammerman, Carnes, Cook, Greenheck, Louvers and Dampers, PennBarry, Twin City Fan, United Enertech, or approved equal.

B. Use low silhouette type hoods.

C. Use louvered penthouse type hoods with drainable blade louvers.

D. Construct hoods of galvanized steel or aluminum as indicated.

E. Construct hoods of galvanized steel or aluminum as indicated with a baked enamel finish; color to be selected by the Architect during the submittal stage.

F. Provide bird screen and motor operated damper (where indicated) for each hood.

2.09 LOUVERS

A. Louvers are specified in the architectural section of these specifications.

B. Manufacturers: Greenheck, Cesco, Kees, Arrow, Airolite, Industrial Louvers, American Warming and Ventilating, Air Balance, Ruskin, Pottorff, Nailor, United Enertech, or approved equal.

C. Similar to Greenheck ESD-435, extruded aluminum alloy not less than 12 gauge (.081" thick), 6063 series frame and blades, all-welded assembly, 35 degree or 45 degree blades with water baffle, 4" thick. Provide with bird screen of ½" x ½" mesh aluminum in 12 gauge aluminum frame and an aluminum sill. Locate the bird screen inside of the louver unless noted otherwise.

D. Louver to bear the AMCA certified ratings seal for both air performance and water penetration, having a free area not less than 50% based on a 48" x 48" section, a water penetration less than 0.05 oz/square foot per 15 minutes under AMCA test at 1000 feet per minute, and an intake pressure drop less than 0.15 inches of water at 1000 feet per minute.

E. Finish to be baked enamel in a standard manufacturer color to be selected by the Architect. Furnish sufficient paint in the same color as the louver to paint the outer surface of panels over unused portions of louvers and to paint the interior portion of ductwork visible through the louvers.

PART 3 - EXECUTION

3.01 MANUAL VOLUME DAMPERS

A. Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

3.02 TURNING VANES

A. Install turning vanes in all rectangular, mitered elbows in accordance with SMACNA standards and/or manufacturer's recommendations.

B. Install double wall, airfoil, 2" radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2" radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.

C. If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheet metal turning vanes in accordance with SMACNA Figure 2-5 and Figure 2-6.

3.03 CONTROL DAMPERS

A. Install dampers in locations indicated on the drawings, as detailed, and according to the manufacturer's instructions. Provide smooth transitions where damper size is different than duct size. Blank off plates will not be accepted. Provide adequate operating clearance and access to the operator. Install an access door adjacent to each control damper for inspection and maintenance.

B. Damper end switches, where required, shall be integral to the actuator that is mounted to the damper drive shaft or auxiliary shaft attached to a damper drive blade. End switches shall be adjusted to prove the damper the position opposite the fail position of the damper actuator unless the control sequence requires a different position to be proven to accomplish the specified control sequence.

C. Each operator shall serve a maximum damper area of 36 square feet. Where larger dampers are used, provide multiple operators.

3.04 ACCESS DOORS

A. Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.

B. Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8" x 8" size for hand access, 18" x 18" size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.

C. Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly adjacent to access doors using a minimum of 0.5" height lettering reading, “SMOKE DAMPER” or “FIRE DAMPER”. Smoke and combination fire smoke dampers shall also include a second line listing the individual damper tag. The tags must be coordinated with the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible from the ceiling access point.

3.05 FLEXIBLE DUCT

A. Flexible duct may only be used for final connections of air inlets and outlets at diffuser, register, and grille locations. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 5 feet in length, and have no more than one (1) 90 degree bend.

B. Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor barrier jacket in place with steel or nylon draw band. Sheetmetal screws and/or duct tape will not be accepted.

C. Flexible duct used to compensate for misalignment of main duct or branch duct will not be accepted.

D. Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.

E. Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.

F. Penetration of any partition, wall, or floor with flexible duct will not be accepted.

3.06 DUCT LINING

A. Apply lining to ductwork as scheduled.

B. Do not apply lining to the following ductwork:
- Outside air ductwork.
- Dishwashing exhaust ductwork.
- Shower exhaust ductwork.
- Supply, return and exhaust ductwork associated with shop ventilation systems where air handling units are located in the shops.

C. Install liner in compliance with the latest edition of NAIMA's Fibrous Glass Duct Liner Standard. Locate longitudinal joints at the corners of duct only. Cut and fit to assure lapped, compressed joints. Coat all transverse and longitudinal joints and edges with adhesive. Provide metal nosing on leading edge where lined duct is preceded by unlined duct. Adhere liner to duct with full coverage area of adhesive. Additionally secure liner to duct using mechanical fasteners spaced as recommended by the liner manufacturer without compressing liner more than 1/8" with the fasteners.

3.07 FLASHINGS

A. Flashing for roof curbs, equipment supports or rails located on roof will be installed by others.

3.08 HOODS FOR INTAKE AND EXHAUST

A. Install in locations indicated on the drawings, coordinating the roof opening location with the General Contractor. Curbs are covered in Section 23 05 29.

3.09 LOUVERS

A. Louvers are furnished by M.C. and installed by G.C.

B. Furnish louvers to the General Contractor for mounting in exterior walls. Connect outside air intake duct to the louver, sealing all connections air and watertight.

C. Provide bird screen on inside of active louver area where none is provided with louvers. Where louvers are equipped with inside bird screen, remove screen at all locations where duct connections are not made.

D. Install insulated metal panel on unused portion of louver. Panels must be sealed weathertight to louver assembly with flashing as required for proper drainage to outside of building. Paint outside surface of panel to match louver prior to installation. Where ductwork is visible through louver when viewed from outside the building, paint inside of duct to match louver color.

END OF SECTION

SECTION 23 34 00
HVAC FANS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes specifications for fans that are not an integral part of a manufactured device. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Submittals
   7. Operation and Maintenance Data
   8. Design Criteria

C. PART 2 - Products
   1. General
   2. Backdraft Dampers
   3. Centrifugal Fans
   4. In-Line Centrifugal Fans
   5. Power Roof Exhaust Fans
   6. Ceiling Exhaust Fans
   7. Destratification Fans (Compact)
   8. Kitchen Range Hoods

D. PART 3 - EXECUTION
   1. Installation

1.02 RELATED WORK

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment
B. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
C. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. AMCA 203 AMCA Fan Application Manual - Troubleshooting
B. AMCA 204 Standard Balance Quality and Vibration Levels for Fans
C. AMCA 210 Laboratory Method of Testing Fans for Rating
D. AMCA 211 Certified Ratings Program Product Rating Manual for Fan Air Performance
E. AMCA 300 Reverberant Room Method for Sound Testing of Fans
F. AMCA 500-D Laboratory Methods for Testing Dampers for Ratings
G. ANSI 11 Method of Evaluating Load Ratings of Bearings

H. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems
I. NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
J. UL 705 Standard Power Ventilators
K. UL 705 (SC) Power Roof Ventilators for Restaurant Exhaust Appliances

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Include dimensions, capacities, fan curves, materials of construction, ratings, weights, motors and drives, sound power levels, appropriate identification and vibration isolation for all equipment. Sound power levels to be based on tests performed in accordance with AMCA Standard 300.

C. Fan curves shall indicate the relationship of CFM to static or total pressure for various fan speeds. Brake horsepower, recommended selection range, and limits of operation are to also be indicated on the curves. Indicate operating point on the fan curves at design air quantity and indicate the manufacturer's recommended drive loss factor for the specific application. Tabular fan performance data is not acceptable.

D. For variable air volume application, include data which indicates the effect of capacity control devices on performance.

E. Submit color selection charts for equipment where applicable.

F. Provide two (2) extra sets of filters for each unit that contains filters

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.08 DESIGN CRITERIA

A. Tested and certify all fans in accordance with the applicable AMCA test code.

B. Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions.

C. Consider drive efficiency in motor selection according to manufacturer's published recommendation or according to AMCA Publication 203, Appendix L.

D. Where inlet and outlet ductwork at any fan is changed from that shown on the drawings, provide any motor, drive and/or wiring changes required due to increased static pressure or baffling necessary to prevent uneven airflow or improve mixing.

E. All internal insulation and other components exposed to the airstream are to meet the flame spread and smoke ratings contained in NFPA 90A.

F. All roof mounted equipment to be provided with curbs or equipment stands in accordance with specification in Section 23 05 29.

PART 2 - PRODUCTS

2.01 GENERAL

A. Use fan size, class, type, arrangement, and capacity as scheduled.

B. Furnish complete with motors, wheels, drive assemblies, bearings, vibration isolation devices, and accessories required for specified performance and proper operation. All single phase motors to have inherent thermal overload protection.

C. Provide variable pitch sheaves for drives 3 hp and smaller, fixed pitch sheaves for drives 5 hp and larger. Design all drives for 150% of motor rating.

D. Use OSHA approved belt guards that totally enclose the entire drive. Construct guards of expanded metal to allow for ventilation; provide tachometer openings at shaft locations.

E. Statically and dynamically balance all fans so they operate without objectionable noise or vibration.

F. All direct drive fan motors shall be provided with a means for balancing fan speed. E.g., solid state speed controller, potentiometer, VFD, etc.

G. Use AMCA Type A spark resistant construction for all fans handling flammable or explosive vapors.

2.02 BACKDRAFT DAMPERS

A. Manufacturers: Backdraft dampers shall be provided by the same manufacturer as the specified exhaust fan. Acceptable fan manufacturers are listed under each fan type. Where motorized dampers are indicated, refer to section 23 09 14 and/or 23 33 00 for requirements.

B. Construction: 18 gauge damper frame, minimum 0.025" thick damper blades with vinyl edge seals, axle, axle bearings and internal linkage. Material and finish shall match duct material where damper is installed, unless otherwise noted.

C. Performance: Dampers shall have an air leakage rate not greater than 20 cfm/ft^2 where not less than 24" in either dimension and 40 cfm/ft^2 where less than 24" in either dimension. The rate of air leakage shall be determined at 1.0" water gauge when tested in accordance with AMCA 500D for such purpose. The dampers shall be labeled by an approved agency.

2.03 CENTRIFUGAL FANS

A. Manufacturers: PennBarry, Peerless, Buffalo, Carrier, Champion, Chicago Blower, Greenheck, New York Blower, Trane, Twin City, Cook, or approved equal.

B. Construct housing of welded steel with angle iron frame. Use spun or die formed inlet cones to provide a streamlined flow into the wheel. Use airfoil blades welded to spun wheel cones unless otherwise indicated. Shafts shall be AISI C 1045 hot rolled steel turned, ground and polished. Shaft shall be sized for at least 125% of the fans maximum cataloged RPM.

C. Bearings to be self-aligning grease packed pillow block type with grease seal and external grease fittings with a minimum L50 life of 200,000 hours at the maximum cataloged operating speed. Provide each fan housing with a capped drain connection and bolted and gasketed access door for inspection of fan wheel. Unless a special coating is scheduled, paint fans with a prime coat after metal cleaning and surface preparation; apply a second coat of paint to all exterior surfaces.

D. Fans shall bear the AMCA Certified Ratings Seal for Sound and Air Performance.

E. Provide half inch galvanized mesh inlet screens for fans without inlet ductwork.

2.04 IN-LINE CENTRIFUGL FANS

A. Manufacturers: Acme, PennBarry, Cook, Greenheck, New York Blower, Peerless, Twin City, CaptiveAire, or approved equal.

B. Construction: The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on a minimum of two sides to permit easy access to all internal components. Provide with closed cell neoprene gasketing. Housing shall accommodate universal mounting feet for vertical or horizontal installation.

C. Wheel: Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency and minimize noise and turbulence.

D. Motors: Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase. Provide AC induction or electronically commutated (EC) motors as scheduled.

E. Fans provided with EC motors shall be provided with potentiometer mounted on exterior fan housing or an accessible location that allows the fan to be balanced while fan is in operation.

F. Belt Drive: Where belt driven fans are specified, provide externally mounted motor on an adjustable base with a belt tube to isolate the belt from the airstream. Bearings to be grease lubricated, self-aligning ball bearing type with grease seal and external grease fitting. Provide extended lube lines for lubrication without disassembling the fan.

G. Design all vertically mounted fans to withstand the vertical thrust loads.

H. Provide half inch galvanized mesh inlet screens for fans without inlet ductwork.

2.05 POWER ROOF EXHAUST FANS

A. Manufacturers: Carnes, Greenheck, PennBary, Jenn-Air, Cook, ACME, Twin City Fan, CaptiveAire, or approved equal.

B. Provide upblast or downblast units as scheduled.

C. Construction: Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. A two-piece top cap shall have stainless steel quick release latches to provide access into the motor compartment without the use of tools. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Aluminum bird screen at discharge.

D. Wheel: Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency and minimize noise and turbulence

E. Motor: AC induction or EC motor as indicated. Motors that are single phase shall have thermal overload protection with integral disconnect switch.

2.06 CEILING EXHAUST FANS

A. Manufacturers: Broan, Carnes, Greenheck, PennBarry, Jenn-Air, Cook, ACME, Twin City Fan, Panasonic or approved equal.

B. Centrifugal forward-curved blower wheel, minimum 22 gauge galvanized steel housing with acoustical lining, integral exhaust grille, adjustable mounting brackets to allow for any ceiling thickness, isolation kit, permanently lubricated motor, integral junction box with permanently lubricated and thermally protected motor factory wired, and integral backdraft damper.

C. Provide wall, eave, or roof discharge assembly, as indicated on the drawings.

2.07 DESTRATIFICATION FANS (COMPACT)

A. Manufacturers: ZOO Fans.

B. Performance: Coordinated design of housing, stator and motor shall provide a columnar laminar airflow.

C. Housing: The fan housing shall be double-wall construction with the interior being cylindrical in design. Tapered designs will not be accepted because of backpressure exhibited on the axial blade fan.

D. Motor: Electronically Commutated (EC) motor with factory installed whips for low voltage control connection and line voltage. Motor is to have continuous power – on/off to be achieved via low voltage signal and/or low voltage contactors.

E. Stator: The fan shall include a multiple-vaned, performance enhancing stator. Non-curved blades will not be accepted.

F. Provide optional 3-prong plug and 6' cord factory installed for 120V models.

G. Mounting System: The fan mounting system shall be designed for quick installation. The mounting system shall include a 200 lb. safe working load cable with quick adjustment and attachment hardware. The mounting system shall also include a 100 lb. safe working load stabilization tether and attachment hardware.

H. Controls: LED User Interface/Controller with manual speed adjustment.

I. Fire Alarm: Interlock fans with fire alarm system to shut down fans when fire alarm system is activated.

2.08 KITCHEN RANGE HOODS

A. Hoods shall be as manufactured by Broan, NuTone, or Trade Wind.

B. Furnish and install kitchen range hoods as shown and as scheduled.

C. Hoods shall be equipped with fans, lights, filters, finish and accessories as scheduled.

D. Operating sound level shall not exceed 6 sones.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install as shown on the drawings, as detailed, and according to manufacturer's installation instructions.

B. Install thrust restraints in accordance with the requirements of Section 23 05 48.

C. Dampers shall be installed in accordance with manufacturer’s installation instructions and be installed square and free from racking. Dampers must be accessible to allow inspection, adjustment, and replacement of components. Provide access door as specified under section 23 33 00.

D. Contractor shall balance blade assembly of destratification fans after installation to assure stable operation.

END OF SECTION

SECTION 23 37 13
DIFFUSERS, REGISTERS & GRILLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes specifications for air terminal equipment. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Submittals
   7. Design Criteria

C. PART 2 - Products
   1. Manufacturers
   2. Square Ceiling Diffusers - 4-Way Throw
   3. Side-Wall Registers and Grilles
   4. Eggcrate Grille

D. PART 3 - EXECUTION
   1. Installation

1.02 RELATED WORK

A. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC
B. Section 23 31 00 - HVAC Ducts and Casings
C. Section 23 33 00 - Air Duct Accessories

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
B. UL 181 - Factory-Made Air Ducts and Connectors.
C. ARI-ADC Standard 880.

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Furnish submittal information including, but not limited to, the following:

Manufacturer's name and model number
Identification as referenced in the documents
Capacities/ratings
Materials of construction
Sound ratings
Dimensions
Finish
Color selection charts where applicable
Manufacturer's installation instructions
All other appropriate data

1.07 DESIGN CRITERIA

A. All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC) Test Code 1062 GRD 84.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturers for specific products are listed under each item.

2.02 SQUARE CEILING DIFFUSERS - 4-WAY THROW

A. High performance type diffuser incorporating short throws and low NC levels. Titus model TMS, Carne series SF, Price model SCD, Metal Aire series 5800, and Krueger series 1400.

B. Diffusers to be aluminum unless otherwise indicated, louvered face furnished with frame type appropriate to installation.

C. Diffuser shall have throw characteristics of a round diffuser having a horizontal 4-way throw pattern.

D. Louver cones shall be one-piece construction with no corner joints.

E. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.03 SIDE-WALL REGISTERS AND GRILLES

A. Titus Series 300 (supply) and Series 350 (return/exhaust), Carnes Model R Series, Price Model 520 (Supply) or 530 (return/exhaust), Metal Aire Series V4000 or H4000, Krueger Series 880, Tuttle & Bailey A54 (supply) and A70D (return/exhaust), Raymon Series RA.

B. Aluminum unless otherwise indicated, with frame type appropriate to installation.

C. Double deflection type blade supply registers and supply grilles allow deflection adjustment in all direction.

D. Opposed blade volume control damper supply registers, operable from face.

E. Fixed blade, 45 degree core return and exhaust registers and grilles unless otherwise indicated.

F. Opposed blade volume control damper return registers, operable from face, where indicated.

G. Register and grille sizes as shown on drawings and/or as scheduled.

H. White, baked enamel finish or powder coat finish, unless otherwise indicated.

I. Screw holes on surface counter sunk to accept recessed type screws.

2.04 EGGCRATE GRILLE

A. Titus model 50, Carnes model RAE or RAT, Price model 80, Metal Aire model CC, Krueger model EGC, Tuttle & Bailey CRE 500, or Raymon model ECR.

B. Aluminum construction with frame type appropriate to installation.

C. Grille face 1/2" x 1/2" or 1" x 1" grid pattern 1/2" deep with a minimum of 85% free area.

D. Grille sizes and finishes as shown on drawings and/or as scheduled.

E. White, baked enamel finish or powder coat finish, unless otherwise indicated.

F. Screw holes on surface counter sunk to accept recessed type screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.

B. Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.

C. Seal connections between ductwork drops and diffusers/grilles airtight.

D. Blank off unused portion of linear slot diffusers and linear bar diffusers and grilles.

E. Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

F. In clean rooms and animal holding rooms, caulk space between diffuser or grille and ceiling or wall to be air and watertight. User clear, non-hardening silicone sealant compatible with ceiling or wall surfaces. Sealant shall be resistant to microbiological growth.

END OF SECTION

This Page Left Blank Intentionally

SECTION 23 41 00
PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes specifications for air system filters. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Submittals
   7. Operation and Maintenance Data
   8. Design Criteria

C. PART 2 - Products
   1. Manufacturers
   2. Panel Filters
   3. MERV 8 Filters
   4. Housings for Panel Filters
   5. Housings for MERV 8 Filters
   6. Filter Gauges

D. PART 3 - EXECUTION
   1. Installation
   2. Filter Gauges

1.02 RELATED WORK

A. Section 23 07 00 - HVAC Insulation
B. Section 23 73 13 - Modular Indoor Central-Station Air-Handling Units
C. Section 23 72 00 – Air-to-Air Energy Recovery Equipment

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. ASHRAE Standard 52
B. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors
C. UL 586 – Standard for High Efficiency Particulate Air Filter Units
D. UL 900 – Standard for Air Filter Units

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Include data concerning dimensions, materials, efficiencies, installation instructions and appropriate identification.

C. Independent test reports verifying filter performance, test procedures and ratings.

D. Provide two (2) extra sets of filters for each unit that contains filters.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.08 DESIGN CRITERIA

A. Use UL Class 1 or Class 2 filters unless noted otherwise (Reference applicable UL standard referenced).

B. Efficiencies indicated in this section are based on ASHRAE Standard 52.

C. Fan motors have been selected to operate against the resistance of dirty filters as specified in this section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. American Air Filter, Barnebey-Cheney, Cambridge, Continental, Flanders, Camil-Farr, Mine Safety Appliances, Research Products, BLC Industries or approved equal.

2.02 PANEL FILTERS

A. Use 1" (or as scheduled) thick fiberglass blanket enclosed in a cardboard frame and reinforced with a perforated metal retainer on the air leaving side. Coat media with flameproof, non-volatile adhesive.

B. Media nominal rating to be 500 FPM face velocity, 0.15 inch WG initial resistance, 0.50 inches WG recommended final resistance. Average arrestance of filter media shall be 80%.

C. Provide filter holding frame.

2.03 MERV 8 FILTERS

A. Use 2" thick, pleated panels, 100% synthetic, self supported media fully bonded and sealed in cardboard frame.

B. Media nominal rating to be 500 FPM face velocity, 0.20 inch WG initial resistance, 1.0 inches WG recommended final resistance. Average arrestance of filter media shall be 90-92%.

C. Furnish a side access housing or holding frame as scheduled.

D. Filter tracks shall be constructed to provide clearance between the pre-filter and final-filter media to facilitate the installation of static pressure tips.

2.04 HOUSINGS FOR PANEL FILTERS

A. Manufactured by air handling unit manufacturer, filter media manufacturer, or contractor fabricated. Casing and tracks constructed of galvanized or enameled steel or aluminum. Provide access to the media tracks from outside the casing so media and be readily changed.

2.05 HOUSINGS FOR MERV 8 FILTERS

A. Housing or holding frame to be of the same manufacturer as filter media or provided by the air handling unit manufacturer. Contractor fabricated housings or filter racks will not be accepted. Casing and tracks constructed of galvanized or enameled steel or aluminum. Provide access to the media tracks from outside the casing so media and be readily changed. Filter tracks shall be constructed to provide clearance between the pre-filter and final-filter media to facilitate the installation of static pressure tips.

2.06 FILTER GAUGES

A. Manufacturers: Dwyer, or approved equal.

B. Direct reading, dial type, diaphragm actuated, in a metal case. Lettering shall be black figures on white background. Provide front recalibration adjustment.

C. Provide gauges with the following ranges:

Filter Type	Scale Range (inch W.G.)
Panel Filters	0.0 to 0.5
MERV 8	0.0 to 1.0

D. Provide one gauge for each filter bank, suitable for flush or surface mounting. Include an air filter gauge accessory package consisting of mounting bracket, aluminum tubing, two static pressure tips, and vent valves for each gauge.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Where air handling equipment is to be used for temporary heating or ventilation of a facility, do not operate the equipment until specified filter media has been installed. Contractor shall be responsible for maintaining the cleanliness of air handling apparatus and air distribution systems during construction through regular inspection and changing of filter media throughout the construction period.

B. Where air handling apparatus is used during the construction period, install new filter media prior to start of air balancing. Additionally, deliver two new sets of media to the owner prior to substantial completion.

C. Install units as shown on drawings and details according to manufacturer's instructions.

D. Reinforce filter holding frames per manufacturer's instructions.

E. Maintain necessary clearance for changing filters.

3.02 FILTER GAUGES

A. Install filter gauge static pressure tips upstream and downstream of filters. Mount gauge on outside of filter housing or filter plenum in accessible position outside of the unit housing, install tubing and gauge valves between gauge and sensor tips. Adjust and level each gauge.

END OF SECTION

SECTION 23 55 00
FUEL-FIRED HEATERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes specifications for fuel-fired heaters. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Submittals
   7. Operating and Maintenance Data
   8. Warranty

C. PART 2 - Products
   1. Gas Fired Unit Heaters
   2. Gas Detection System

D. PART 3 - EXECUTION
   1. Installation
   2. Gas Fired Unit Heaters

1.02 RELATED WORK

A. Section 23 11 00 - Facility Fuel Piping
B. Section 23 05 23 - General-Duty Valves for HVAC Piping
C. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
D. Section 23 05 13 - Common Motor Requirements for HVAC Equipment
E. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment
F. Section 23 51 00 - Breechings, Chimneys, and Stacks

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. AGA American Gas Association
B. ANSI Z83.4 Direct Gas Fired Makeup Air Heaters
C. ANSI Z83.6 Gas Fired Infrared Heaters
D. GAMA Gas Appliance Manufacturers Association
E. NEC National Electrical Code

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Include specific manufacturer and model numbers, equipment identification corresponding to project drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power requirements and wiring diagrams, filter information and information for all accessories.

C. Provide two (2) extra sets of filters for each unit that contains filters

1.07 OPERATING AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.08 WARRANTY

A. Gas fired unit heaters heat exchangers warranted for five years. Remainder of unit heater components warranted for 1 year from startup.

PART 2 - PRODUCTS

2.01 GAS FIRED UNIT HEATERS

A. Manufacturers: Modine, Reznor, Sterling or Trane.

B. Horizontal discharge, direct vent sealed combustion type. AGA certified for use with natural gas. Minimum combustion efficiency (Ec) of 80%. All wiring shall comply with the National Electrical Code.

C. Construct casing of cold rolled steel with baked enamel finish. Direct drive propeller type fan statically and dynamically balanced and including fan safety guard and adjustable vertical and horizontal louvers for control of air diffusion on discharge of unit. Aluminized steel burners, electronic spark ignition with electronic flame supervision and timed lockout control. Heavy gauge stainless steel heat exchanger and factory installed induced draft blower for heat exchanger prepurge and combustion gas venting. Provide a hinged access panel on the bottom of the unit to access the burner or provide side access (pull out drawer) to burner assembly. Single point power connection. Unit must be approved for vertical or side wall venting

D. Provide spark ignited intermittent pilot system with electronic flame supervision.

E. AGA gas controls, including manual main shut off valve, 24 volt redundant combination gas control valve with 100 percent safety shut off valve and main gas pressure regulator.

F. Provide fan controls and limit safety controls including but not limited to:
- Pressure switch to verify combustion/exhaust gas airflow
- High limit controls
- Fan time delay to delay the fan start until the heat exchanger reaches a predetermined temperature and to allow the fan to operate, after burner shut down, to remove heat exchanger residual heat.

G. This Contractor shall provide all temperature control and interlocking necessary to perform the specified control sequence. All relays, transformers and controls are to be in enclosures. Provide factory installed 24 volt control transformer along with 24 v wall mounted thermostat. All wiring shall be in conduit in accordance with Division 26 00 00 - Electrical and comply with the NEC.

H. Provide an air inlet/vent termination assembly and threaded hanger connections.

2.02 GAS DETECTION SYSTEM

A. Manufacturers: Honeywell, Toxalert, Opera, Armstrong Monitoring Crop, Brasch, American Gas Safety (AGS), or equal.

B. Provide a controller to monitor integral or remote electrochemical carbon monoxide (CO) and nitrogen dioxide (NO2) sensors and with integral relay(s) to start the exhaust fan(s) per the drawings. When a sensor indicates a gas concentration of 35 ppm (CO), 1 ppm (NO2) or higher, the associated ventilation system shall start and an LED on the face of the controller shall indicate “Warning level” (ventilation system on) operation. If the gas concentration reaches 50 ppm (CO), 2 ppm (NO2) or higher a red alarm LED on the face of the controller shall light and the audible alarm shall sound and an alarm set of contacts shall close. The audible alarm shall have a momentary push button silence switch.

C. Provide “Sensor Failure” indication for each sensor. The sensor shall be designed such that the controller can detect when a sensor has failed. Provide an alarm or LED on the face of the controller panel for each sensor input to indicate sensor failure. The detection of a failed sensor shall sound the audible alarm.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units as shown on plans, as detailed and according to the manufacturer’s installation instructions.

B. Pipe vents from gas regulator to outside (where regulators are provided).

C. Install remote panels and thermostats where indicated on the drawings. Provide all wiring between remote panels/thermostats and the gas fired item.

3.02 GAS FIRED UNIT HEATERS

A. Install units and connect gas, combustion air and vent piping as instructed by the manufacturer and in compliance with applicable code requirements. Suspend from building structure to maintain headroom beneath units as indicated in section 23 05 29. Connect combustion air and venting to outside of building as indicated on the drawings and terminate per the manufacturer's instructions.

END OF SECTION

This Page Left Blank Intentionally

SECTION 23 72 00

AIR-TO-AIR ENERGY RECOVERY VENTILATOR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes specification for air-to-air energy recovery ventilators for indoor installation. Within this document, these units may be referred to as Energy Recovery Ventilator (ERV) for brevity. Included are the following topics:

B. PART 1 - GENERAL
1. Scope
2. Related Work
3. Submittals
4. Quality Assurance
5. Warranty
6. Coordination

C. PART 2 – PRODUCTS
1. Manufacturers
2. General
3. Cabinet
4. Blowers
5. Heat Exchanger
6. Filter
7. Motorized Dampers

D. PART 3 - EXECUTION
1. Examination
2. Installation
3. Mounting
4. Start-up Service

1.02 RELATED WORK

A. Section 23 05 13 – Common Motor Requirements for HVAC Equipment.
B. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
B. Section 23 31 00 – HVAC Ducts and Casings.

1.03 SUBMITTALS

A. Product data: For each type or model of Energy Recovery Ventilator, include the following:

1. Unit performance data for both Supply Air and Exhaust Air, with system operating conditions indicated.

2. Enthalpy plate performance data for both summer and winter operation.

3. Motor ratings and unit electrical characteristics.

4. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.

5. Estimated gross weight of each installed unit.

6. Filter types, quantities, and sizes

7. Installation, Operating and Maintenance manual (IOM) for each model.

B. Shop Drawings: For air-to-air energy recovery ventilators, include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data for air-to-air energy recovery ventilator

1. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

2. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

3. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in the Owner’s name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain Air-to-Air Energy Recovery Ventilator with all appurtenant components or accessories from a single manufacturer.

B. For the actual fabrication, installation, and testing of work under this section, use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.

C. Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.

D. Certifications: The energy recovery cores used in these products shall be third party Certified by AHRI under its Standard 1060 for Energy Recovery Ventilators. AHRI published certifications shall confirm manufacturer's published performance for airflow, static pressure, temperature and total effectiveness, and exhaust air leakage (EATR). Products that are not currently AHRI certified will not be accepted. OACF shall be no more than 1.02 and EATR shall be at 0% against balanced airflow.

E. Every unit to be factory tested prior to shipping: Motor Dielectric Voltage-Withstand Bench Test, Unit Dielectric Voltage-Withstand Test, Continuity of Internal Control Circuits Test, Unit Amperage Test

1.05 WARRANTY

A. The energy transfer core shall have a ten year warranty against defects in material or workmanship.

1.06 COORDINATION

A. Coordinate size and location of all building penetrations required for installation of each Energy Recovery Ventilator and associated electrical systems.

B. Coordinate sequencing of construction for associated plumbing, HVAC, electrical supply.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mitsubishi Lossnay, Greenheck Minicore, Samsung Fresh Access, or approved equal.

2.02 GENERAL

A. The ERV unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, control circuit board and blowers with motors, filters, and insulated foam air guides. Each unit will have an automatic by-pass damper system for economic operation under certain conditions. The unit shall have factory installed control board with functions for local, remote, and optional control modes.

2.03 CABINET

A. The cabinet shall be fabricated of galvanized steel, and covered with polyurethane foam insulation as necessary with steel mounting points securely attached.

2.04 BLOWERS

A. The unit shall be furnished with two (2) direct drive centrifugal blowers running simultaneously supplying and extracting air at the same rate for balanced ventilation air flow.

B. The blower motors shall be a directly connected to the blower wheels and have permanently lubricated bearings.

C. The blowers and motors shall be mounted for quiet operation.

2.05 HEAT EXCHANGER

A. The heat exchanger element shall be constructed of specially treated cellulous fiber membrane separated by corrugated layers to allow total heat (sensible and latent) energy recovery from the exhaust air to the supply air or from the supply air to the exhaust air as determined by design conditions.

B. The element shall have protective filters installed at both the supply and exhaust sides with an access cover to allow easy maintenance.

2.06 FILTER

A. The ERV shall be equipped with factory installed air filters located at each intake face (both supply and exhaust sides) of the core to clean the air and prevent clogging.

2.07 MOTORIZED DAMPERS

A. The ERV shall be equipped with motorized intake and exhaust dampers interlocked with occupied mode of system.

B. Where ERV is not equipped with motorized intake and exhaust dampers, install in locations as shown on plans and interlock with occupied mode of the system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.

B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.

C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer’s installation instructions as documented in manufacturer’s IOM, Best practices, and all applicable building codes.

B. Install unit with clearances for service and maintenance.

C. Install in horizontal orientation above lay-in ceiling.

3.03 MOUNTING

A. Mounting of the ERV shall be as indicated in the plans and drawings. The ERV shall not require any condensate pan or receptacle nor condensate drain or piping. Mounting may be horizontal or vertical and the unit may be inverted as required by ductwork connection

3.04 START-UP SERVICE

A. Contractor to perform startup service. Clean entire unit and install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 “Testing, Adjusting and Balancing” and comply with provisions therein.

END OF SECTION

This Page Left Blank Intentionally

SECTION 23 81 26
SPLIT-SYSTEM DUCTLESS AIR CONDITIONERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes specifications for split-system ductless heat pump and cooling only type systems. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Submittals
   7. Operation and Maintenance Data
   8. Delivery, Storage and Handling
   9. Warranty

C. PART 2 - Products
   1. Units up to 3 tons (10.5 kW)
   2. Cooling Coil Condensate Piping
   3. Integral Condensate Pump
   4. Refrigerant Piping and Accessories

D. PART 3 - EXECUTION
   1. Installation
   2. Refrigerant Piping and Accessories
   3. Startup

1.02 RELATED WORK

A. Section 23 05 00 - Common Work Results for HVAC
B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment
C. Section 23 23 00 - Refrigerant Piping

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A.	ARI 210/240	Unitary Air Conditioning and Heat Pump Equipment
B.	ARI 365	Commercial and Industrial Unitary Air Conditioning Condensing Units
C.	ASHRAE 15	Safety Standard for Refrigeration Systems
D.	ASHRAE 90.1-2022	Energy Standard for Buildings Except Low Rise Residential Buildings
E.	NEC	National Electrical Code
F.	ASTM B117	Standard Practice for Operating Salt Spray (fog) Apparatus
G.	UL 60335-2-40	Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

B. Rate unit performance in accordance with the latest edition of ARI Standard 365 or ARI Standard 210/240, whichever is applicable for the equipment.

C. Construct units in accordance with ASHRAE 15, UL standards and the NEC. Units shall carry the UL label.

D. Factory run and test units to see that each control device operates properly. Pressure test, evacuate, charge with holding charge of refrigerant and full oil charge prior to shipping from the factory.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Submit outdoor unit and indoor unit shop drawings including the following information: specific manufacturer and model numbers, dimensional and weight data, required clearances, materials of construction, capacities and ratings, efficiencies, stages of unloading capacity achievable without hot gas bypass, refrigerant type and charge, component information, size and location of piping connections, electrical connections, wiring diagrams, and information for all specialties and accessories.

C. Submit manufacturer's installation and start-up instructions, maintenance data, troubleshooting guide, parts lists, controls and accessories.

D. At substantial completion, submit warranty certificate and copy of start-up report.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.08 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer's instructions for storing, rigging, unloading, and transporting units. Protect units from physical damage. Leave factory-shipping covers in place until installation.

B. Ship units to jobsite fully assembled.

1.09 WARRANTY

A. Provide a one year parts and labor warranty on the entire unit beginning upon substantial completion of project.

B. Provide a five year parts warranty on the compressor(s) beginning upon substantial completion of project.

PART 2 - PRODUCTS

2.01 UNITS UP TO 3 TONS (10.5 kW)

A. Manufacturers: Carrier, Daikin, Friedrich, LG, Mitsubishi, Samsung, Toshiba, York (JCI), or approved equal.

B. GENERAL

1. Provide a heat pump or cooling only unit, as indicated, with an indoor ceiling or wall mounted fan coil with matched outdoor unit. The system shall use R-32 or R-454B refrigerant.

2. Indoor fan coil unit(s) shall include a coil, fan and fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit(s) shall be furnished with integral mounting hardware.

3. Outdoor unit shall be factory-assembled and suitable for ground, rooftop, or wall mounting. Unit shall include a compressor, a coil and propeller fan, metering device(s), and a control box. Provide vertical or horizontal discharge as shown on the drawings.

4. The minimum efficiency shall be 16.0 SEER for cooling only systems and 10.0 HSPF for heat pump systems.

C. INDOOR FAN COIL UNIT (Wall/Ceiling Mounted)

1. Provide a fully insulated cabinet with a galvanized steel sub-chassis and discharge and inlet grilles constructed from high-impact plastic. The unit shall include a filter track with factory-supplied cleanable filters and an integral wall mounting bracket.

2. Provide a direct-drive fan with automatic motorized air vanes. The fan motor shall have permanently lubricated ball bearings and inherent overload protection with a minimum of three speeds. Provide adjustable horizontal and/or vertical discharge louvers.

3. Construct the coil of copper tubes with aluminum fins bonded to the tubes by mechanical expansion. Coat the coil for enhanced wettability. Provide a corrosion-resistant drip pan under the coil with side drain connections.

4. Provide an outdoor air intake duct connection.

D. OUTDOOR UNIT

1. Construct cabinet of heavy gauge galvanized steel coated with a baked enamel finish on the inside and outside that meets the Federal Test Standard No. 141 (Method 6061) 500-hour salt spray exposure test. Provide access panels for the compressor, fan, and control components. Include an acoustic lining.

2. Provide a hermetic scroll or rotary swing variable speed compressor with operating oil charge. The compressor motor shall be NEMA class F and suitable for operation in a refrigerant atmosphere. Include motor temperature and current protection, a crankcase heater, suction and discharge line service valves with gage ports, a refrigerant accumulator, and a reversing valve for heat pump systems. Mount compressor on rubber vibration isolators.

3. Construct coil from aluminum fins mechanically bonded to seamless copper tubing that has been cleaned, dehydrated and sealed. The refrigeration circuit shall be factory leak tested.

4. Provide a direct drive propeller fan with vertical or horizontal discharge as shown on the drawings and guards constructed from heavy gauge PVC-coated wire or galvanized steel. The fan shall be statically and dynamically balanced. Provide a totally enclosed single phase motor with class B insulation, permanently lubricated ball bearings, inherent overload protection, and inherent shaft corrosion resistance.

5. Provide a stacking kit for installation (not for heat pumps). Provide a wall mounting kit for installation.

6. Condensing unit controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:
    - A time delay control sequence.
    - Outdoor fan failure detection.
    - Compressor motor current and temperature overload protection.
    - Compressor low and high pressure protection.

E. CONTROLS

1. Provide a microprocessor system to control space temperature, determine optimum fan speed, and conduct self-diagnostics. The temperature control range shall be from 62°F to 84°F. Provide a wired remote control for user interfacing.

2. Provide the following system control functions:
    - An automatic restart after power failure at the same operating conditions as at failure.
    - A timer function to provide a minimum 24-hour timer for system auto start / stop.
    - Return air temperature sensing.
    - Automatic air sweep control to provide on or off activation of air sweep louvers.
    - Dehumidification mode for increased latent capacity.
    - Fan-only operation for room air circulation when no cooling or heating is required.
    - Diagnostics to continuously monitor unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit.
    - Indoor fan speed control shall be user selectable for high, medium, low, or microprocessor-controlled operation during all operating modes.
    - Automatic heating to cooling changeover with a deadband for preventing rapid cycling between heating and cooling.
    - A liquid level sensor in the condensate reservoir to stop cooling if the liquid level is too high.

3. Provide wired thermostat for wall mounting.

F. ELECTRICAL

1. The system shall be fed by 208/230-volt, single phase, 60 hertz power.

2. Division 26 contractor shall provide conduit for both the power and control wiring between indoor unit and outdoor unit.

3. All power and control wiring must be installed per NEC and all local electrical codes.

2.02 COOLING COIL CONDENSATE PIPING

A. ASTM B88, type L hard temper copper tubing with ASTM B145/ANSI B16.23 cast red bronze or ASTM B75/ANSI B16.29 wrought solder-type drainage fittings.

B. Schedule 40 PVC may be used in accordance with WI Admin. Code at Contractor's option.

2.03 INTEGRAL CONDENSATE PUMP

A. Provide an integral condensate pump that consists of an internal reservoir/sensor assembly and a remote sound shielded pump assembly.

2.04 REFRIGERANT PIPING AND ACCESSORIES

A. Provide refrigerant piping and accessories in accordance with Section 23 23 00.

B. Precharged tubing line sets may be used on systems 3 tons and less in size

C. Provide precharged refrigerant lines that can be oriented to connect to the side or back of unit. Both refrigerant lines shall be insulated for heat pump applications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units, piping and accessories in accordance with the manufacturer's written instructions and recommendations. Mount condensing unit(s) on a [precast concrete pad on grade] [poured concrete pad on grade] [roof mounted curb per detail] [wall mounting kit] as indicated on the drawings.

B. Maintain adequate service access and airflow clearances for all components as recommended by the manufacturer and as indicated on the drawings.

C. Charge unit(s) with full oil charge and refrigerant charge based on the entire refrigeration system pipe size and length.

D. Provide all control wiring in conduit in compliance with Section 23 09 14 and Division 26 00 00 - Electrical.

E. Coordinate power wiring requirements with Division 26 00 00 contractor.

3.02 REFRIGERANT PIPING AND ACCESSORIES

A. Install refrigerant piping and accessories in accordance with Section 23 23 00 and the manufacturer's instructions.

B. The unit manufacturer shall verify the final refrigeration pipe sizing process to ensure conformance with requirements such as maximum lengths, refrigerant velocities, unloading considerations, and proper oil return. The Division 23 contractor shall provide refrigeration piping drawings from the field which detail how the piping will be installed.

3.03 STARTUP

A. Adjust units for maximum operating efficiency, adjust all controls to required final settings and demonstrate that all components are functioning properly. Submit four copies of a written startup report following the initial startup. Include in the report: work done to the system, all readings taken, a statement certifying that the refrigeration system(s) are leak free and a statement certifying that the unit(s) have been placed in proper running condition as recommended by the manufacturer and as intended in the drawings and specifications.

END OF SECTION

SECTION 23 82 00
HEATING AND COOLING TERMINAL UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Scope. This section includes specification for heating and cooling terminal equipment using electricity as the source. Included are the following topics:

B. PART 1 - GENERAL
   1. Scope
   2. Related Work
   3. Reference
   4. Reference Standards
   5. Quality Assurance
   6. Submittals
   7. Operation and Maintenance Data
   8. Design Criteria

C. PART 2 - Products
   1. Electric Radiant Panels

D. PART 3 - EXECUTION
   1. Installation
   2. Electric Heaters

1.02 RELATED WORK

A. Section 23 05 23 - General-Duty Valves for HVAC Piping
B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment
C. Section 23 33 00 - Air Duct Accessories
D. Section 23 41 00 - Particulate Air Filtration

1.03 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

A. ARI 210 Standard for Unitary Air-Conditioning Equipment
B. ARI 410 Standard for Forced-Circulation Air-Cooling and Air-Heating Coils
C. CS 140
D. NEMA
E. NEC

1.05 QUALITY ASSURANCE

A. Refer to Division 1, General Conditions, Equals and Substitutions.

1.06 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals.

B. Include dimensions, capacities, materials of construction, ratings, weights, wiring diagrams, and appropriate identification for all equipment in this section. Include color selection chart where applicable.

C. Provide two (2) extra sets of filters for each unit that contains filters

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.08 DESIGN CRITERIA

A. Forced Circulation Coils: Ratings certified in accordance with ARI 410.

B. Electrical Equipment and heaters shall be UL listed for the service specified.

C. Electrical components and work must be in accordance with National Electrical Code.

PART 2 - PRODUCTS

2.01 ELECTRIC RADIANT PANELS

A. Manufacturers: Markel, Raywall, Redd-I, Berko, Qmark, Marley, Ouellet or approved equal.

B. Assembly: UL listed and labeled, with thermal box and cover, and controls.

C. Heating Elements: Enclosed copper tube element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material, and two layers of insulation.

D. Ceiling Panels: 24 x 24 inch or 24 x 48 inch aluminum pans; manufactured and assembled to configuration indicated. Configure panels within T-bar ceiling module or provide plaster trim frame as indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's installation instructions.

B. Install branch water or steam/condensate piping to each unit with a minimum of three elbows to allow for expansion and contraction of the piping system.

C. Coordinate location of units with other trades to assure correct recess size for recessed units.

D. After installation, provide protective covers to prevent accumulation of dirt on units during balance of construction.

3.02 ELECTRIC HEATERS

A. Install units where indicated on the drawings and details. Where heaters are indicated to be installed in ductwork, provide manufacturers recommended upstream and downstream ductwork to prevent overheating problems.

B. Units will be wired by the Electrical Contractor.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 01 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF PROJECT

A. This project consists of two phases. Phase 1 is a new addition onto the existing fire station and phase 2 is the remodel of the existing fire station. All shall include all material to provide for the completion of all work associated with the following, but not be limited to the following:

1. Temporary services.
2. Site utility work.
3. Low voltage conduit and wire.
4. Panelboards.
5. Surge protection.
6. Disconnects.
7. Engine generator and transfer switch.
8. Wiring Devices.
9. Interior lighting.
10. Exterior lighting.

B. Telecom, sound, and security design provided by others, but rough-ins by E.C. Coordinate with telecom provider for more information.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

1.03 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Equipment, fixtures, material and installation shall conform to the requirements of the local Building Department, the serving utility companies, the National Electrical Code, National Electrical Safety Code, Life Safety Code, Occupational Safety and Health Act, and applicable national, state, and local codes, ordinances, and regulations.

B. All equipment shall be equal to, or exceed, the minimum requirements of NEMA, IEEE, and UL.

C. Should any change in Drawings or Specifications be required to comply with governmental regulations, the Contractor shall notify Architect/Engineer prior to execution of the Work. The work shall be carried out according to the requirements of such code in accordance with the instruction of the Architect/Engineer and at no additional cost to the Owner.

D. The provisions of Standards, Codes, Laws, Ordinances, etc., shall be considered minimum requirements. In case of conflict between their published requirements, the Owner's Representative shall determine which is to be followed and his decision shall be binding. Specific requirements of this specification or the drawings, which exceed the published requirements, shall take precedence over them.

1.04 QUALITY ASSURANCE

A. Work under this Division shall be supervised by a person who holds a certification issued by the Wisconsin Department of Safety and Professional Services as a certified electrical contractor, certified electrical contractor-restricted or certified master electrician.

B. Work under this Division shall be executed by a person who holds a certification issued by the Wisconsin Department of Safety and Professional Services as a certified electrical contractor, certified electrical contractor-restricted, certified master electrician, certified journeyman electrician or certified beginning electrician.

1.05 FEES

A. All local fees, permits, and services of inspection authorities shall be obtained and paid for by the Contractor. The Contractor shall cooperate fully with local utilities with respect to their services. The owner is responsible for any costs to be incurred relative to power service (primary and/or secondary) and telephone service provided by the utilities.

1.06 SCOPE OF WORK

A. Electrical Installations: This division of the specifications covers the electrical systems of the project. It includes work performed by the electrical trades as well as trades not normally considered as electrical trades.

B. Provide all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor consumable items, fees, licenses, etc., necessary to provide complete systems. Perform start-up and checkout on each item and system to provide fully operable systems.

C. Examine and compare the Electrical Drawings with these specifications and report any discrepancies between them to the Architect/Engineer and obtain from him written instructions for changes necessary in the work. At time of bid the most stringent requirements must be included in the bid.

D. Examine and compare the Electrical Drawings and Specifications with the Drawings and Specifications of other trades and report any discrepancies between them to the Architect/Engineer and obtain from him written instructions for changes necessary in the work. At time of bid, the most stringent requirements must be included in said bid.

E. Install and coordinate the electrical work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interferences in a manner approved by the Architect/Engineer. All changes required in the work of the Contractor, caused by his neglect to do so, shall be made by him at his own expense.

F. It is the intent of the Drawings and Specifications to provide a complete workable system ready for the Owner's operation. Any item not specifically shown on the Drawings or called for in the Specifications, but normally required to conform with the intent, are to be considered a part of the Contract.

G. All materials furnished by the Contractor shall be new and unused (temporary lighting and power products are excluded) and free from defects. All materials used shall bear the Underwriter's Laboratory, Inc. label provided a standard has been established for the material in question.

H. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment or material shall be the product of one manufacturer throughout the entire project. Multiple manufacturers will not be permitted.

1.07 DEFINITIONS

A. “PROVIDE” means to furnish, install, purchase, transport, place, erect, connect, wire, test, and turn over to Owner, complete and ready for regular operation, the particular Work referred to.

B. “INSTALL” means to set in place, join, unite, fasten, link, attach, wire, set up, or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation, the particular Work referred to.

C. “FURNISH” means to purchase, supply, and deliver to job site, all materials, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application for the particular Work referred to.

D. “WIRE”, “WIRING” means the inclusion of all raceways, fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such Work.

E. “CONDUIT” means the inclusion of all fittings, hangers, supports, sleeves, etc

F. “AS DIRECTED” means as directed by the Architect/Engineer, or his representative.

G. “CONCEALED” means embedded in masonry or other construction, installed behind wall furring or within double partitions, or installed above hung ceilings.

1.08 COORDINATION OF THE WORK

A. Certain materials will be provided by other trades. Examine the Contract Documents to ascertain these requirements.

B. Carefully check space requirements with other trades and the physical confines of the area to insure that all material can be installed in the spaces allotted thereto including finished suspended ceilings and the spaces within the existing building. Make modifications thereto as required and approved.

C. Transmit to other trades all information required for work to be provided under their respective Sections in ample time for installation.

D. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items of work that require access so that the ceiling trade will know where to install access doors and panels.

E. Coordinate, project and schedule work with other trades in accordance with the construction sequence.

F. The Drawings show only the general run of raceways and approximate location of outlets. Any significant changes in location of outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Architect/Engineer and receive his approval before such alterations are made. All such modifications shall be made without additional cost to the Owner.

G. Obtain from the Architect/Engineer in the field the location of such outlets or equipment not definitely located on the Drawings.

H. Circuit “tags” are used to show the circuit number and the panel designation for wiring devices and luminaires. Equipment circuits are indicated on equipment connection schedule. Show the actual circuits numbers on the finished record drawings and on panel directory card. Where circuiting is not indicated, Electrical Subcontractor must provide required circuiting in accordance with the loading indicated on the drawings and/or as directed.

I. Adjust location of conduits, panels, equipment, pull boxes, fixtures, etc. to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each raceway prior to fabrication.

1. Right-of-Way
    a. Lines that pitch have the right-of-way over those that do not pitch. For example: steam, condensate, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.
    b. Make offsets, transitions and changes in direction in raceways as required to maintain proper headroom in pitch of sloping lines whether or not indicated on the Drawings.

J. Wherever the work is of sufficient complexity, prepare additional Detail Drawings to scale similar to that of the bidding Drawings of the same size as the Contract Drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the Drawings as to the area to which it applies. Submit for review Drawings clearly showing the work and its relation to the work of other trades before commencing shop fabrication or erection in the field.

K. Coordinate with the local Electric Utility Company and the local Telephone Company as to their requirements for service connections and provide all necessary materials, labor and testing.

L. Coordinate with contractors for work under other Divisions of this specification for all work necessary to accomplish this contractor's work.

1.09 PROGRESS OF WORK

A. The Contractor shall order the progress of his work to conform to the progress of the work of other trades and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from the defective or ill-timed work performed under this section shall be borne by the Contractor.

1.10 DELIVERY, STORAGE AND HANDLING

A. Ship and store all products and materials in a manner that will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement or repair. Any such repairs shall be subject to review and acceptance of the manufacturer and Architect/Engineer.

B. Deliver materials in manufacturer's unopened container fully identified with manufacturer's name, trade name, type, class, grade, size and color.

C. Store materials suitably sheltered from the elements, but readily accessibly for inspection by the Architect/Engineer until installed. Store all items subject to moisture damage in dry, heated spaces.

1.11 EQUIPMENT ACCESSORIES

A. Provide supports, hangers and auxiliary structural members required for support of the work.

B. Furnish and set all sleeves for passage of raceways through structural, masonry and concrete walls of floors and elsewhere as will be required for the proper protection of each raceway passing through building surfaces.

C. Wall mounted equipment may be directly secured to wall by means of steel bolts. Maintain at least 1" air space between equipment and supporting wall. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars. Prefabricated steel channels providing a high degree of mounting flexibility, such as those manufactured by Kindorf, Glob-Strutt and Unistrut, may be used for mounting arrays of equipment.

1.12 OPERATIONS AND MAINTENANCE MANUALS

A. General: Provide operations & maintenance (O&M) manuals in accordance with the Contract Documents.

1. Provide two (2) copies of each manual.
2. Manuals shall be 8-1/2 inches X 11 inches in hard cover 3-ring loose-leaf binders.
3. Manuals shall be complete and in Owner's hands prior to turning building over to Owner and at least 10 days prior to instruction to operating personnel.

B. Provide manufacturer's literature as regularly published by the respective manufacturers for proper preventative and comprehensive maintenance.

C. Provide O&M manuals including but not limited to the following:

1. Alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.
2. Operating instructions for complete system including:
   a. Normal starting, operating, and shut-down.
   b. Emergency procedures for fire or failure of major equipment.
   c. Summer and winter special procedures, if any.
   d. Day and night special procedures, if any.
3. Maintenance instruction including:
   a. Proper lubricants and lubricating instructions for each piece of equipment, and date when lubricated.
   b. Necessary cleaning, replacement and/or adjustment schedule.
4. Manufacturer's data for each piece of equipment including:
   a. Installation instructions.
   b. Drawings and specifications.
   c. Parts list, including recommended items to be stocked.
   d. Complete wiring diagrams.
   e. Marked or changed prints locating all concealed parts and all variations from the original system design.
   f. Test and inspection certificates.

D. Refer to individual specification sections for additional O&M requirements.

1.13 RECORD DOCUMENTS

A. Prepare record (“as-built”) documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate installed conditions for:

1. Major raceway systems, size, and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.

2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

3. Approved substitutions, contract modifications, and actual equipment and materials installed.

1.14 GUARANTEE

A. Guarantee all material and workmanship for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified elsewhere, such longer term to apply. Within 24 hours after notification, correct any deficiencies that occur during the guarantee period at no additional cost to the Owner, all to the satisfaction of the Owner and Architect/Engineer. Obtain similar guarantees from subcontractors, manufacturers, suppliers and subtrade specialists.

B. See Division 1 – Closeout Procedures, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. Applicable equipment and materials shall be listed by Underwriters' Laboratories and Manufactured in accordance with ASME, NEMA, ANSI or IEEE standards, and as approved by local authorities having jurisdiction as mentioned in Division 1.

B. If products and materials are specified or indicated on the Drawings for a specific item or system, use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of Shop Drawings where Shop Drawings are required or as approved in writing where Shop Drawings are not required.

C. All equipment capacities, etc. are listed for job site operating conditions. All equipment sensitive to altitudes or ambient temperatures to be derated and method of derating shown on Shop Drawings. Where operating conditions shown differ from the laboratory test conditions, the equipment to be derated and the method of derating shown on Shop Drawings.

2.02 SUBSTITUTION OF MATERIALS OR EQUIPMENT

A. All requests for substitution of materials or equipment shall be made in writing. The request for prior approval must be in the Engineers office not less than 10 days prior to the bid date. Samples of proposed substitute materials or equipment shall be submitted to the Engineer for review whenever they are requested. Bids shall be based only upon the specified materials and equipment, or substitutes that have received written acceptance from the Engineer prior to the bid.

B. Wherever the words "for approval" or "approved" are used in regard to manufactured specialties, or wherever it is desired to substitute a different make or type of apparatus for that specified, submit all information pertinent to the adequacy and adaptability of the proposed apparatus, and secure Architect/Engineer's acceptance before apparatus is ordered.

C. Wherever quantities or a definite make and size of apparatus are specified, the make and size of apparatus which is proposed must conform substantially (in regard to the operating results) to that specified or implied. Same shall apply to important dimensions relating to operation of apparatus in coordination with the rest of the system, or to properly fitting it into available space conditions. Any substitution of equipment or apparatus shall include all necessary revisions, as required to complete the installation.

D. Acceptance of substitutions, for equipment specified herein, will not be given merely upon submission of manufacturer's names and will be given only after receipt of complete and satisfactory performance data covering the complete range of operating conditions in tabular and graphical form. Furnish complete and satisfactory information relative to equipment dimensions, weight, etc. Acceptance of all equipment specified or shown on the Drawings, or substitutions submitted for that specified or shown on the Drawings, will be granted if such equipment, in the opinion of the Architect/Engineer, conforms to the performance requirements, space conditions, weight requirements and quality requirements. Any additional construction and design costs incurred as a result of any accepted substitution shall be borne by the Contractor. The opinion and judgment of the Architect/Engineer shall be final, conclusive, and binding.

2.03 SUBMITTALS

A. Submit through General or Prime Contractor. Refer to Division 1 – Section 'Submittals'.

B. Prepare and submit six (6) detailed hard copies or one (1) electronic copy of Shop Drawings for materials, systems, and equipment as listed herein, including locations and sizes of all openings in floor decks, walls, and floors.

C. The Work described in any Shop Drawing submission shall be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions, and proper coordination with all trades on the job. Each submitted Shop Drawing shall include a certification that all related job conditions have been checked and that no conflict exists.

D. All drawings shall be submitted sufficiently in advance of field requirements to allow ample time for checking and resubmitting as may be required. All submittals shall be complete and contain all required and detailed information.

E. Acceptance of any submitted data or Shop Drawings for material, equipment apparatus, devices, arrangements, and layout shall not relieve Contractor from responsibility of furnishing same of proper dimensions and weight, capacities, sizes, quantity, quality and installation details, to efficiently perform the requirements and intent of the Contract. Such acceptance shall not relieve Contractor from responsibility for errors, omissions, or inadequacies of any sort on submitted data or Shop Drawings.

F. Each Shop Drawing shall contain the following information.

1. Provide general information on each copy of the submittal.

    a. Project title.
    b. Reference to the applicable drawing and specification article.
    c. Identify each device per the schedules and drawings.
    d. Contractor and supplier identification, addresses and telephone numbers.
    e. Submittal Date.
    f. Tab each submittal with its specification section. Do not supply a complete submittal without breaking out each specification section.

2. Certification that the contractor has reviewed the submittal.

3. Refer to individual specification sections for additional information requirements.

G. Shop Drawing submittals shall be provided for each specific material, system, or equipment as identified herein.

1. As a minimum, make submittals on the following items:

   a. Raceways, conduit & wire
   b. Wiring devices and plates
   c. Panelboards
   d. Fuses
   e. Disconnect switches
   f. Motor controllers, starters, and contactors
   g. Lighting fixtures, lamps
   h. Special systems - fire alarm.

2. Refer to individual specification sections for additional submittal requirements.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 01 10

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

B. Requirements specified in Division 26 Section "Basic Electrical Requirements" apply to this Section.

C. This Section includes limited scope general construction materials and methods for application with electrical installations as follows:

1. Joint sealers for sealing around electrical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
2. Cutting, patching, and repairing.
3. Excavation, trenching, and backfill.
4. Waterproofing.
5. Supports.
6. Fastenings.
7. Testing equipment and materials.
8. Cleaning up.

1.02 DEFINITIONS

A. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.

2. Subbase: As used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.

3. Subgrade: As used in this Section refers to the compacted soil immediately below the slab or pavement system.

4. Unauthorized excavation: Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Engineer.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

PART 2 PRODUCTS

2.01 JOINT SEALERS

A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

B. Colors: As selected by the Engineer from manufacturer's standard colors.

C. Elastomeric Joint Sealers: Provide the following types:

1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.

2. Products: Subject to compliance with requirements, provide one of the following:

a. One-Part, Nonacid-Curing, Silicone Sealant
b. "Chem-Calk N-Cure 2000", Bostic Construction Products Division.
c. "Dow Corning 790", Dow Corning Corporation.
d. "Silglaze N SCS 2501", General Electric Company.
e. "Silpruf SCS 2000", General Electric Company.
f. "864", Pecora Corporation.
g. "Rhodorsil 5C", Rhone-Poulenc, Inc.
h. "Spectrum 1", Tremco, Inc.
i. "Spectrum 2", Tremco, Inc.

D. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assembles in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

a. "Dow Corning Fire Stop Foam", Dow Corning Corp.
b. "Pensil 851", General Electric Co.

2.02 INSTALLATION

A. Examine substrates, area, and condition, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Preparation for Joint Sealers.

1. Surface Cleaning for Joint Sealers: Clean the surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

2. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

C. Application of Joint Sealers

1. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

a. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.

b. Comply with recommendations of ASTM C 790 for use of acrylic emulsion joint sealants.

2. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops with fire- resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

PART 3 EXECUTION

3.01 INSTALLATION

A. Follow manufacturer’s instructions for installing, connecting, and adjusting all equipment. Provide a copy of such instructions at the equipment during any work on the equipment. Provide all special supports, connections, wiring, accessories, etc.

B. Use mechanics skilled in their trade for all work.

C. Rough-in:

1. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

2. Refer to equipment specifications in Divisions 2 through 26 for rough-in requirements.

D. Electrical Installations: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate electrical systems, equipment, and materials installation with other building components.

2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.

4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

7. Coordinate connection of electrical systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect/Engineer.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "ACCESS DOORS".

12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.02 CUTTING, PATCHING, AND REPAIRING

A. The work shall be carefully laid out in advance. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of raceway, outlets or other equipment, the work shall be carefully done. Any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc. shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner.

B. Where conduits, mounting channels, outlet, junction, or pull boxes are mounted on a painted surface, or a surface to be painted, they shall be painted to match the surface. Whenever support channels are cut, the bare metal shall be cold galvanized.

C. Perform cutting and patching in accordance with Division 01 Section "CUTTING AND PATCHING". In addition to the requirements specified in Division 01, the following requirements apply:

1. Perform cutting, fitting, and patching of electrical equipment and materials required to:

a. Uncover work to provide for installation of ill-timed work.

b. Remove and replace defective work.

c. Remove and replace work not conforming to requirements of the Contract Documents.

2. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

3. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

4. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

5. Patch finished surfaces and building components using new materials specified for the original installation and experienced installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.03 EXCAVATION, TRENCHING, AND BACKFILL

A. Provide excavation for the Work. Excavate all material encountered, to the depths indicated on the drawings or required. Remove from the site, excavated materials not required or suitable for backfill. Provide grading, as may be necessary, to prevent surface water from flowing into trenches or other excavations. Remove any water accumulating therein. Provide sheeting and shoring as may be necessary for the protection of the Work and for the safety of personnel.

B. Provide trenches of widths necessary for the proper execution of the Work. Grade bottom of the trenches accurately to provide uniform bearing and support the Work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the depths indicated. Where rock excavations are required. Excavate rock to a minimum overdepth of four (4") inches below the trench depths indicated on the Drawings or required. Backfill overdepths in the rock excavation and unauthorized overdepths with loose granular, moist earth, thoroughly machine tamped, to a compaction level of at least 95 percent to standard protector density or 75 percent relative density or as specified by the Architect. Whenever unstable soil that is incapable of properly supporting the Work, as determined by Architect/Engineer, is encountered in the bottom of the trench, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel, or other suitable material.

C. Excavate trenches for utilities to a depth that will provide the following minimum depths of cover from existing grade or from indicated finished grade, whichever is lower, unless otherwise specifically shown.

1. Primary electric service: four (4) feet (minimum)
2. Secondary electric service: two (2) feet (minimum)
3. Telephone service: two (2) feet (minimum)

D. Trenches shall not be placed within ten (10) feet of foundation or soil surfaces which must resist horizontal forces.

E. Do not backfill trenches until all required tests have been preformed and the installation observed by the Engineer. Comply with the requirements of other sections of these specifications. Backfill shall consist of non-expansive soil with limited porosity. Deposit in six (6") inch layers and thoroughly and carefully tamp until the Work has a cover of not less than one (1) foot. Backfill and tamp remainder of trench at twelve (12") inch intervals until complete. Uniformly grade the finished surface. Backfill and tamp with compaction at least equal to the surrounding area.

3.04 WATERPROOFING

A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, perform it prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect/Engineer and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.

B. If Contractor penetrates any walls or surfaces after they have been waterproofed, he shall restore the waterproof integrity of that surface as directed by the Architect/Engineer at his own expense.

3.05 SUPPORTS

A. Support work in accordance with the best industry practice and the following.

B. Include supporting frames or racks extending from building structure for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets.

C. Include supporting frames or racks for equipment, intended for vertical surface mounting, which is required in a free standing position.

D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members. They shall be rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.

E. Nothing, (including outlet, pull and junction boxes and fittings) shall depend on electric conduits, raceways, or cables for support, except that threaded hub type fittings having a gross volume not in excess of 100 cubic inches may be supported from heavy wall conduit, where the conduit is securely supported from the structure within five inches of the fitting on two opposite sides.

F. Nothing shall rest on, or depend for support on, suspended ceilings media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling).

G. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure.

3.06 FASTENINGS

A. Fasten electric work to building structure in accordance with the best industry practice and the following.

B. Floor or pad mounted equipment shall not be held in place solely by its own dead weight. Include anchor fastening in all cases.

C. For items which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging, tying to the building structural elements.

3.07 TESTING EQUIPMENT AND MATERIALS

A. The Contractor shall provide all testing instruments, equipment and all materials, connections, labor, etc., required to perform tests.

B. Test all circuits, fixtures, equipment, and systems for proper operation and freedom from grounds, shorts and open circuits before acceptance is requested.

C. Measure voltage at panelboards and outlets after the building is fully occupied. Make final transformer tap adjustments based on these measurements.

D. Perform all tests required by local authorities, such as tests of life safety systems, in addition to tests specified herein.

E. Perform tests required by other specification sections.

3.08 CLEANING UP

A. Contractor shall take care to avoid accumulation of debris, boxes, crates, etc., resulting from the installation of his work. Contractor shall remove from the premises each day all debris, boxes, etc., and keep the premises clean.

B. Contractor shall clean up all fixtures and equipment at the completion of the project.

C. All switchboards, panelboards, wireways, trench ducts, cabinets and enclosures shall be thoroughly vacuumed clean prior to energizing equipment and at the completion of the project. Equipment shall be opened for observation by the Architect/Engineer as required.

END OF SECTION

SECTION 26 01 15

TEMPORARY SERVICE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The Electrical Contractor shall arrange with local utility for temporary power for construction areas. A new temporary service will be required to feed the existing building while the new addition work is done.

B. Temporary lighting and circuits shall conform to all aspects of 2017 National Electrical Code Provisions. Among other provisions, code prohibits use of Romex, UF, or open wiring and requires cord connections for all work.

C. Temporary service is required for construction areas.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 INSTALLATION

A. The temporary service size shall be 200 amp, 120/240 volt, 1 phase. Provide 100 amp panel in area of each addition.

B. The Electrical Contractor shall provide, at no cost, to other contractors, all lamps, wiring switches, sockets and similar equipment required for temporary system until substantial completion. Temporary system shall be installed and maintained in accordance with requirements of the safety code of the Industrial Commission and such as to prevent injury or damage to persons, equipment or construction. All facilities exposed to moisture or weather shall be weatherproof type, and electrical equipment enclosures shall be locked to prevent access.

C. In accordance with the latest issue of the National Electrical Code, all temporary electrical circuits for construction purposes shall be equipped with combination ground fault interrupter and circuit breaker meeting the requirements of UL for Class A, Group 1 devices. The ground fault interrupter portion shall be solid state type, insulated and isolated from the breaker mechanism. A test button shall be provided for checking the device. The breaker mechanism shall provide overload and short circuit protection and shall be operated by a toggle switch with overcenter switching mechanism so that contact cannot be held closed.

D. The Electrical Contractor shall provide at least one 120-volt, single phase outlet for lighting and one grounded duplex outlet for small power tools for each 1,000 sq. ft. of floor space. Circuits shall be 20 ampere, single pole, No. 12 wire. Circuit length shall not exceed 200 feet. Not less than 15-foot candles illumination shall be provided. Lighting shall be provided to maintain 15-foot candles minimum light levels.

E. Subcontractors and other contractors shall be allowed to use the service provided for general lighting and fractional horsepower tools at no cost. Each contractor shall furnish his own extension cords and lamps other than those furnished for general lighting.

F. Contractors requiring voltage other than basic temporary system specified, three phase power, or a special single-phase run, for operation of construction equipment or testing shall make their own arrangements with the Owner for cost of energy used and with Electrical Contractor for cost of service extension, installation and removal when no longer required.

G. Each contractor shall provide and pay for installation of temporary service for lighting, heating or cooling of their temporary offices. They shall make arrangements with the Electrical Contractor for the cost of installation and removal when no longer required.

H. Heating and Ventilating Contractor shall expedite the work under his contract in such a manner that the permanent power wiring system and panels will be installed and connected to permanent heating and ventilating equipment in time to operate and test this equipment when the building has been closed sufficiently to permit the use of portions of the heating and ventilating system for temporary heating during construction. Permanent wiring and connections may be used at permanent equipment; however, the use of the permanent system during construction shall in no way waive any part of the guarantee period.

I. After substantial completion of the permanent electrical system and building wiring by the Electrical Contractor, permanent receptacles may be used during finishing work. Permanent wiring for lighting fixtures, switches and receptacles shall be installed only after all masonry and plastering has been completed, but this wiring shall not be used for motors larger than fractional HP or for welding equipment. Circuits for larger motors and welding equipment may be provided with special circuits to mains of electrical panels at the expense of contractors requiring them, provided that special permission is obtained from the Architect/Engineer and the installation is made by the Electrical Contractor.

J. Upon completion of the project, the Electrical Contractor shall remove the temporary electrical systems.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wire and cable for 600 volts and less.

B. Wiring connectors and connections.

1.02 RELATED REQUIREMENTS

A. Division 31 - Earthwork.

B. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.

B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2017.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

A. See Division 01 - Submittal Procedures.

B. Test Reports: Indicate procedures and values obtained.

C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency.

E. Project Record Documents: Record actual locations of components and circuits.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.

C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 WIRING REQUIREMENTS

A. Concealed Dry Interior Locations: Use only building wire in raceway, building wire with Type THHN, THWN, XHHW insulation in raceway, armored cable, or metal clad cable. See approved locations for AC and MC cable.

B. Exposed Dry Interior Locations: Use only building wire in raceway, building wire with Type THHN, THWN, XHHW insulation in raceway, armored cable, or metal clad cable. See approved locations for AC and MC cable.

C. Above Accessible Ceilings: Use only building wire in raceway, building wire with Type THHN, THWN, or XHHW insulation in raceway, armored cable, or metal clad cable. See approved locations for AC and MC cable.

D. Wet or Damp Interior Locations: Use only building wire with Type THWN or XHHW insulation in raceway.

E. Exterior Locations: Use only building wire with Type THWN or XHHW insulation in raceway, direct burial cable, service-entrance cable.

F. Underground Installations: Use only building wire with Type THWN or XHHW insulation in raceway.

G. Use solid conductor for feeders and branch circuits 10 AWG and smaller.

H. Use stranded conductors for control circuits.

I. Use conductor not smaller than 12 AWG for power and lighting circuits.

J. Use conductor not smaller than 16 AWG for control circuits.

K. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (25 m).

L. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet (60 m).

M. Conductor sizes are based on copper.

2.02 WIRE MANUFACTURERS

A. Cerro Wire Inc.

B. Industrial Wire & Cable, Inc.

C. Southwire Company.

D. Substitutions: See Division 01 - Product Requirements.

2.03 BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor: Copper.

1. For Sizes Smaller Than 4 AWG: Copper.
2. For Sizes 4 AWG and Larger: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation: NFPA 70, Type THW, THHN, THWN, XHHW.

E. Insulation: Thermoplastic material rated 60 degrees C.

2.04 ARMORED CABLE (See Permitted Use in 3.03 Installation)

A. Description : NFPA 70, Type AC.

B. Conductor: Copper.

1. For Sizes Smaller Than 4 AWG: Copper.
2. For Sizes 4 AWG Through 1 AWG: Copper.

C. Insulation Voltage Rating: 300 volts.

D. Insulation Temperature Rating: 60 degrees C.

E. Insulation Material: Thermoplastic.

F. Conductor Assembly Covering: Lead.

2.05 METAL CLAD CABLE (See Permitted Use in 3.03 Installation)

A. Description : NFPA 70, Type MC.

B. Conductor: Copper.

1. For Sizes Smaller Than 4 AWG: Copper.
2. For Sizes 4 AWG and Larger: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 60 degrees C.

E. Insulation Material: Thermoplastic.

F. Armor Material: Steel.

G. Armor Design: Interlocked metal tape.

H. Jacket: PVC; use in locations indicated.

2.06 WIRING CONNECTORS

A. Split Bolt Connectors:

1. Not acceptable.

B. Solderless Pressure Connectors:

1. High copper alloy terminal. May be used only for cable termination to equipment pads or terminals.
2. Substitutions: See Division 01 - Product Requirements.

C. Spring Wire Connectors:

1. Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
2. Substitutions: See Division 01 - Product Requirements.

D. Compression Connectors:

1. Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps.
2. Substitutions: See Division 01 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

C. Verify that raceway installation is complete and supported.

D. Verify that field measurements are as indicated.

3.02 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.03 INSTALLATION

A. Install wire and cable securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Route wire and cable as required to meet project conditions.

1. Wire and cable routing indicated is approximate unless dimensioned.

2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

3. Include wire and cable of lengths required to install connected devices within 10 ft of location shown.

C. Use wiring methods indicated.

D. Pull all conductors into raceway at same time.

E. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

F. Protect exposed cable from damage.

G. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.

H. Use suitable cable fittings and connectors.

I. Neatly train and lace wiring inside boxes, equipment, and panelboards.

J. Clean conductor surfaces before installing lugs and connectors.

K. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

L. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.

M. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

N. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

O. AC and MC cable permitted uses:

1. **Flexible connections less than 4'.**
2. Light fixture connections above suspended ceiling. **Length shall be 6' or less.** Not approved for fixture-to-fixture wiring.
3. Conductor to last device on branch circuits installed in walls.
4. Control and signal circuits.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Division 01.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding components.

B. Provide all components necessary to complete the grounding system(s) consisting of:

1. Metal underground water pipe.
2. Metal frame of the building.
3. Concrete-encased electrode.
4. Metal underground gas piping system.

1.02 RELATED REQUIREMENTS

A. Division 01 - Concrete Reinforcing.

B. Division 01 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2017.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms.

B. Communications Busbar(s): 5 ohms.

1.05 SUBMITTALS

A. See Division 01 - Administrative Requirements for submittals procedures.

B. Product Data: Provide for grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record the actual locations of components and grounding electrodes.

F. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cooper Power Systems.

B. Framatome Connectors International.

C. CadWeld.

D. Substitutions: See Division 01 - Product Requirements.

2.02 CONDUCTORS

A. Material: Stranded copper (aluminum not permitted).

B. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

C. Foundation Electrodes: As required by code.

D. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used at the same facility.

E. Conductors for Telecommunications shall be as follows:

1. Telecommunications Bonding Conductor (TMGB to Service Ground): No. 3/0 minimum.

2. Telecommunications Bonding Backbone (TBB; TMGB to TGB): No. 3/0 minimum.

~~3.~~ Telecommunications Grounding Equalizer (GE): No. 3/0 minimum.

4. Bonding Conductors shall be insulated with a Green Jacket or jacket marked with Green Tape or labeled per NEC Guidelines

2.03 BUS/BUSBAR

A. Material: Copper (aluminum not permitted).

B. Size:

1. All Power systems: 1/4" X 2", length as needed (24” minimum).

2. Telecommunications Main Ground Busbar (TMGB): 1/4" x 4" x 20" long (minimum).

3. Telecommunications Grounding Busbar (TGB): 1/4" x 2" x 12" long (minimum).

C. Busbars for Telecommunications shall:

1. Be pre-drilled to accommodate two-hole lugs.

2. 3/8” stud hole size; hole spacing per ANSI J-STD-607-A.

3. Incorporate insulators and stand-off brackets that electrically isolate busbar from mounting surface.

D. Provide main ground busbar located adjacent to main electrical service equipment to terminate all ground conductors.

2.04 CONNECTORS AND ACCESSORIES

A. Mechanical Connectors: Bronze.

1. Substitutions: See Division 01 - Product Requirements.

B. Exothermic Connections:

1. Product: CadWeld
2. Substitutions: See Division 01 - Product Requirements.

C. Wire: Stranded copper.

D. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Install 4 AWG bare copper wire in foundation footing.

B. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.

C. Provide bonding to meet requirements described in Quality Assurance.

D. Bond together metal siding not attached to grounded structure, bond to ground.

E. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

3.03 COMMUNICATION SYSTEM GROUNDING

A. Grounding and Bonding System for Communications shall be an isolated grounding system with a single ground point. That ground point is to be the common grounding electrode system at the building electrical service entrance (main ground bar located in electrical room).

B. The system shall be compliant with ANSI J-STD-607-B with the exception that the ground cable shall not be bonded to building steel except at the electrical service entrance.

C. Provide Grounding Busbar for Telecommunications at each Telecommunications Room, the Main Equipment Room and at the electrical service entrance. Coordinate Busbar location(s) and conductor routing with Division 27 contractor.

D. Provide Telecommunications Bonding Conductor from Telecommunications Main Grounding Busbar (TMGB) at the Communications Entrance Facility to building common grounding electrode system. Attach grounding conductor to building steel as allowed only at the main electrical service entrance.

E. Provide Telecommunications Bonding Backbone (TBB) conductor from the TMGB to Telecommunications Grounding Busbar (TGB) at each Telecommunication Room, Telecommunications Equipment Room and Telecommunications Enclosure.

1. The TBB shall be connected through Telecommunications Main Ground Busbar direct to the Telecommunications Ground Busbar (TGB).

2. The TGBs may be bonded to the TBB via tap off of the TBB. Use the same conductor size for the tap as the main TBB.

3. Provide 10 foot of slack in the TBB conductor at each TGB location.

4. Do not bond the TBB or TGB to the building steel at the TGB location(s); bond only at the building common grounding electrode system.

F. Provide Grounding Equalizer(s) (GE). Connect GE conductor directly to TGBs being interconnected.

3.04 FIELD QUALITY CONTROL

A. Owner will provide field inspection in accordance with Division 01.

B. Provide field inspection in accordance with Division 01.

C. Inspect and test in accordance with NETA STD ATS except Section 4.

D. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit and equipment supports.

B. Anchors and fasteners.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.03 SUBMITTALS

A. See Division 01 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer’s catalog data for fastening systems.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized.

C. Anchors and Fasteners:

1. Do not use powder-actuated anchors, spring clips, or beam clamps.

2. Obtain permission from Architect before using powder-actuated anchors.

3. Concrete Structural Elements: Use precast inserts, expansion anchors, powder-actuated anchors, or preset inserts.

4. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.

5. Concrete Surfaces: Use self-drilling anchors or expansion anchors.

6. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.

7. Solid Masonry Walls: Use expansion anchors or preset inserts.

8. Sheet Metal: Use sheet metal screws.

9. Wood Elements: Use wood screws.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.

1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

2. Do not drill or cut structural members.

3. Obtain permission from Architect before drilling or cutting structural members.

B. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

C. Install surface-mounted cabinets and panelboards with minimum of four anchors.

D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.

E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 26 05 34

CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit, fittings and conduit bodies.

1.02 RELATED REQUIREMENTS

A. Section 33 71 19 - Electrical Underground Ducts and Manholes.

B. Division 01 - Firestopping.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems.

F. Section 26 05 37 - Boxes.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2015.

C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2015.

D. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.

E. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association; 2013.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2014.

G. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2018.

H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit; National Electrical Manufacturers Association; 2013.

I. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2016.

J. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

A. See Division 01 - Administrative Requirements for submittals procedures.

B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, and conduit bodies.

C. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Conduit Size: Comply with NFPA 70.

1. Minimum Size: 1/2 inch unless otherwise specified.

B. Underground Installations:

1. More than 5 Feet from Foundation Wall: Use rigid steel conduit, intermediate metal conduit, or thickwall nonmetallic conduit.

2. Within 5 Feet from Foundation Wall: Use rigid steel conduit, intermediate metal conduit, plastic coated conduit, or plastic coated conduit.

3. In or Under Slab on Grade: Use rigid steel conduit, intermediate metal conduit, or plastic coated conduit.

4. Minimum Size: 3/4 inch.

C. Outdoor Locations Above Grade: Use rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, or electrical metallic tubing.

D. In Slab Above Grade: (All locations shall be approved by Owner and Electrical Designer.)

1. Use rigid steel conduit, intermediate metal conduit, or thickwall nonmetallic conduit.

2. Maximum Size Conduit in Slab: 3/4 inch; 1/2 inch for conduits crossing each other.

E. Wet and Damp Locations: Use rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, or electrical metallic tubing.

F. Dry Locations:

1. Concealed: Use rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, or electrical metallic tubing.

2. Exposed: Use rigid steel conduit, rigid aluminum conduit, intermediate metal conduit, or electrical metallic tubing.

2.02 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Rigid Aluminum Conduit: ANSI C80.5.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.03 PVC COATED METAL CONDUIT

A. Description: NEMA RN 1; rigid steel conduit with external PVC coating.

B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.04 FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction.

B. Fittings: NEMA FB 1.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction with PVC jacket.

B. Fittings: NEMA FB 1.

2.06 ELECTRICAL METALLIC TUBING (EMT)

A. Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression or set screw type.

2.07 NONMETALLIC CONDUIT (Use Only in Locations as Shown on Plans)

A. Description: NEMA TC 2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.08 NONMETALLIC TUBING (Use Only in Locations Shown on Plans)

A. Description: NEMA TC 2.

B. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

A. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 1. **All conduit shall be run overhead unless indicated on the plans.**

B. All raceways shall be routed concealed in finished and unfinished areas unless authorized by the Architect and Engineer.

C. Install steel conduit as specified in NECA 101.

D. Install nonmetallic conduit in accordance with manufacturer's instructions.

E. Arrange supports to prevent misalignment during wiring installation.

F. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

G. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

H. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29.

I. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

J. Do not attach conduit to ceiling support wires.

K. Arrange conduit to maintain headroom and present neat appearance.

L. Route exposed conduit parallel and perpendicular to walls.

M. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

N. Route conduit in and under slab from point-to-point.

O. Do not cross conduits in slab.

P. Maintain adequate clearance between conduit and piping.

Q. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

R. Cut conduit square using saw or pipecutter; de-burr cut ends.

S. Bring conduit to shoulder of fittings; fasten securely.

T. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

U. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations.

V. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size.

W. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

X. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic.

Y. Provide suitable pull string in each empty conduit except sleeves and nipples.

Z. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

AA. Ground and bond conduit under provisions of Section 26 05 26.

AB. Identify conduit under provisions of Section 26 05 53.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 01.

B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation specified.

END OF SECTION

SECTION 26 05 37

BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall and ceiling outlet boxes.

B. Pull and junction boxes.

1.02 RELATED REQUIREMENTS

A. Section 26 27 16 - Electrical Cabinets and Enclosures.

B. Section 26 27 26 - Wiring Devices: Wall plates in finished areas.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.

B. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2014.

C. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2013.

D. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2013.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2018.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

A. See Division 01 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Appleton Electric.

B. Legrand.

C. Hubbell.

D. Wiremold.

E. Substitutions: See Division 01 - Product Requirements.

2.02 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.

2. Concrete Ceiling Boxes: Concrete type.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.

D. Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.03 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 26 27 16.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:

1. Material: Galvanized cast iron.

2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. Fiberglass Handholes: Die molded glass fiber hand holes:

1. Cable Entrance: Pre-cut 6 x 6 inch cable entrance at center bottom of each side.

2. Cover: Glass fiber weatherproof cover with nonskid finish.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

C. Coordinate installation of outlet boxes for equipment connected under Section 26 27 17.

D. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

E. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.

1. Adjust box locations up to 10 feet if required to accommodate intended purpose.

F. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

G. Maintain headroom and present neat mechanical appearance.

H. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

I. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

J. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 01.

K. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

L. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

M. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

N. Use flush mounting outlet box in finished areas.

O. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

P. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.

Q. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

R. Use stamped steel bridges to fasten flush mounting outlet box between studs.

S. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

T. Use adjustable steel channel fasteners for hung ceiling outlet box.

U. Do not fasten boxes to ceiling support wires.

V. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

W. Use gang box where more than one device is mounted together. Do not use sectional box.

X. Use gang box with plaster ring for single device outlets.

Y. Use cast outlet box in exterior locations exposed to the weather and wet locations.

3.02 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

3.03 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

D. Field-painted identification of conduit.

1.02 RELATED REQUIREMENTS

A. Division 01 - Painting and Coating.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

A. See Division 01 - Administrative Requirements for submittals procedures.

B. Product Data: Provide catalog data for nameplates, labels, and markers.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation.

B. Seton Identification Products.

C. HellermannTyton.

D. Substitutions: See Division 01 - Product Requirements.

2.02 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

B. Locations:

1. Each electrical distribution and control equipment enclosure.
2. Communication cabinets.
3. Disconnects, starters, and relays.

C. Letter Size:

1. Use 1/8 inch letters for identifying individual equipment and loads.
2. Use 1/4 inch letters for identifying grouped equipment and loads.
3. Use 1 inch letters for identifying distribution and control equipment enclosures.

D. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations.

2.03 WIRE MARKERS

A. Description: Cloth type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.

2.04 CONDUIT MARKERS

A. Description: Use tape or paint to mark conduit.

B. Location: Furnish markers for each conduit longer than 6 feet.

C. Spacing: 20 feet on center.

D. Color:

1. 120/240 Volt System: White.
2. Option Standby 120/240: Black/Yellow.
3. Fire Alarm System: Red.
4. Telephone System: Yellow. Verify with the owner.
5. Data System: Blue.

2.05 UNDERGROUND WARNING TAPE

A. Description: 4-inch-wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines.

2.06 WIRING DEVICE IDENTIFICATION

A. Wall switches, receptacles, occupancy sensors, photocells, poke-through fittings, access floor boxes, and time clocks shall be identified with circuit numbers and panelboard source (ex. Panel ABC-3). In exposed areas, identifications should be made inside of device covers, unless directed otherwise. Use machine-generated adhesive labels, or neatly hand-written permanent marker.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install nameplates and labels parallel to equipment lines.

B. Secure nameplates to equipment front using screws.

C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Identify conduit using field painting under provisions of Division 01.

1. Paint colored band on each conduit longer than 6 feet.

2. Paint bands 20 feet on center.

3. Colors:

a. 120/240 Volt System: White.
b. Option Standby 120/240: Black/Yellow.
c. Fire Alarm System: Red.
d. Telephone System: Yellow. Verify with the owner.
e. Data System: Blue.

E. Identify underground conduits using underground warning tape. Install one tape per trench at a minimum of 12" above the underground installation.

F. Label electrical service meters and disconnects per utilities and NEC specifications.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 05 73

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance requirements for overcurrent protective devices.

B. Short circuit study.

1.02 RELATED REQUIREMENTS

A. Section 26 24 16 - Panelboards: Overcurrent protective devices in panelboards.

B. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

A. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001.

B. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

C. NFPA 70 - National Electrical Code; 2011.

1.04 SUBMITTALS

A. See Division 01 - Administrative Requirements, for submittal procedures.

B. Study Preparer's Qualifications.

C. Study Report: Submit protective device studies as specified, prior to submission of product data submittals or ordering or fabrication of protective devices.

1. Evaluation of product data submittals by Architect will not commence until acceptable studies have been submitted.

2. Evaluation of product data submittals by Architect will not commence until acceptable preliminary studies in sufficient detail to ensure that device selection will be adequate have been submitted.

3. Include stamp or seal and signature of preparing engineer.

D. Product Data: In addition to submittals specified elsewhere, submit manufacturer's time-current curves for all protective devices.

E. Field Engineer Qualifications.

F. Field Inspection Report: Show final adjusted settings of protective devices.

G. Certificates: Prior to final inspection, certify that field adjustable protective devices have been set in accordance with requirements of protective device analysis.

H. Project Record Documents: Revise protective device study as required to show as-built conditions.

1. Submit not less than 60 days prior to final inspection of electrical system.

2. Include hard copies in operation and maintenance data submittals.

3. Include all files prepared using software packages, on CD-ROM, with file name cross-references to specific pieces of equipment and systems.

1.05 PROTECTIVE DEVICE STUDY

A. Analyze the specific electrical and utilization equipment (according to NEC definition), the actual protective devices to be used, and the actual feeder lengths to be installed.

1. Scope of Studies: All new distribution wiring and equipment, from primary source to buses and branch circuit panelboards.

2. Primary Source, for Purposes of Studies: Utility company primary protective devices.

3. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.

4. Report: State the methodology and rationale employed in making each type of calculation; identify computer software package(s) used.

B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with all electrical equipment and wiring to be protected by the protective devices; identify nodes on the diagrams for reference on report that includes:

1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at the main switchboard bus and all downstream devices containing protective devices.

2. Breaker and fuse ratings.

3. Generator kW and voltage ratings, percent impedance, X/R ratios, and wiring connections.

4. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.

5. Identification of each bus, with voltage.

6. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

C. Short Circuit Study: Calculate the fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.

1. Show fault currents available at key points in the system down to a fault current of 7,000 A at 208 V.

2. Include motor contributions in determining the momentary and interrupting ratings of the protective devices.

3. Primary Fault Level Assumptions: Obtain data from utility company.

4. Report: Include all pertinent data used in calculations and for each device include:
   a. Device identification.

   b. Operating voltage.

   c. Protective device.

   d. Device rating.

   e. Calculated short circuit current, asymmetrical and symmetrical, and ground fault current.

D. Analysis: Determine ratings and settings of protective devices to minimize damage caused by a fault.

1. Identify any equipment that is underrated as specified.

2. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Architect.

F. Protective Device Rating and Setting Chart: Summarize in tabular format the required characteristics for each protective device based on the analysis; include:

1. Device identification.

2. Relay CT ratios, tap, time dial, and instantaneous pickup.

3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.

4. Fuse rating and type.

5. Ground fault pickup and time delay.

6. Input level and expected response time at two test points that are compatible with commonly available test equipment and the ratings of the protective device.

7. Highlight all devices that as furnished by Contractor will not achieve required protection.

1.06 QUALITY ASSURANCE

A. Study Preparer Qualifications: Electrical testing agency regularly engaged in short circuit and coordination studies, with at least 5 years experience in work of this type, and employing professional electrical engineer licensed in the State in which the Project is located to perform the studies.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

1. Acceptable Software Products:

a. EDSA Micro Corporation: www.edsa.com.
b. Operation Technology, Inc; ETAP: www.etap.com.
c. SKM Systems Analysis, Inc; Power Tools for Windows: www.skm.com.

C. Contractor Responsibility: Provide all project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths.

D. Contractor shall provide site survey of relevant Owner power distribution equipment to obtain needed data for study.

PART 2 PRODUCTS

2.01 PROTECTIVE DEVICES

A. Replace existing protective devices to achieve specified performance.

B. The specified equipment has been designed and selected to achieve the specified performance; ensure that equipment actually installed provides that performance.

C. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of this analysis.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate, and adjust the installed protective devices to conform to requirements determined by the coordination analysis.

B. Adjust installed protective devices having adjustable settings to conform to requirements determined by the coordination analysis.

C. Adjust solid-state protective modules for motors prior to applying load to motor.

D. Submit report showing final adjusted settings of all protective devices.

END OF SECTION

SECTION 26 09 18

REMOTE CONTROL SWITCHING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Programmable switching controls.

B. Remote control switching relays.

C. Remote sensors.

D. Relay cabinets.

1.02 RELATED REQUIREMENTS

A. Section 26 05 34 - Conduit.

B. Section 26 05 37 - Boxes: Switch outlets and installation of switch devices.

C. Section 26 24 16 - Panelboards.

1.03 REFERENCE STANDARDS

A. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks; National Electrical Manufacturers Association; 2005.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

A. See Division 01 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data showing dimensions and ratings for components.

C. Shop Drawings: Indicate wiring diagrams of system, showing interface with branch circuit wiring.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record locations of components and record circuiting and switching arrangements.

F. Maintenance Data: Include replacement parts numbers.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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

1.06 EXTRA MATERIALS

A. See Division 01 - Product Requirements, for additional provisions.

B. Furnish two of each relay type.

C. Furnish two of each cabinet key.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cooper Greengate.
B. Hubbell.
C. Sensor Switch, Acuity Brands.
D. Wattstopper.
E. Leviton.
F. Substitutions: See Division 01 - Product Requirements.

2.02 PROGRAMMABLE RELAY PANELS

A. Manufacturers:

1. Hubbell.
2. Leviton
3. Sensor Switch, Acuity Brands.
4. Wattstopper.
5. Substitutions: See Division 01 - Product Requirements.

B. Description: Relay cabinet with power supply, terminal blocks, and logic cards for the specified programming functions.

C. Relays per Panel: As shown on drawings.

D. Programming Functions:

1. Multiple Switch Control: More than 1 switch can control each relay.

2. Pilot Status Indication: Signal for indicating relay status at remote location.

3. Relay Grouping: Allow relays to be grouped for common control.

4. Scheduling: Allow scheduling of 99 events each capable of switching 1 relay groups according to a programmed time schedule. Allow for up to 12 holidays.

5. Phone Control: Allow remote control telephone numbers, each capable of switching 1 relay groups.

E. Cabinet: Surface-mounted sheet metal cabinet.

2.03 REMOTE CONTROL SWITCHING RELAYS

A. Manufacturers:

1. Hubbell.
2. Leviton
3. Sensor Switch, Acuity Brands.
4. Wattstoppper.
5. Substitutions: See Division 01 - Product Requirements.

B. Description: Heavy duty, two-coil momentary contact type remote control relays.

C. Contacts:

1. Rated 20 amperes at 120 volts and with isolated and non-isolated pilot contacts where indicated.

2. Motor Load: 1-1/2 HP at 120 volts.

D. Line Voltage Connections: Clamp type screw terminals.

2.04 REMOTE SENSORS

A. Exterior Lighting Sensor:

1. Description: Photodiode lighting sensor in weatherproof housing.

B. Interior Lighting Sensor:

1. Description: Photodiode lighting sensor suitable for mounting on wall or ceiling and characterized with a dead band to eliminate ON-OFF cycling of relays in response to its own switching action.

2. Product: As shown on plans.

3. Substitutions: See Division 01 - Product Requirements.

C. Photocell Control Unit:

1. Photodiode control unit with PHOTOCELL ENABLE and MASTER OVERRIDE inputs for remote control, 3-minute time delay.

2. Selectable ranges for 1 to 10 fc (0.1 to 1 lx), 10 to 100 fc (1 to 10 lx), 100 to 1000 fc (10 to 100 lx), 1000 to 10,000 fc (100 to 1000 lx).

3. Product: As shown on plans.

4. Substitutions: See Division 01 - Product Requirements.

2.05 RELAY CABINETS

A. Boxes: Galvanized steel with removable endwalls.

B. Interior Panel: Metal, suitable for mounting components, matte white.

C. Fronts: Steel, flush type with concealed trim clamps door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.

D. Metal Barriers: Between wiring of different systems and voltages.

E. Power Terminals: NEMA ICS 4, unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

F. Signal and Control Terminals: NEMA ICS 4, modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

G. Ground Bus Terminal Block: Bond each connector to enclosure.

H. Plastic Raceway:

1. Description: Plastic channel with hinged or snap-on cover.

I. Power Supply: NFPA 70, Class 2 transformer.

1. Ratings: 120 /24 volt, 75 VA momentary, 40 VA continuous.
2. Rectifier: Silicon, rated 20 amperes intermittent, 7.5 amperes continuous, 30 VAC, 100 PRV.

2.06 POWER LIMITED WIRE AND CABLE

A. Remote Control Cable: Copper conductor, 300 volt insulation rated 60 degrees C, individual conductors twisted together and covered with PVC jacket.

B. Plenum Cable: Copper conductor, 300 volt insulation rated 60 degrees C, individual conductors twisted together and covered with nonmetallic jacket; suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all wiring in conduit in accordance with Section 26 05 34.

B. Install wiring in the following locations in conduit in accordance with Section 26 05 34:

1. Within walls.
2. Above inaccessible ceilings.

3. Within hollow spaces used as air handling ducts and plenums.
4. Exposed along surfaces.

C. Install relays to be accessible. Allow space for adequate ventilation and circulation of air.

3.02 PROGRAMMING AND TRAINING

A. Program system to function as indicated on drawings, schedules, and in this specification.

B. Demonstrate to Architect/Engineer a complete and working system.

C. Provide acceptable on-site training by a trained representative of the manufacturer to Owner not to exceed two hours in duration at time of acceptance of system.

D. Provide off-site consultation to Owner at no charge for a two-year period after date of acceptance.

E. Provide complete Operation and Maintenance Manual of system and all components.

F. Demonstrate proper operation of system.

3.03 SCHEDULES

A. As shown on drawings.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 09 43

DISTRIBUTED DIGITAL LIGHTING CONTROLS

PART 1 GENERAL

1.01 SCOPE OF PROJECT

A. Provide Distributed Digital Lighting Controls (controls) as specified herein. The controls shall consist of a series of standalone digital load controllers and intelligent low-voltage devices dedicated to the room/space they are serving. All local devices shall be connected together via an In-Room Network, enabling digital communication between devices. Digital Lighting Control Panels may also be used for lighting control as part of the overall lighting control scheme.

B. The controls shall provide time-based, sensor-based (e.g. occupancy/vacancy and daylight sensors), and/or manual control. The controls shall turn lighting loads ON/OFF, and shall dim the lighting where indicated.

C. Included are the following topics:

PART 1 - GENERAL
- Scope of Project
- Related Work
- Reference Standards
- Design/Performance Requirements
- Quality Assurance
- Submittals
- Operation and Maintenance Data
- Extra Materials

PART 2 - PRODUCTS
- System Requirements
- Digital Load Controllers (Room Controllers)
- Digital Motion Sensors
- Digital Manual Controls
- Digital Auxiliary Input/Output (I/O) Interface Modules
- Digital Lighting Control Panels (Relay and Dimming Panels)
- Configuration Tools
- Network Cables

PART 3 - EXECUTION
- Delivery, Storage, and Handling
- Project Conditions
- Sensor Layouts
- Installation
- Field Quality Control
- Post Start-up Tuning
- Warranty
- Product Support and Service
- Training

1.02 RELATED WORK

A. Section 26 51 00 – Interior Lighting.

1.03 REFERENCE STANDARDS

A.	NFPA 70	National Electrical Code; National Fire Protection Association.
B.	NEMA	National Electrical Manufacturers Association.
C.	FCC	Federal Communications Commission – Emission Standards.
D.	UL	Underwriters Laboratories, Inc. Listings.
E.	UL 2043	Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces
F.	UL 20	General-Use Snap Switches
G.	UL 508	Standard for Industrial Control Equipment
H.	UL 916	Standard for Energy Management Equipment
I.	UL 924	Standard for Emergency Lighting and Power Equipment

1.04 DESIGN/PERF\ORMANCE REQUIREMENTS

A. Distributed Digital Lighting Controls shall accommodate the square-footage coverage requirements for each area controlled utilizing digital load controllers, digital occupancy/vacancy sensors, digital daylighting sensors, digital switches, digital lighting control panels, and accessories that suit the required lighting and electrical system parameters.

B. System shall conform to requirements of NFPA 70.

C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.

D. System shall be listed under UL sections 916 and/or 508.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company certified by the manufacturer and specializing in installation of Distributed Digital Lighting Control products with minimum three years documented experience.

1.06 SUBMITTALS

A. Shop Drawings: Shop drawings shall include the following:

- Product Datasheets (general device descriptions, dimensions, electrical specifications, wiring details, nomenclature)
- All manufacturers shall submit to the specifying engineer a line-by-line compliance comparison between each specifications requirement and the system being proposed. Any ambiguities in the drawings or specifications shall be brought to the attention of the specifying engineer for clarification.
- Riser Diagrams – typical per room type (detailed drawings showing interconnectivity of devices)

- Other Diagrams – as needed for special operation or interaction with other system(s)
- Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up
- Hardware and Software Operation Manuals
- Other operational descriptions as needed

B. Occupancy Sensor Shop Drawings:

- Symbols on drawings are diagrammatic and represent design intent only. Provide manufacturer-recommended layout drawings showing quantity and location of sensors, and associated wiring diagrams.

C. Closeout Submittals:

- Project Record Documents: Record actual installed locations **and settings for each** lighting control device and show interconnecting wiring.

- Operation and Maintenance Manual:
  - Include approved Shop Drawings and Product Data.
  - Include Sequence of Operation, identifying operation for each room or space.
  - Include manufacturer's maintenance information.
  - Operation and Maintenance Data: Include detailed information on device programming and setup.
  - Include startup and test reports.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.08 EXTRA MATERIALS

A. Provide the following spare materials:

- One (1) ON/OFF relay
- One (1) ON/OFF DIMMING relay
- One (1) of each type of motion sensor used
- One (1) digital wall switch – one of each type used

PART 2 PRODUCTS

2.01 SYSTEM REQUIREMENTS

A. Lighting control zones shall consist of one or more intelligent lighting control components (digital load controllers), be capable of stand-alone operation, and be capable of being connected to a higher-level network backbone.

B. Network Characteristics

- In-Room Network:
  - The In-Room network shall be a free topology lighting control network using physical wiring connections and communication protocol designed to control a room/space/small area of a building.
  - Digital room devices connect to the In-Room network, which provides both communications and power to room devices.

C. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.

2.02 DIGITAL LOAD CONTROLLERS (ROOM CONTROLLERS)

A. General:

1. Digital load controllers shall be simple to install and shall not have dip switches or potentiometers, or require special configuration.

2. The controllers shall include the following features:
   - Standard junction box mounting.
   - Low voltage connection using standard RJ-45 connectors and CAT5e cable. Other wiring topologies are acceptable if controls accomplish all requirements specified in these documents.
   - Each connected load shall be capable of any of the following behaviors: Manual ON, Automatic ON, Automatic ON to 50 percent, or Automatic ON to Preset level or last level set.
   - UL 2043 plenum rated.
   - Manual override and LED indication for each load.
   - Power supply to power the digital load controller itself and the peripheral sensors and controls connected to the In-Room Network.
   - Dual voltage (120/277 VAC, 60 Hz), rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming).
   - Zero cross circuitry for each load.
   - All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

B. ON/OFF Load Controllers. Controller shall include the following:

- Multiple relay configurations per unit.

C. ON/OFF/Dimming Load Controllers. Controllers shall include the following:

- Multiple relay configurations per unit.
- Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected LED driver.
- One dimming output per relay.
    - 0-10V Dimming: one 0-10 volt analog output per relay for control of compatible LED drivers. The 0-10 volt output shall automatically close upon loss of power to the Controller to assure full light output from the controlled lighting.
    - Line Voltage, Forward Phase Dimming: one forward phase control line voltage dimming output per relay for control of compatible LED drivers, forward phase compatible ELV, and incandescent loads.
- Each load shall have an independently configurable preset ON level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.

2.03 DIGITAL MOTION SENSORS

A. General:

1. Sensors shall be available in wall, ceiling, corner-mounted, or wall-switch configurations.

2. Sensors shall use either passive infrared (PIR) sensing, or if dual technology, passive infrared and passive acoustic or passive infrared and ultrasonic sensing for detecting room occupancy.

3. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas.

B. Features. Sensors shall be provided with the following features:

- Sensitivity Adjustment, Time Delay, Detection Technology, and Walk-Through Mode.
- Dual-Technology Sensors shall have independent configurable trigger modes to choose proper technology according to space use to eliminate false-triggers.
- Each sensor may be programmed to control specific loads within an In-Room network.
- Each sensor shall allow remote programming through a handheld commissioning tool via a two-way infrared (IR) transceiver or by configuration through a local network device.

C. Digital Wall Switch Motion Sensors. Digital wall switch motion sensors shall be provided with the following features:

- Shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
- One- or two-button switches for one or two switch-legs.
- Optional daylight sensor feature for daylighting override.

2.04 DIGITAL MANUAL CONTROLS

A. Wall Switches

1. Low voltage dimming and momentary pushbutton switches in 1, 2, 3, 4, 5, and 8 Button configurations.

2. Wall switches shall include the following features:
   - Buttons may be programmed as Load or Scene Buttons.
   - Buttons may be programmed as ON/OFF, ON only, or OFF only.
   - Switch buttons may be bound to any load on a room controller and are not load type dependent.

B. Dimmer Switches
- Raise/lower dimming adjustment controls.
- Dimmer switches shall include multiple LEDS to indicate load levels.
- Dimmer switches shall be able to be ganged with multi-button switches under the same wallplate.
- Three-way and 4-way switch locations are supported for ON/OFF or Dimming control.

C. Digital Scene Switches
- Scene switches allow for Preset Scene recall and dimming override control.

2.05 DIGITAL AUXILIARY INPUT/OUTPUT (I/O) INTERFACE MODULES

A. General:
- Operate on Class 2 power supplied by In-Room network.
- Status LEDs indicate if input is energized.
- UL 2043 plenum rated where required.

B. Switched Contact Closure Interface:
- Utilized for automatic control via input from other sources such as switches, relay-based system, BAS, etc.
- Includes 24VDC output and input terminals for momentary or maintained third party contact closure inputs.
- Utilize input module for an Auto ON and Sweep OFF function input from other sources for the controlled area. During normal hours of operation, all local low-voltage devices are fully operational. During after hours, a timer shall be applied to all low-voltage switches or dimmers so that the room will automatically sweep off every two hours following switch activation. Provide a blink warning to alert occupants of impending OFF.

- Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current.
- Specific I/O devices shall have an input that reads a 0-10 VDC signal from an external device.
- Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event (e.g. toggle the lighting load) or run a local/remote control profile.
- Specific I/O devices shall sense state of low-voltage outdoor photocells.
- Specific I/O devices shall sense momentary and maintained contact closures, and either toggle a connected load after a momentary contact or ramp the load high/low during a maintained contact (stopping when the contact releases).

C. Serial Data Interface:
- Utilized for control from A/V system to send ON/OFF/Preset commands to In-Room Network.
- Includes 24VDC output and 10 pin RS232 connection.
- Coordinate programming with the Distributed Digital Lighting Control System manufacturer's technician and the A/V system technician for successful interface between both systems.

2.06 DIGITAL LIGHTING CONTROL PANELS (RELAY AND DIMMING PANELS)

A. General:

1. It is the intent of this paragraph to provide a Digital Lighting Control Panel as part of an integrated lighting control system. Contractor is responsible for confirming that the panels and associated peripheral devices such as sensors and manual controls interoperate as a single system.

2. Digital Lighting Control Panels shall be incorporated into the lighting control system Global Network where used.

3. Provide lighting control panels as required. Each panel shall be of modular construction and consist of the following components:
   - The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
   - The interior construction shall provide total isolation of line voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel.
   - Direct wired switch inputs associated with each relay shall support two-wire, momentary or maintained contact switches.
   - Digital inputs shall support digital switches, digital I/O modules capable of receiving 0-5V or 0-10V analog photocell inputs, digital I/O modules capable of receiving momentary or maintained contact closure inputs, digital photocell modules, and digital occupancy sensors.
   - Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells associated with the lighting control panel as necessary to meet the project requirements.

B. Relays. Relays shall provide the following ratings and features:

- Panel shall provide one 0-10VDC dimming output paired with each relay.
- Each relay shall contain an LED status light and an override pushbutton. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
- Relays shall be individually replaceable in a modular plug-in design.
- Relays shall be single-phase normally-closed latching type relays capable of switching 120/277 VAC or two-phase relays capable of switching 208/240/480 VAC loads.
- Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
- Tested to 300,000 mechanical on/off cycles.
- Relay operation shall be automatically sequenced to reduce impact on the electrical distribution system when large loads are controlled simultaneously.

C. Digital Network Clock

- Each panel shall include a digital clock capable to issue system wide automation commands.
- The clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and shall include battery backup for the clock function and for program retention. The clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
- The clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours to automation groups that implement pre-configured control scenarios. Scenarios shall include:
  - Scheduled ON / OFF
  - Manual ON / Scheduled OFF
  - Astro ON / OFF (or Photo ON / OFF)
  - Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
- Schedules programmed into the clock of any one panel shall be capable of executing local schedules or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost.

2.07 CONFIGURATION TOOLS

A. A configuration tool facilitates optional customization of In-Room networks.

- Provide two Configuration Tools for the project.
- Provide free, downloadable PC software for direct programming of In-Room Networks.

B. Features and functionality of the wireless configuration tool shall include but not be limited to:

- Optional customization of In-Room networks using two-way wireless communications or USB interface.
- Must be able to read and modify parameters for room controllers, occupancy sensors, wall switches, daylighting sensors, network bridges and relay panels, and identify room devices by type and serial number.
- Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.

2.08 NETWORK CABLES

A. In-Room Networks

1. This specification is based on CAT5e data cables for In-Room Networks. Other wiring topologies are acceptable if controls accomplish all requirements specified in these documents.

2. Use manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors for In-Room Networks. If manufacturer’s cables are not used, each field-terminated cable shall be tested prior to installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.

3. UL 2043 plenum rated where required.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

3.02 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
Relative humidity: Maximum 90 percent, non-condensing.

3.03 SENSOR LAYOUTS

A. Confirm quantity and provide appropriate coverage by sensors on a per-space requirement. Symbols on drawings are diagrammatic and represent design intent only.

B. Occupancy sensors shall be installed at locations indicated on the manufacturer’s submittal layout drawings. Sensors shall be located to prevent false triggering of the lights to ON when no occupant is present.

3.04 INSTALLATIONS

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. Install all room/space devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.

If pre-terminated cable is not used for room/space wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.

Install all room-to-room digital devices using manufacturer-supplied network wire. Network wire substitution is not permitted and may result in loss of product warranty.

Low-voltage wiring topology must comply with manufacturer's specifications.

Document final wiring locations, routing, and topology on as-built drawings.

C. All line-voltage connections shall be tagged to indicate circuit and switched legs.

D. Test all devices to ensure proper communication.

E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

F. Adjust time delay so that controlled area remains lighted while occupied.

G. Provide written or computer-generated documentation on the configuration of the system including room-by-room description including:

Sensor parameters, time delays, sensitivities, and daylighting setpoints.
Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
Load Parameters (e.g. blink warning, etc.)

H. Tighten all panel Class I conductors at circuit breakers and at loads to torque ratings as marked on enclosure UL label.

I. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimmed loads shall have separate neutrals.

K. Verify all loads to be free from short circuits prior to connection to room controllers.

3.05 FIELD QUALITY CONTROL

A. Electrician/Low Voltage Technician: Any low voltage wiring made onsite by electrical or low voltage contractor must be verified end to end with industry standard test equipment capable of printing or producing a digital file of the testing results.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Manufacturer in writing a minimum of three (3) weeks prior to system start-up and testing.

C. Tests and Inspections: Manufacturer's service representative or electrical/low-voltage contractor installing low voltage cabling that is not pre-terminated from the manufacturer shall perform the following inspections and prepare reports.

D. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports:
- Verify end-to-end testing of all low voltage wiring that is not pre-terminated from the manufacturer. Provide detailed results via paper or digital format downloadable from testing equipment.
- Verify Class I and II wiring connections by validating system performance.
- Set IP addresses and other network settings of system front-end hardware per facility's IT instructions.
- Verify/complete task programming for all switches, dimmers, time clocks, and sensors.
- Verify that the control of each space complies with the Lighting Sequence of Operation.
- Correct any system issues and retest.

E. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
- Date of test or inspection.
- Loads per space.
- Fixture Address identification.
- Quantity and Type of each device installed.
- Reports providing each device's settings.

3.06 POST START-UP TUNING

A. Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from initial occupancy. Provide a detailed report to the Architect/Owner of post start-up activity.

3.07 WARRANTY

A. Manufacturer shall provide a 5-year limited warranty on products within this installation, except where otherwise noted, and consisting of a one-for-one device replacement.

3.08 PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

3.09 TRAINING

A. The Contractor, through their supplier, shall provide training on the system operation for the owner as part of this contract. The training shall consist of two (2) two-hour sessions.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 53 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.

B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).

C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).

D. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.

E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2013.

F. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2017.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

A. See Division 1 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

E. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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

1.06 MAINTENANCE MATERIALS

A. See Division 1 - Product Requirements, for additional provisions.

B. Furnish two of each panelboard key.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Electrical/Cutler-Hammer.

B. GE Industrial.

C. Square D.

D. Substitutions: See Division 1 - Product Requirements.

2.02 POWER DISTRIBUTION PANELBOARDS

A. Description: NEMA PB 1, circuit breaker type.

B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.

C. Minimum integrated short circuit rating: As indicated on plans.

D. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.

E. Molded Case Circuit Breakers with Current Limiters: With replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole; UL listed.

F. Cabinet Front: Surface type, fastened with concealed trim clamps, hinged door with flush lock, metal directory frame, finished in manufacturer's standard gray enamel.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.

C. Minimum Integrated Short Circuit Rating: As indicated on plans.

D. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.

1. Type SWD for lighting circuits.
2. Type HACR for air conditioning equipment circuits.
3. Class A ground fault interrupter circuit breakers where scheduled.
4. Do not use tandem circuit breakers.

E. Enclosure: NEMA PB 1, Type 1.

F. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.

G. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

C. Height: 6 feet (1800 mm) to top of panelboard; install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section 26 05 53.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.

1. Minimum spare conduits: 5 empty 1 inch (DN27).

H. Ground and bond panelboard enclosure according to Section 26 05 26.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Division 1.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.03 ADJUSTING

A. Measure steady state load currents at each panelboard feed. Re-arrange circuits to balance the phase loads to within 10 percent.

END OF SECTION

SECTION 26 27 01

ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Meter bases.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2006.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.03 SYSTEM DESCRIPTION

A. System Characteristics: 120/240 volts, single phase, three-wire, 60 Hertz. 320 amp meter socket with a 400 amp service disconnect.

B. Service Entrance:

1.04 SUBMITTALS

A. See Division 1 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide ratings and dimensions of transformer cabinets and meter bases.

C. Submit utility company-prepared drawings.

1.05 QUALITY ASSURANCE

A. Utility Company:

B. Perform work in accordance with utility company written requirements and NFPA 70.

1. Maintain one copy of each document on site.

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

1.06 PRE-INSTALLATION MEETING

A. Convene one week prior to commencing work of this section. Review service entrance requirements and details with Utility Company representative.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. GE Industrial.

B. Milbank Manufacturing.

C. Square D.

D. Substitutions: See Division 1 - Product Requirements.

2.02 COMPONENTS

A. CT Cabinet:

1. Size: As required by utility.

B. Meter Socket: Furnished by utility company.

C. Meter Socket: As required by utility.

D. Utility Transformer Pad: Prefabricated fiberglass reinforced plastic transformer pad with cable pit.

1. Supplied by utility.

E. Other Components: As required by utility company.

PART 3 EXECUTION

3.01 PREPARATION

A. Arrange with utility company to obtain permanent electric service to the Project.

B. Verify that field measurements are as indicated on utility company drawings.

3.02 INSTALLATION

A. Install service rack, weatherhead, transformer pad, metering transformer cabinets, and meter base as required by utility company.

B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

END OF SECTION

SECTION 26 27 17

EQUIPMENT WIRING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 26 05 34 - Conduit.

B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

C. Section 26 05 37 - Boxes.

D. Section 26 27 26 - Wiring Devices.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).

B. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2016.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

A. See Division 1 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Conform to NEMA WD 1.
2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
4. Product:
5. Substitutions: See Division 1 - Product Requirements.

B. Disconnect Switches: As specified in Section 26 28 18 and in individual equipment sections.

C. Wiring Devices: As specified in Section 26 27 26.

D. Flexible Conduit: As specified in Section 26 05 34.

E. Wire and Cable: As specified in Section 26 05 19.

F. Boxes: As specified in Section 26 05 37.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.03 EQUIPMENT SCHEDULE

A. Schedule on drawings.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Occupancy sensors.

D. Receptacles.

E. Device plates and decorative box covers.

1.02 RELATED REQUIREMENTS

A. Section 26 05 37 - Boxes.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2015.

B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).

C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2016.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

A. See Division 01 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Installation Instructions.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 EXTRA MATERIALS

A. See Division 01 - Product Requirements, for additional provisions.

B. Furnish two of each style, size, and finish wall plate.

C. Provide two protective rings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cooper Wiring Devices.

B. GE Industrial.

C. Leviton Manufacturing, Inc.

D. Wiremold.

E. Substitutions: See Division 01 - Product Requirements.

2.02 WALL SWITCHES

A. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.

1. Body and Handle: Plastic with toggle handle. (Verify color with Architect.)
2. Ratings:
   a. Voltage: 120 volts, AC.
   b. Current: 20 amperes.
3. Ratings: Match branch circuit and load characteristics.

B. Switch Types: Single pole, double pole, and 3-way.

2.03 WALL DIMMERS

A. Wall Dimmers: Specify per light fixture manufacturer’s recommendations. Type as indicated on drawings, complying with NEMA WD 6 and WD 1.

1. Body and Handle: Plastic. (Verify color with Architect.)
2. Voltage: Per fixture type.
3. Power Rating: Per fixture and manufacturer’s recommendations.
4. Power Rating: Match load shown on drawings.
5. Power Rating: As indicated in schedule.

B. Accessory Wall Switches: Match dimmer appearance.

2.04 OCCUPANCY SENSORS

A. Provide type as indicated on drawings.

2.05 RECEPTACLES

A. Receptacles: Heavy duty, complying with NEMA WD 6 and WD 1.

1. Configuration: NEMA WD 6, type as specified and indicated.

B. Convenience Receptacles: Type 5 to 15.

C. Single Convenience Receptacles.

D. Duplex Convenience Receptacles.

E. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

F. Provide tamper and arc fault receptacles per NEC and Local codes.

G. ***Standby Generator Receptacles shall be red with a normal colored wall plate***.

2.06 WALL PLATES

A. Decorative Cover Plates: Smooth plastic. (Verify color with Architect/Owner.)

B. Jumbo Cover Plates: Smooth plastic. (Verify color with Architect/Owner.)

C. Weatherproof Cover Plates: Gasketed cast metal with hinged.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that outlet boxes are installed at proper height.

B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that floor boxes are adjusted properly.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.03 INSTALLATION

A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

E. Do not share neutral conductor on load side of dimmers.

F. Install receptacles with grounding pole on top.

G. Connect wiring device grounding terminal to outlet box with bonding jumper.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Connect wiring devices by wrapping conductor around screw terminal.

J. Use jumbo size plates for outlets installed in masonry walls.

K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

L. Install protective rings on active flush cover service fittings.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 37 to obtain mounting heights specified.

B. Install wall switch 44 inches above finished floor.

C. Install convenience receptacle 18 inches above finished floor.

D. Install convenience receptacle 6 inches above counter.

E. Install dimmer 44 inches above finished floor.

F. Install telephone jack 18 inches above finished floor.

G. Install telephone jack for side-reach wall telephone to position top of telephone at 48 inches above finished floor.

H. Install telephone jack for forward-reach wall telephone to position top of telephone at 48 inches above finished floor.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Division 01.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify that each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 28 18

ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fusible switches.

B. Nonfusible switches.

1.02 RELATED REQUIREMENTS

A. Section 26 28 13 - Fuses.

1.03 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2012.

B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2013.

C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2017.

D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

A. See Division 1 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide switch ratings and enclosure dimensions.

C. Project Record Documents: Record the actual locations of enclosed switches.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Electrical/Cutler-Hammer.

B. GE Industrial.

C. Square D.

D. Substitutions: See Division 1 - Product Requirements.

2.02 COMPONENTS

A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.

1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.

2. Handle lockable in OFF position.

3. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.

1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.

2. Handle lockable in OFF position.

C. Enclosures: NEMA KS 1.

1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install fuses in fusible disconnect switches.

C. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Division 1.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.5.1.2.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 32 13

ENGINE GENERATORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes packaged engine-generator sets for Standby power supply with the following features:

1. Fuel Natural Gas engine
2. Unit Mounted Cooling System
3. DGC 2020 - Level 2 Fully Enhanced
4. Level 2 - Basic Sound Attenuation (Steel)
5. Performance Requirements for Sensitive Loads.

B. Related Sections include the following:

1. Division 1 for specifications covering demonstrations and training of the equipment.

2. Section 26 05 53 “Identification for Electrical Systems” for specifications covering electrical systems.

3. Section 26 05 26 “Grounding and Bonding for Electrical Systems” for specifications covering grounding of components.

4. Section 26 36 00 “Transfer Switches” for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

5. Section 26 05 19 “Low-Voltage Electrical Power Conductors and Cables” for specifications covering wiring.

1.03 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over a range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

B. NG: Natural Gas.

C. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of the power outage.

1.04 SUBMITTALS

A. Product Data: Include the following:

1. Thermal Damage curve for generator.
2. Time-current characteristic of curves for generator protective device.

B. Shop Drawings: Detailed equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawing of engine-generator set and other components specified.

2. Design Calculations: Signed and sealed by a qualified engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

3. Vibration Isolation Base Details: Signed and sealed by a qualified engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.

4. Wiring Diagrams: Power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

1. This generator manufacturer must be regularly engaged in the production of engine-generator sets and associated controls for a minimum of twenty years, thereby identifying one source of supply and responsibility. Equal means having the same system configuration, operation, footprint of the engine-generator set with the same sizing solution. Alternate offerings must be submitted for approval 14 days prior to bid.

2. The manufacturer shall provide factory-trained service and parts support through a factory authorized dealer/supplier that is regularly doing business in the area of installation.

3. The manufacturer shall have printed literature and brochures describing the standard system specified, not a one of a kind fabrication.

4. As part of qualification process; an authorized dealer/supplier, herein known as the dealer shall represent the manufacturer. To qualify as the dealer/supplier, it must be a “Full Product Line Sales and Service Dealer” and shall have 24-hour service availability. The dealer/supplier must have certified generator service technicians, inventory of parts to support after sales service and can prove 5 years of experience in the engine-generator field.

B. Source quality-control test reports.

1. Certified summary of prototype-unit test report.

2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.

4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.

5. Report of sound generation.

6. Report of exhaust emissions showing compliance with applicable regulations.

7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

8. Operation and Maintenance Data: For packaged engine-generator sets to include emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section “Closeout Procedures” include the following:

a. List of tools and replacement items recommended to be stored at the Project for ready access. Including part and drawing numbers, current prices, and source of supply.

C. Field quality-control test reports

D. Warranty: Special warranty specified in this Section

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine-generator sets to include emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section “Closeout Submittals” include the following:

1. List of tools and replacement items recommended to be stored at the Project for ready access. Including part and drawing numbers, current prices, and source of supply.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every ten of each type and rating, but no less than one of each.
2. Indicator Lamps: Two for every six of teach type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Belts: One set of each alternator and fan belt.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than 2 hours normal travel time from Installer's place of business to Project site.
2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on the testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association (NETA) or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

D. Source Limitations: Obtain packaged engine-generator sets and auxiliary components through one source from a single manufacturer.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of packaged generator sets and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Comply with ASME B15.1.

H. Comply with NFPA 37.

I. Comply with NFPA 30.

J. Comply with NFPA 70.

K. Comply with NFPA 99.

L. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

M. Comply with UL 2200.

N. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

1.09 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:.

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Construction Manager's and Owner's written permission.

B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Minimum Temperature: -20°F
2. Maximum Temperature: 100°F
3. Relative Humidity: 0 - 95 percent
4. Altitude: 1500 feet

1.10 COORDINATION

A. Coordinate size and location of concrete bases for package engine-generator sets. Cast anchor-bolt inters into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine-generator sets and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 Yr - 3000 Hr Basic Stdby Limited warranty from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work included, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product:

1. MTU Onsite Energy.
2. Generac.
3. Onan/Cummins Power Generation; Industrial Business Group.
4. Caterpillar

2.02 ENGINE GENERATOR SET

A. 30 kW / 240 Volt 1 Phase 60Hz packaged engine generator set shall be a coordinated assembly of compatible components.

B. Factory-assembled and tested, engine-generator set.

C. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

D. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidence by records of prototype testing.

2. Output Connections: 240 Volt 1 Phase 60Hz.

3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

E. Generator-Set Performance with PMG excitation:

1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.

   a. Nameplate Data for Oversized Generator: Show rating required by the Contract Documents rather than ratings that would normally be applied to the generator size installed.

2. Steady-State Voltage Operational Bandwidth: .25 percent of rated output voltage from no load to full load.

3. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three to four seconds.

4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.

5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variation outside the steady-state operational band and no hunting or surging of speed.

6. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.

7. Sustained Short-Circuit Current: For a 1-phase, bolted short circuit at system output terminals, system shall supply minimum of 300 percent of rated full-load current for not less than 10 seconds without damage to winding insulation or other generator system components.

8. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.

   a. Provide permanent magnet excitation for power source to voltage regulator..

9. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.03 ENGINE DOOSAN

A. Basic Engine: Cast-iron, Oil pan, Wet exhaust manifold and vibration damper**.**

B. Rated Engine Speed: 1800 rpm.

C. Starter: One electric starter 24v DC.

D. Dual Fuel System: Controlled by a microprocessor based engine control module (ECM) and a high speed electronic fuel pressure regulator (EPR). The ECM and EPR work with a three way catalyst and pre and post catalyst O2 sensors for feedback control. The system operates on the basis of a stoichiometric air fuel ratio.

E. Alternator: Engine mounted belt drive.

F. Lube Oil System: Forced feed lubrication, Lube oil filter, Lube oil heat exchanger, Filler neck and dip stick.

G. Combustion Air System: Dry type air filter.

H. Cooling System: Coolant circulation pump and Pusher fan.

I. Governor: Electronic Control through ECU, with speed sensing.

J. Engine Fuel System:

1. Electronic Pressure Regulator: Regulates the fuel mixture based on Intake Air Temperature, Load, Etc.

2. ECU: Coupled into the generator set control panel interface to allow direct control from the panel.

3. System Control: Closed Loop fuel system using readings from O2 senor(s) to maintain proper fuel mixture through control of the Electronic Pressure Regulator.

K. Coolant Jacket Heater: An electric water heater with integral thermostatic control, properly sized to maintain engine jacket water at 90 degrees and suitable for operation in an ambient temperature of -20°F. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

L. Cooling system: Closed loop, liquid cooled, with radiator factory mounted on engine-generator set mounting frame and integral engine-driven coolant pump.

1. Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

2. Size of radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent of load condition.

3. Expansion Tank: Constructed withstand maximum closed-loop coolant system pressure for engine used.

4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber.

a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and non-collapsible under vacuum.

b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

M. Critical Grade Silencer: The silencer shall attenuate exhaust noise to a Critical level.

1. An Exhaust silencer shall be furnished of industrial standard construction, all welded, for stationary engine application. Long radius, low restriction fittings will be used throughout, and pipe size will be sufficiently large to handle the engine exhaust flow at full load without causing back pressure in excess of that allowed by the engine manufacturer.

N. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and “blocked filter” indicator.

O. Starting System: 12 or 24 volt electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 “Project Conditions” Article.

2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.

3. Cranking Cycle: As required by NFPA 110 for system level specified.

4. Battery: Adequate capacity within ambient temperature range specified in Part 1 “Project Conditions” Article to provide specified cranking cycle at least **twice** without recharging.

5. Battery Cable: Sized as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.

6. Battery Compartment: Battery rack floor mounted constructed of steel, gloss black finish. Include accessories required to support and fasten batteries in place.

7. Battery Charger: 12 or 24VDC, current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Minimum equalizing-charging rate of 10 amps shall be initiated automatically after battery has lost charge until and adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.

    b. Automatic Temperature Compensation: Must be equipped with temperature compensation to assure correct charging in all conditions.

    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus .5 percent.

    d. Ammeter and Voltmeter: Digital display shall indicate charging rates.

    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of AC input or DC output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

    f. Enclosure and Mounting: NEMA-1.

P. Ignition: Coil on plug electronic ignition.

2.04 CONTROLS AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, the generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts the generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

C. Configuration: Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Rigidly mounted to the generator set.

D. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following accessories:

E. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

F. Connection to Data Link: A separate terminal block, factor wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals. Data system connections to terminals are covered in Section 260913 “electrical Power Monitoring and Control.”

G. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.

1. Overcrank Shutdown.
2. Coolant Low-temperature Alarm.
3. Control Switch Not in Auto Position.
4. Battery-charger Malfunction Alarm.
5. Battery Low-voltage Alarm.

H. Common Remote Audible Alarm: Signal the occurrence of any even listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.

1. Engine High-temperature Shutdown.
2. Lube-oil, Low-pressure Shutdown.
3. Overspeed Shutdown.
4. Remote Emergency-stop Shutdown.

5. Engine High-temperature Pre-alarm.
6. Lube-oil, Low-pressure Pre-alarm.
7. Fuel Tank, Low-fuel Level.
8. Low Coolant Level.

I. Remote Alarm Annunciator: Designed for compliance with NFPA 110. LEDs labeled with proper alarm conditions identify each alarm as well as an audible signal for each alarm condition. Silencing switch in face of panel silences signal without altering visual indication. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

LED indications are provided for the following:

1. Alarms:

    a. Low Coolant Level
    b. High Coolant Temperature
    c. Low Oil Pressure
    d. Overcrank
    e. Overspeed
    f. Emergency Stop Activated
    g. Fuel Leak
    h. Sender Failure

2. Pre-alarms:

    a. High Coolant Temperature
    b. Low Coolant Temperature
    c. Low Oil Pressure
    d. Low Fuel Level
    e. Battery Overvoltage
    f. Weak Battery
    g. Battery charger Failure

3. Operational status:

    a. Switch Not in Auto
    b. Display Panel On
    c. EPS Supplying Load

J. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button is protected from accidental operation.

2.05 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Thermal-magnetic type; 80 percent rated; complying with NEMA AB 1 and UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Mounting: On generator set in an enclosure.
4. Bell Alarm: None
5. Shunt Trip: Provides remote control capability to open circuit breaker.

B. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shut-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.

2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.

3. As overcurrent heating effects on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.

4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

C. Ground-Fault Indication: Comply with NFPA 70, “Emergency System” signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

2.06 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to the engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Drip proof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: PM300 voltage regulator is an encapsulated electronic voltage regulator that controls the output of a brushless AC generator by regulating the current into the exciter field.

SPECIFICATION	PM300 REGULATOR
Burden	500 VA
Output Power- Continuous	63 Vdc at 3.5 Adc (190w)
Output Power - Forcing(240 Vac Input	105 Vdc at 5 Adc (525w)
Regulation	1 .0%
Remote Voltage Adjustment Range	± 10% with 2000 ohm rheostat ± 5% with l000 ohm rheostat
Frequency Compensation	Adjustable
Roll off frequency	54-61 Hz for 60 Hz 45-51 Hz for 50 Hz
Operation	Weight6.5 oz.
Operating Temperature	- 40°C to + 60°C
Storage Temperature	- 65°C to + 85°C
Power Dissipation	8 watts maximum
Size	3.94" L X 2.66” W X 2.20: H
EMI Suppression	Internal Electromagnetic Interference Filter (EMI Filter)

I. Strip Heater: A small heater element mounted permanently in the generators winding or outlet box to provide a warm, moisture free environment.

J. Bearing RTD: None

K. Stator RTD: None

2.07 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Enclosure is designed to be wind resistant up to 100 mph. ASCE 7-05 Exposure C, 3-second wind gusts.

B. Description: Steel enclosure with the following features:

1. Construction: Formed and/or welded steel.
2. Hinged doors for access with lockable latches.
3. Louvered and/or baffled air inlet. Grated air outlet.

4. Interior lined with acoustical foam for sound attenuation.
5. Choice of standard colors. Custom colors available upon request.
6. Additional Enclosure Features:
    - Sound Attenuation
        - Application of foam material to reduce noise emissions. Weather protective sound attenuated enclosure, **70**dBA at 23 feet with sound level measured at any point around the generator set at full rated load.
    - Door Restraints
        - Hardware installed to secure doors in the open position to aide in service and operation.
    - AC Lighting
        - Consists of one or more (dependent upon enclosure size) vapor-proof UL listed light fixtures prewired in conduit to a customer connection point.
        - Operates on 120Vac and is controlled by a prewired SPST switch.

2.08 VIBRATION ISOLATION DEVICES

A. Neoprene Pad

1. ¼ inch thick elastomeric pad in square shape to be placed under the base frame at each of the pre-drilled isolator mounting holes.

2. Helps to prevent sliding of the unit as well as reducing the transmission of sound and vibration into the floor.

2.09 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.10 SOURCE QUALITY CONTROL

A. Prototype Testing: factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Full Load Run.
3. Maximum Power.
4. Voltage Regulation.
5. Transient and Steady-State Governing.

6. Single-Step Load Pickup.
7. Safety Shutdown.
8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
9. Report factory test results within 10 days of completion of test.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator set performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

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

3.02 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.03 CONNECTIONS

A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

B. Piping installation requirements are specified in Division 23 Sections. Drawings indicate general arrangement of piping and specialties.

C. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

D. Connect fuel piping to engines with a gate valve and union and flexible connector.

1. Natural-gas piping, valves, and specialties for gas distribution are specified in Division 23 Section "Facility Natural-Gas Piping."

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.04 IDENTIFICATION

A. Identify system components according to Division 22 Section "Identification for Plumbing Piping and Equipment" and Division 26 Section "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection except those indicated to be optional for "AC Generators and for Emergency Systems" specified by NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

E. Coordinate tests for transfer switches and run them concurrently.

F. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

G. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

J. Remove and replace malfunctioning units and retest as specified above.

K. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Section 017900 "Demonstration and Training."

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 36 00

TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automatic Transfer Switch.

1.02 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Engraved nameplates.

B. Section 26 32 13 - Engine Generators: Testing requirements.

1.03 REFERENCE STANDARDS

A. NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment; National Electrical Manufacturers Association; 2005.

B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

A. See Division 1 - Administrative Requirements for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation Data: Instructions for operating equipment under emergency conditions when engine generator is running.

E. Maintenance Data: Routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

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

1.06 MAINTENANCE SERVICE

A. Provide service and maintenance of transfer switches for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ASCO Power Technologies, LP.

B. Eaton Electrical/Cutler-Hammer.

C. Russelectric.

D. Kohler.

D. Substitutions: See Division 1 - Product Requirements.

2.02 AUTOMATIC TRANSFER SWITCH (Mechanically Held)

A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.

B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.

E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

F. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

2.03 MICROPROCESSOR CONTROLLER WITH MEMBRANE INTERFACE PANEL

A. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent serial communications capability. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

B. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.

C. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1. ANSI C37.90A/IEEE 472 Voltage Surge Test
2. NEMA ICS - 109.21 Impulse Withstand Test
3. IEC801-2 Electrostatic discharge (ESD) immunity
4. ENV50140 and IEC 801 - 3 Radiated electromagnetic field immunity
5. IEC 801 - 4 Electrical fast transient (EFT) immunity
6. ENV50142 Surge transient immunity
7. ENV50141: Conducted radio-frequency field immunity
8. EN55011: Group 1, Class A conducted and radiated emissions
9. EN61000 -4 - 11 Voltage dips and interruptions immunity

2.04 ENCLOSURE

A. The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.

B. Controller shall be flush-mounted display with LED indicators for switch position and source acceptability. It shall also include test and time delay bypass switches.

2.05 OPERATION

A. Voltage and Frequency Sensing

1. The voltage of each phase of the normal source shall be monitored, with pickup adjustable to 95% of nominal and dropout adjustable from 70% to 90% of pickup setting.

2. Single-phase voltage and frequency sensing of the emergency source shall be provided.

B. Time Delays

1. An adjustable time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals.

2. An adjustable time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.

3. A generator stabilization time delay shall be provided after transfer to emergency.

4. An adjustable time delay shall be provided on retransfer to normal, adjustable to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.

5. A 5-minute cool down time delay shall be provided on shutdown of engine generator.

6. All adjustable time delays shall be field adjustable without the use of special tools.

C. Additional Features

1. A set of contacts rated 5 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

2. A push-button type test switch shall be provided to simulate a normal source failure.

3. A push-button type switch to bypass the time delay on transfer to emergency, the engine exerciser period on the retransfer to normal time delay whichever delay is active at the time the push-button is activated.

4. Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal.

5. Auxiliary contacts rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact, closed, when the ATS is connected to the emergency source.

6. Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the

emergency source (red). Also provide indicating lights for both normal and emergency source availability.

7. Terminals shall be provided to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.

8. Engine Exerciser - An engine generator exercising timer shall be provided, including a selector switch to select exercise with or without load transfer.

9. Inphase Monitor - An Inphase monitor shall be inherently built into the controls. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer.

10. Communications Interface - Connectivity Module to allow several different serial devices that communicate at different baud rates and with different protocols to a common Ethernet media. The module shall be used to connect Annunciators to the standard Ethernet TCP/IP network with standard 10 base-T (RJ-45) connector. The module shall be designed to communicate with up to 4 clients such as Web applications (web pages) communication products simultaneously over an Ethernet connection.

11. Programmable Engine Exerciser - A seven or fourteen day programmable engine exerciser with digital readout display. Shall include one form C contact for availability of normal and emergency sources. Include “with or without” load control switch for exerciser period. The exerciser shall be backed up by a permanent battery. (Accessory11BG).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface is suitable for transfer switch installation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide engraved plastic nameplates under the provisions of Section 26 05 53.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Division 1.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.22.3.

3.04 MANUFACTURER'S FIELD SERVICES

A. Provide the services of the manufacturer's technical representative to check transfer switch connections and operations and place in service.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of transfer switch in normal and emergency modes.

PART 4 ADDITIONAL REQUIREMENTS

4.01 WITHSTAND AND CLOSING RATINGS

A. The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. WCR ATS ratings as be as follows when used with specific circuit breakers:

ATS Size	Withstand & Closing Rating MCCB	W/CLF
30	22,000A	100,000
70 - 200	22,000A	200,000
230	22,000A	100,000
260 - 400	42,000A	200,000
600 - 1200	65,000A	200,000
1600 - 2000	85,000A	200,000
2600 - 3000	100,000A	200,000

4.02 TESTS AND CERTIFICATION

A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The ATS manufacturer shall be certified to ISO 9001: 2000 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001: 2000.

4.03 SERVICE REPRESENTATION

A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years. For ease of maintenance, the transfer switch nameplate shall include drawing numbers and serviceable part numbers.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 43 05

SURGE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes the materials and installation requirements for surge protective devices (SPD). Surge protective devices are used for the protection of all AC electrical circuits from the effects of lightning induced currents, substation-switching transients and internally generated transients resulting from inductive and/or capacitive load switching.

1.02 RELATED SECTIONS

A. Basic Electrical Requirements

B. Raceways, boxes, and fittings

C. Wire and cable

D. Grounding

1.03 SUBMITTALS

A. Submit shop drawings, product data and manufacturer's installation instructions.

B. The surge suppression submittals shall also include:

1. Dimensional drawing of each suppressor type indicating mounting arrangements.
2. Category C3 (20KV,10KA,8/20u sec. waveform) clamp voltage test results.
3. UL 1449 clamp voltage documentation.

1.04 CERTIFIED TESTS

A. The surge suppressor manufacturer shall provide certified test results on the actual product being shipped to the job site. An officer or engineer of the company as being performed on the product after manufacture shall certify the test results.

B. The test conducted shall be per ANSI C62.41-1991 and ANSI C62.45. The units shall be tested in all modes listed in this specification for Category C1.

C. The engineer, after review of test data, may require unit to be returned and a new unit provided that meets the requirements of this specification.

D. See Division 1 - Administrative Requirements, for submittal procedures.

1.05 WARRANTY

A. The surge suppressor manufacturer shall warrant the surge protective devices and supporting components against defects in material and workmanship for a period of five years.

1.06 MANUFACTURER QUALIFICATIONS

A. Surge protective devices shall be manufactured in the USA by a company normally engaged in the design and manufacture of such devices for at least five (5) years.

B. Both the service entrance and branch panel suppressors shall be of the same manufacturer.

1.07 SAFETY AGENCY APPROVALS

A. Suppressors shall be listed in accordance with UL 1449, standard for safety, transient voltage surge suppressors and UL 1283. They shall also be CSA or UL approved.

B. See Division 1 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 SERVICE ENTRANCE

A. Surge Protective Devices shall be installed integral in switchboards at all service entrances of building and/or as shown on the riser diagram.

B. Suppressors shall be tested with the category C3 high exposure waveform (20KV,10KA,8/20u sec. waveform) per ANSI/IEEE C62.41- 1991.

C. Wye systems shall have suppression elements between each phase conductor and the system neutral, between each phase conductor and the system ground and between the neutral conductor and ground.

D. Each phase shall have a minimum of two modules. The surge modules shall be fused at a minimum rating of 20 amps and a current limit rating of 200,000 AIC. Modules and fuses shall be field replaceable.

E. Visible indication of proper suppressor connection and operation shall be provided. The indicator shall consist of an LED array. No single LED or neon indicators will be used.

F. The surge protective device shall be equipped with an audible alarm that shall actuate when any part of the surge circuitry has been damaged. A silence button shall be provided with the alarm.

G. Suppressors shall meet or exceed the following criteria:

1. Minimum single impulse current rating (L-N + L-G): 240,000 amperes per phase.

2. Incorporate hybrid circuitry.

3. UL 1449 (ANSI C62.41-1991 Category C1) clamping voltage shall not exceed the following:

	VOLTAGE	L-N	L-G	N-G
a.				
b.	120/208	800	800	800

4. The Category C3 clamping voltage ANSI/IEEE C.62.41-1991 (20KV-1.2/50us.,10KA-8/20us.) shall not exceed the following:

   a. VOLTAGE L-N L-G N-G
   b. 120-208 600 600 600

5. Suppressors shall exhibit redundant protection for each phase and consist of solid-state components and shall operate bi- directionally.

6. Maximum continuous operating voltage of the suppressor shall be greater than 110% of the nominal system voltage.

7. The surge suppressor shall incorporate an internal disconnect (200,000 AIC, 3 pole, UL approved).

8. The following manufacturers will be approved, provided they meet the above specifications:

   a. Advanced Protection Technologies, Inc.
   b. Liebert/Control Concepts
   c. Current Technology
   d. LEA Dynatech
   e. Square D
   f. Or Approved Equal

2.02 SECONDARY SERVICE SUPPRESSORS FOR BRANCH PANELS

A. Surge Protective Devices shall be installed integral in designated branch panels as shown on the riser diagram. All surge suppression controls/test buttons shall be located behind panel door.

B. Wye systems shall have suppression elements between each phase conductor and the system neutral, between each phase conductor and the system ground and between the neutral conductor and ground.

C. Visible indication of proper suppressor connection and operation shall be provided.

D. The surge protective device shall be equipped with an audible alarm that shall actuate when any part of the surge circuitry has been damaged. A silence button shall be provided with the alarm.

E. The suppressor shall exhibit Sine Wave Tracking circuitry. The surge suppressor shall have suppression circuitry that is field replaceable without disturbing the conduit, enclosure.

F. Suppressors shall meet or exceed the following criteria:

   1. Minimum single impulse current rating (L-N + L-G): 80,000 amperes per phase.

   2. UL Clamping voltage shall not exceed the following:

      a. VOLTAGE L-N L-G N-G
      b. 120/208 800 800 800

G. Suppressors shall be of solid-state components and operate bi- directionally. The manufacturer of the surge panel shall offer either a surface or flush cover, as required by the job conditions.

H. Maximum continuous operating voltage of the suppressor shall be greater than 110% of the nominal system voltage.

I. The following manufacturers will be approved, provided they meet the above specifications:

1. EFI Electronics Corporation
2. Liebert/Control Concepts
3. Current Technology
4. LEA Dynatech
5. Square D
6. Or Approved Equal

PART 3 EXECUTION

3.01 SERVICE ENTRANCE

A. Install one primary suppressor integral in switchboards at each utility service entrance or as indicated on the riser diagram. Follow manufacturer's installation instructions.

B. Suppressor shall be installed on the load side of the service entrance.

C. Conductors between suppressor and point of attachment shall be #6 AWG stranded copper conductor or larger. The conductors shall be kept as short and straight as possible. Lead length of connecting conductors shall be within 36 inches.

D. Suppressor's ground shall be bonded to the service entrance ground.

3.02 BRANCH PANELS

A. Factory install surge suppression in branch panels and distribution panels where shown on panel schedules.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires, egress fixtures, and accessories.

B. Exit signs.

C. Lamps.

D. LED Luminaires.

E. LED Drivers.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 36 00 - Air Terminal Units: Air distribution accessories for air handling luminaires.

1.03 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006 (R2015).

B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004 (R2015).

C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002.

D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.

E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.

F. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2016.

G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

H. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2018.

1.04 SUBMITTALS

A. See Division 1 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

1. Photometric Data: Submit on CD or DVD, in IESNA LM-63 standard format.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Division 1 - Product Requirements, for additional provisions.
2. Extra Plastic Lenses: One of type and size.
3. Extra Lamps: One of each type and size.
4. Extra Ballasts: One of type and size.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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

PART 2 PRODUCTS

2.01 LUMINAIRES

A. Furnish products as indicated in Schedule on drawings.

B. Substitutions: See Division 1 - Product Requirements.

2.02 EXIT SIGNS

A. Manufacturers:

1. Cooper Lighting.
2. Lithonia Lighting.
3. Hubbell.
4. Substitutions: See Division 1 - Product Requirements.

B. Exit Signs: Exit sign fixture suitable for use as emergency lighting unit.

1. Furnish products as indicated in schedule on drawings.

2.03 LAMPS

A. Lamp Types: As specified for each luminaire.

2.04 LED LUMINAIRES

A. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:

1. Minimum Light Output.
2. Zonal Lumen Requirements.
3. Minimum Luminaire Efficacy.
4. Minimum CRI.
5. L70 Lumen Maintenance.
6. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.

B. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.

C. Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.

D. Luminaire shall be mercury-free, lead-free, and RoHS compliant.

E. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.

F. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.

G. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.

H. Lumen output shall not depreciate more than 20% after 10,000 hours of use.

I. Luminaire and driver shall be furnished from a single manufacturer to ensure compatibility.

J. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.

K. LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).

L. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.

M. Luminaire shall have a maximum Total Harmonic Distortion (THD) of ≤20% at full input power and across specified voltage range.

N. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.

O. All luminaires shall be provided with knockouts for conduit connections.

P. The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).

Q. Provide all of the following data on submittals:

1. Delivered lumens
2. Input watts
3. Efficacy
4. Color rendering index.

R. The failure of one LED shall not affect the operation of the remaining LEDs.

2.05 LED DRIVERS

A. General:

1. Provide driver type (non-dimmed, step-dimmed, continuous-dimming, etc.) as indicated on the luminaire schedule on the drawings.

2. Minimum Warranty of 5 years (not pro-rated) to include LED driver and all LED components.

3. Driver shall have a rated life of 50,000 hours, minimum.

4. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.

5. Driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.

6. Driver shall operate normally for input voltage fluctuations of plus or minus 10 percent.

7. Driver shall have a maximum Total Harmonic Distortion (THD) of ≤20% at full input power and across specified voltage range.

8. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.

9. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.

10. Provide all of the following data on submittals:

    a. Input watts
    b. Power Factor (pf)
    c. Crest Factor (cf) at full input power
    d. Total Harmonic Distortion (THD).

B. Dimming Drivers:

1. LED driver shall be compatible with dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC), Constant Voltage, or Pulse Width Modulation (PWM) operation.

2. Step-Dimming Drivers: Easily switched from 0% to 50% to 100% output power. Both switch-leg inputs shall control 50% of the luminaire's light output equally.

3. Continuous Dimming Drivers: LED luminaires shall dim to (10%, 1%, or 0.1%) as specified in the Luminaire Schedule on the plans without visible flicker or "popcorn effect". "Popcorn effect" is defined as the luminaire being on a pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the luminaire. Continuous Dimming Drivers shall use 0-10V control.

2.06 ACCESSORIES

A. Product:

1. Substitutions: See Division 1 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

C. Support luminaires equal to or larger than 2 x 4 foot (600 x 1200 mm) size independent of ceiling framing.

D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

F. Exposed Grid Ceilings: Support surface mounted luminaires in grid ceiling directly from building structure.

G. Exposed Grid Ceilings: Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.

H. Exposed Grid Ceilings: Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.

I. Install recessed luminaires to permit removal from below.

J. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

K. Install clips to secure recessed grid-supported luminaires in place.

L. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings.

M. Install accessories furnished with each luminaire.

N. Connect luminaires and exit signs to branch circuit outlets provided under Section 26 05 34 using flexible conduit.

O. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

P. Bond products and metal accessories to branch circuit equipment grounding conductor.

Q. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

R. Interface with air handling accessories furnished and installed under Section 23 36 00.

S. 0-to-10V Dimming Control Wiring Installation:

1. Zero-to-10V dimming control conductors are classified by the NEC as Class 2 conductors and shall be kept separate from line-voltage conductors per NEC 725.136(A). Matching the insulation rating of Conductors of Different Systems does not apply to Class 2 conductors per NEC 300.3(C)(1), Informational Note No.1.

2. Wall box dimmers will typically have two conduits: One conduit for line-voltage power, and one conduit or conduit stub for the 0-10V control wiring.

3. At each luminaire, separate openings (either manufactured knock-outs or punched openings) shall be used for the line-voltage power and the 0-10V wiring. The EC shall use a cable connector at the opening for the 0-10V wiring. Zero-to-10V conductors entering and within a luminaire enclosure shall maintain a minimum separation of 6 mm (0.25 in.) per NEC 725.136(D).

4. Exposed 0-10V cables shall be installed in separate conduits from line-voltage conductors.

5. The 0-10V cables may be routed in free air where concealed above accessible ceilings. Cables routed in free air shall observe the following installation requirements:

    a. The 0-10V cables may be tie-wrapped to the outside of the luminaire power raceway where allowed by NEC 300.11(B)(2). Tie-wraps shall be UL listed for UV resistance. Care should be taken in the use of cable ties to secure and anchor the cabling. Ties shall not be over tightened as to compress the cable jacket. No sharp burrs shall remain where excess length of the cable tie has been cut.

    b. Cabling shall be neatly run at right angles and be kept clear of other trades work.

    c. Cabling shall be secured within twelve (12) inches of direction change or termination.

    d. Cabling shall be supported at a maximum of 5-foot intervals utilizing “J-Hook” or “Bridle Ring” supports anchored to ceiling concrete, piping supports or structural steel beams. If cable sag at mid-span exceeds 12-inches, another support shall be provided. Cable supports shall be installed to maintain cable bend to larger than the minimum bend radius.

    e. Cabling shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, suspended ceiling supports or electrical or communications conduit. Do not place cable directly on the ceiling grid or attach cable in any manner to the ceiling grid wires.

    f. All cables shall be free of tension at both ends. Nylon strain relief connectors shall be provided at each device and junction box where cables enter. In cases where the cable must bear some stress, Kellum type grips may be used to spread the strain over a longer length of cable.

    g. Cable manufacturer’s minimum bend radius shall be observed in all instances.

    h. Use suitable cable fittings and connectors.

T. Luminaire Connections – Metal-Clad (MC) Cable:

1. Metal-Clad (MC) type cable that combines power and Class 2 circuits into a single cable may be used for the luminaire wiring where 0-10V dimming control wiring is required. Examples of such products are Encore Wire® MC-LED™ or Southwire® MC-PCS Duo™. Manufacturer's names and catalog numbers are used for quality and performance only. MC Cables manufactured by others shall be equally acceptable provided they meet or exceed in performance and quality as specified.

2. Recessed, including Master-Satellite connections:

   a. Use a luminaire fixture whip from a J-box for recessed lay-in luminaires. Luminaire fixture whips shall be aluminum or steel AC Cable (Armored Cable) or Flexible Metal Conduit (FMC). Metal Clad (MC) cable that combines power and Class 2 circuits (for 0-10V dimming control) into a single cable may be used as a whip for luminaires that are dimmed.
   b. Cable/Conduit whips shall be 3/8" (10 mm) minimum diameter, six feet (1.8 m) maximum length.
   c. Flexible whips or pre-wired systems between master and satellite luminaires may be supported by the ceiling grid wires.
   d. The flexible connectors shall be steel, galvanized, clamp type with locknut, snap-in type with locknut, or snap-in connector type, including those used on the master-satellite units.

3. Chain or Cable Hung (unfinished spaces):

   a. Use manufacturer’s SO cord or a luminaire fixture whip from a J-box. Luminaire fixture whips shall be aluminum or steel AC Cable (Armored Cable) or Flexible Metal Conduit (FMC). Metal Clad (MC) cable that combines power and Class 2 circuits (for 0-10V dimming control) into a single cable may be used as a whip for luminaires that are dimmed.
   b. Conduit whips shall be 3/8" (10 mm) minimum diameter. Conduit whip or SO cord shall be cut to length (six feet (1.8 m) maximum) and shall allow movement of the chain/cable/luminaire, but shall not be long enough to “loop” and shall present a neat and workmanlike appearance.
   c. Luminaire field wired flexible cord installations shall be connected per NEC 410.62.
   d. The flexible connectors shall be steel, galvanized, clamp type with locknut, snap-in type with locknut, or snap-in connector type, including those used on the master-satellite units.
   e. Conduit whip slack shall be tie-wrapped to the chain supports. Tie-wraps shall be UL listed for UV resistance.

4. Cable Hung (finished spaces):

   a. Use manufacturer’s SO cord from luminaire to a J-box.
   b. SO cord shall be cut to length (six feet (1.8 m) maximum) and shall allow movement of the cable/luminaire, but shall not be long enough to “loop” and shall present a neat and workmanlike appearance.

c. SO cord slack may be tie-wrapped to the cable supports. Tie-wraps shall be UL listed for UV resistance.
d. Luminaire field wired flexible cord installations shall be connected per NEC 410.62.

5. Surface Mounted (unfinished spaces): Provide direct conduit and box connection.

6. Surface Mounted (finished spaces): Provide direct conduit and box connection. Use surface metal raceway where indicated on drawings. Conceal box and conduit where appropriate. Flexible metal conduit shall not be used where the conduit is exposed.

3.02 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Division 1.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.03 ADJUSTING

A. Aim and adjust luminaires as indicated.

B. Position exit sign directional arrows as indicated.

3.04 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate luminaire operation for minimum of two hours.

3.06 PROTECTION

A. Relamp luminaires that have failed lamps at Substantial Completion.

3.07 SCHEDULE – On Drawings.

END OF SECTION

This Page Left Blank Intentionally

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires, egress fixtures, and accessories.

1.02 RELATED REQUIREMENTS

A. Division 3 - Cast-in-Place Concrete: Foundations for poles.

1.03 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.

B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004.

C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.

D. ANSI O5.1 - American National Standard for Wood Poles -- Specifications and Dimensions; 2002.

E. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002.

F. IESNA RP-8 - American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000(R2005) (ANSI/IES RP8).

G. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.

H. NFPA 70 - National Electrical Code; National Fire Protection Association; 2017.

1.04 SUBMITTALS

A. See Division 1 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

1. Photometric Data: Submit on CD or DVD, in IESNA LM-63 standard format.

D. Test Reports: Indicate measured illumination levels.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Maintenance Data: For each luminaire.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Division 1 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store and handle solid wood poles in accordance with ANSI O5.1.

PART 2 PRODUCTS

2.01 LUMINAIRES

A. Furnish products as indicated in Schedule on drawings.

B. Substitutions: See Division 1 - Product Requirements.

2.02 LUMINAIRES

A. As specified for in fixture schedule.

1. Substitutions: See Division 1 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 501.

B. Bond luminaires, metal accessories, and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.

3.02 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.03 ADJUSTING

A. Aim and adjust luminaires to provide illumination levels and distribution indicated on Drawings.

3.04 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.05 SCHEDULE – On Drawings.

END OF SECTION

This Page Left Blank Intentionally

SECTION 30 05 00
COMMON WORK RESULTS FOR ALL EXTERIOR WORK
BASED ON DFD MASTER SPECIFICATION DATED 09/01/2015

PART 1 – GENERAL

SCOPE

This section provides information common to two or more technical site work specification sections or items that are of a general nature, and not included in other sections. This section applies to ALL work included as part of Division 31, Division 32, and Division 33. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Referenced Organizations
- Referenced Documents
- Quality Assurance
- Safety
- Permits
- Construction Limits
- Equipment & Materials Furnished by Others
- Provisions for Future Work
- Work by Others
- Submittals
- Off Site Storage
- Codes
- Certificates and Inspections
- As-Built Drawings

PART 2 - MATERIALS
- Barricades, Signs, and Warning Devices

PART 3 - EXECUTION
- Maintenance of Site and Building Access/Egress
- Continuity of Existing Traffic/Parking and Traffic Control
- Survey and Staking
- Utility Locates
- Protection and Continuity of Existing Utilities
- Protection of Existing Work and Facilities
- Stormwater/Excavation Water Management

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

31 20 00 – Earthmoving
31 22 16.15 – Roadway Subgrade Preparation
31 23 16.13 – Trenching
31 25 00 – Erosion Control
32 11 23.33 – Dense Graded Base
32 12 16.13 – Plant Mix Asphalt Paving
32 13 13 – Concrete Paving
32 17 23 – Pavement Markings
32 91 13 – Soil Preparation
32 91 13.50 – Stormwater Bio Infiltration
32 92 19 – Seeding
33 11 00 – Water Utility Distribution Piping

33 30 00 – Sanitary Sewerage Utilities
33 40 00 – Storm Sewer

REFERENCED ORGANIZATIONS

Abbreviations of organizations referenced in these specifications are as follows:

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
EPA	Environmental Protection Agency
OSHA	Occupational Safety and Health Administration
WDNR	State of Wisconsin Department of Natural Resources
WISDOT	State of Wisconsin Department of Transportation

REFERENCED DOCUMENTS

Where reference is made to WisDOT or SSHSC in this specification it shall mean the pertinent sections of the Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction (SSHSC), current edition, and all supplemental and interim supplemental and interim specifications.

Where reference is made to the SSSWC, it shall mean pertinent sections of the Standard Specifications for Sewer and Water Construction (SSSWC) in Wisconsin, current edition.

Method of measurement and basis of payment sections in referenced documents shall not apply.

QUALITY ASSURANCE

Provide materials and products as required by individual specification sections. Refer to Section GC - General Conditions of the Contract regarding substitutions.

Provide quality assurance testing and reporting as required by individual specification sections.

SAFETY

Contractor is solely responsible for worksite safety.

Perform all work in accordance with applicable OSHA, state and local safety standards.

PERMITS

Unless otherwise noted in the Contract Documents, Contractor shall be responsible for obtaining and paying for all permits necessary to complete the work.

CONSTRUCTION LIMITS

Construction Limits are indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by the Project Representative. In no case shall construction activities extend beyond state property lines or construction easements.

The Contractor shall restore all disturbed areas in accordance with the drawings and specifications. If drawings and specifications do not address restoration of specific areas, these areas will be restored to pre-construction conditions as approved by the Project Representative.

EQUIPMENT & MATERIALS FURNISHED BY OTHERS

Equipment and items furnished by contractor.

PROVISIONS FOR FUTURE WORK

No future work likely.

WORK BY OTHERS

Coordinate work under this project with work by Owner and other contractors on the site.

SUBMITTALS

Refer also to the General Conditions and Division 1.

Submit manufacturer's shop drawings, product data, samples, substitutions and operation and maintenance (O&M) data for approval as required by individual specification sections.

Unless otherwise noted, provide 6 copies of each submittal. Submit to project architect/engineer (A/E) unless otherwise directed by Project Representative at the Pre-Construction Meeting.

OFF SITE STORAGE

Refer to Division 1.

In general, the payments for materials stored off site will only be considered in instances where there is limited space available for storage on the site. Prior approval by the Project Representative, together with the execution of a Storage Agreement will be required.

CODES

Comply with the requirements of all applicable, local, state and federal codes.

CERTIFICATIONS AND INSPECTIONS

Refer to Section GC - General Conditions.

Obtain and pay for all required sampling, testing, inspections, and certifications except those expressly listed as provided by the A/E or other third party in the Contract Documents. Deliver originals of certificates and documents to the Project Representative within 3 days; provide copies to the A/E. Include copies of the certifications and documents in the O&M Manual.

AS-BUILT DRAWINGS

Not Applicable

PART 2 – MATERIALS

BARRICADES, SIGNS, AND WARNING DEVICES

Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA standards and the FHA Manual of Uniform Traffic Control Devices (MUTCD).

PART 3 - EXECUTION

MAINTENANCE OF SITE AND BUILDING ACCESS/EGRESS

Unless otherwise shown or directed, maintain existing access and egress to the facility throughout construction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency vehicle access, and emergency egress. Do not interrupt access and egress without prior written approval from the Project Representative.

CONTINUITY OF EXISTING TRAFFIC/PARKING AND TRAFFIC CONTROL

Refer also to Section GR - General Requirements.

Do not interrupt or change existing traffic, delivery, or parking without prior written approval from the Project Representative. When interruption is required, coordinate schedule with the Owner agency to minimize disruptions. When working in public right-of-way, obtain all necessary approvals and permits from applicable municipalities and WISDOT.

When Contractor's activities impede or obstruct traffic flow, Contractor shall provide traffic control devices, signs and flaggers in accordance with other Contract Documents and the current version of the MUTCD, or as shown on the Drawings.

SURVEY AND STAKING

A/E will provide benchmarks and control points for the project as requested by the Contractor if information is available and not already shown on the plans.

Contractor shall be responsible for transferring benchmarks, control points, lines and grades to the project site as necessary to complete work.

UTILITY LOCATES

Contact Diggers Hotline at 1-800-242-8511 in accordance with statutory requirements. Request that non-member utilities, institution owned utilities, and private utilities be located by the appropriate parties. Coordinate utility locates with Wisconsin Department of Natural Resources.

Contractor shall include the costs for ***ALL*** underground utility locates in their bid. Locates shall include excavation, backfill, survey and pictures of existing utilities within the construction limits. Survey information shall include size, elevation, GPS location, materials and height and width of utility. Locates shall be authorized by Project Representative.

PROTECTION AND CONTINUITY OF EXISTING UTILITIES

Verify the locations of any water, drainage, gas, storm sewer, sanitary sewer, electric, telephone/communication, fuel, steam lines, chilled water or other utilities and site features which may be encountered in any excavations or other sitework. All lines shall be properly underpinned and supported to avoid disruption of service.

Do not interrupt or change existing utilities without prior written approval from the Project Representative, affected utilities and users. Notify all users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be provided in writing and describe the nature and duration of outages and provide the name and number of Contractor's foreman or other contact.

Any service connections encountered that are to be removed shall be cut off at the limits of the excavation and capped in accordance with the requirements of applicable codes and any specifications governing such removals.

PROTECTION OF EXISTING WORK AND FACILITIES

Verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, streetlights, utilities, and all other such facilities that may be encountered or interfered with during the progress of the work. Take measures necessary to safeguard all existing work and facilities that are outside the limits of the work or items that are within the construction limits but are intended to remain. Report any damage to existing facilities to the Project Representative immediately. Correct all damages at no cost to Owner.

STORMWATER/EXCAVATION WATER MANAGEMENT

Control grading around structures, pitch ground to prevent runoff into excavated areas.

Pits, trenches within building lines and other excavations shall be maintained free of water.

Provide trenching, pumping, other facilities as needed to control stormwater runoff and excavation water.

Notify Architect/Engineer if springs or running water are encountered in excavation; provide discharge by trenches, drains, pumping to point outside of excavation. Provide information to Architect/Engineer of points and areas that water will be discharged.

Implement stormwater runoff and drainage control measures to prevent damage from flooding, erosion, and sedimentation to on-site and off-site areas during construction.

END OF SECTION

Page Intentionally Left Blank

SECTION 32 11 23.33
DENSE GRADED BASE
BASED ON DFD MASTER SPECIFICATION DATED 09/01/2015

PART 1 - GENERAL

SCOPE

The work under this section consists of constructing a dense graded base using crushed stone or crushed gravel. The Contractor may also use crushed concrete, reclaimed asphaltic pavement, reprocessed material, or blended material. The work under this section shall provide a surface ready for constructing and supporting the Concrete or Asphalt Pavement.

PART 1 - GENERAL
- Scope
- Related Work
- Reference Standards
- Quality Assurance
- Submittals

PART 2 - MATERIALS
- Dense Graded Base

PART 3 - EXECUTION
- Construction
- Compaction
- Cleanup

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Related work specified elsewhere:
Section 30 05 00 – Common Work Results For Exterior Work
Section 32 12 16 -- Plant Mix Asphalt Paving
Section 32 13 13 SF – Concrete Paving

REFERENCE STANDARDS

American Society for Testing and Materials (ASTM):

D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods
E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

QUALITY ASSURANCE

The Contractor shall conduct sampling, testing, and analysis as required by this section and elsewhere in the Contract Documents either by retaining the services of an independent construction materials testing consultant or with internal certified testers. The materials testing personnel shall meet the requirements of ASTM E329.

The Contractor's construction materials testing personnel shall complete one of the material testing methods as outlined in Table 32 11 23.33-1.

Table 32 11 23.33 -1

Material	Test Required	Test/Sample Frequency
1¼-inch Base Aggregate Dense	ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort	1 test/500 CY placed
1¼-inch Base Aggregate Dense	ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods	1 test/500 CY placed

SUBMITTALS

Provide copies of all material testing reports completed for the project within 48 hours of completing the individual tests. Along with each individual test result, provide a running spreadsheet of all individual test results.

PART 2 - MATERIALS

DENSE GRADED BASE

Use dense graded base ***1-1/4 -inch.*** Provide aggregate conforming to WisDOT Section 301.2 of the SSHSC for crushed stone, crushed gravel, crushed concrete, reclaimed asphaltic pavement, reprocessed material or blended material. Material gradations shall conform to WisDOT Section 305.2.2 of the SSHSC unless specified elsewhere in the contract documents.

PART 3 - EXECUTION

CONSTRUCTION

Preparing the Foundation

Refer to Section 31 22 16.15 – Roadway Subgrade Preparation.

Pulverized and Re-laid Pavement

Pulverize the existing asphaltic pavement full depth according to WisDOT Section 325.3 of the SSHSC.

Placing Dense Graded Base Aggregate

Construct Dense Graded Base as specified in WisDOT Section 305.3 of the SSHSC. Compact each base layer, including shoulder foreslopes, with equipment specified in WisDOT Section 301.3.1 of the SSHSC.

Use standard compaction conforming to WisDOT Section 301.3.4.2 of the SSHSC, unless otherwise specified herein. Final shaping of shoulder foreslopes does not require compaction.

Construct the base to the width and section the drawings show. Shape, and compact the base surface to within 0.04 feet of the drawing elevation.

Ensure there is adequate moisture in the aggregate during placing, shaping, and compacting to prevent segregation and achieve adequate compaction. Moisture condition dense graded base as necessary to achieve required density as determined by ASTM D1557.

Excavation shall be reasonably free of water prior to placement of dense graded base. Do not place dense graded base on frozen surfaces or use frozen material.

Maintain the base until paving over it, or until the DFD Project Representative accepts the work, if paving is not part of the contract.

Placing Dense Graded Base Shoulders

If the roadway is closed to through traffic during construction, construct the aggregate shoulders before opening the road to traffic.

If the roadway remains open to through traffic during construction and a 2-inch or more drop-off at the pavement edge exists; eliminate the drop-off within 48 hours after completing the asphalt or concrete work. Unless the special provisions specify otherwise, provide aggregate shoulder material compacted to a 4:1 or flatter cross slope from the surface of the pavement edge.

Provide and maintain signing and other traffic protection and control devices, as specified in WisDOT Section 643 of the SSHSC, until completing shoulder construction to the required cross-section and flush with the asphaltic pavement or surfacing.

Construct aggregate shoulders to the elevations and typical sections the drawings show, except for minor modifications needed to conform to other work. Use equipment that does not damage or mar the pavement surface, curbs, or appurtenances.

Place aggregate directly on the shoulder area between the pavement edge and the outer shoulder limits. Recover uncontaminated material deposited outside the limits and place within the limits.

Do not deposit aggregate on the pavement during placement, unless the A/E specifically allows. Do not leave aggregate on the pavement overnight. After placing the shoulder aggregate, keep the pavement surface free of lose aggregate.

COMPACTION

Compacting Dense Graded Base Aggregate

If using a pneumatic roller, do not exceed a compacted thickness of 6 inches per layer. For the first layer placed over a loose sandy subgrade, the Contractor may, with A/E approval, increase the compacted layer thickness to 8 inches. If using a vibratory roller, do not exceed a compacted thickness of 8 inches per layer.

The material shall be compacted to meet the following:

Test Method to determine maximum density and moisture	ASTM D1557
Relative compaction relative to the optimum	95%
Moisture content relative to the optimum	-2% to +2%

The compacted material shall be tested for in-place field density in accordance with this Section, Part I, Quality Assurance.

Compacting Dense Graded Base Shoulders

Spread and compact the aggregate in compacted layers of 6 inches or less to 95% of the modified maximum density prior to placing each subsequent layer.

After final compaction, shape the shoulders to remove all longitudinal ridges to ensure proper drainage.

CLEANUP

After the project is completed, thoroughly clean up all debris which may have accumulated during the placement of dense graded base and breaker run, if placed. All storm sewer manholes, inlets, and trench drains within the project area shall be inspected in the presence of the DFD Project Representation, the Owner Agency, and the A/E to confirm there is no accumulated debris. The Contractor shall ensure the manholes, inlets, and trench drains are free of water and debris prior to inspection by the parties noted above. Any accumulated debris in the manholes, inlets, and trench drains shall be removed and properly disposed of by the Contractor.

Replace or repair as required, all surfaces and/or landscape features damaged or disturbed under this item of work.

END OF SECTION

SECTION 32 12 16. 13
PLANT MIX ASPHALT PAVING
BASED ON DFDM MASTER SPECIFICATION DATED 12/12/2017

PART 1 - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide and construct the paving and surfacing as provided for in these specifications and on the drawings. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work

PART 2 - MATERIALS
- Recycled Products and Materials
- Hot Mix Asphalt (HMA) Pavement
- Tack Coat

PART 3 - EXECUTION
- Hot Mix Asphalt (HMA) Pavement
- Reheating Joints
- Pavement Repairs

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Related Work Specified Elsewhere:
Section 30 05 00 – Common Work Results for all Exterior Work
Section 32 11 23.33 – Dense Graded Base
Section 32 13 13 SF – Concrete Paving

PART 2 - MATERIALS

RECYCLED PRODUCTS AND MATERIALS

The Wisconsin Department of Administration, Division of Facilities Development and Management (DFDM) strongly encourages the use of recycled materials and products containing recycled materials. Bidders may submit specifications for recycled materials and products containing recycled materials for consideration by the DFDM for use on the project as part of the submittal process following the contract award.

HOT MIX ASPHALTIC (HMA) PAVEMENT

Provide HMA pavement thickness and type as indicated on the plan and conforming to the requirements of WisDOT SSHSC Section 450 and Section 460. Utilize the same material type throughout the paving operation unless noted elsewhere on the drawings. Ensure all asphaltic materials provided under this section conform to the requirements of WisDOT SSHSC, Section 455 and as revised in any current Supplemental Specifications.

TACK COAT

Apply tack coat at a minimum rate of 0.05 gallons per square yard to the lower layer(s) of HMA pavement surface prior to placing surface layer of HMA pavement, unless otherwise noted. Tack coat shall require a minimum asphalt content of 50% and meet all other requirements of the WisDOT SSHSC Section 455.

PART 3 - EXECUTION

HOT MIX ASPHALT (HMA) PAVEMENT

Complete all work under this section to WisDOT SSHSC, Section 450 and Section 460. Provide HMA layer thicknesses as shown on the drawings. The minimum thickness of the HMA binder layer shall not be less than 1-1/2 inches (9.5 mm nominal aggregate size). The minimum thickness of the HMA surface layer shall not be less than 1-1/2 inches (9.5 mm nominal aggregate size).

PAVEMENT REPAIRS

Sawcut all pavement surfaces to neat and straight lines at the limits of removal by a two-step method. Limit the initial pavement removal to the immediate area of the proposed work. Full depth sawcutting is not required for this phase of removal. After the work is completed, make a full depth sawcut to neat and straight lines outside the widest point of pavement disruption. Sawcut the lines of the repair parallel to existing joints, or parallel to or perpendicular to pavement edges so as to form a neat patch. Carefully remove all remaining pavement within the sawcut area to the lines of the sawcut. Do not disturb the existing base materials between the area disturbed by the work and the sawcut line by the sawcutting, pavement removal, or pavement replacement processes.

Remove all walks, curbs, and other jointed paving by sawcutting at the nearest joint beyond the limits of removal.

Adjust all inlets, manholes, catch basins, valve boxes, and other such castings to match new finished grade as incidental work.

Clean and fill all major structural cracks (not alligatored areas) with crack filler conforming to ASTM D-3405 prior to placing new HMA pavement overlay. Place tack coat on all surfaces in accordance with WisDOT SSHSC Section 455. Apply emulsified asphalt tack coat at the rate of 0.05 gallons per square yard to the existing asphalt surface.
Place HMA binder course in all areas undergoing removal and replacement and in areas receiving new HMA surface course. Remove existing gravel as necessary to allow placement of binder course in lift thicknesses as shown on the drawings.

Place HMA surface course on all roadway, parking lots, service drives, and loading dock areas as designated on the drawings.

END OF SECTION

SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

SUMMARY

Section Includes Concrete Paving

- Driveways.
- Roadways.
- Parking lots.
- Curbs and gutters.
- Walks.

ACTION SUBMITTALS

Product Data: For each type of product.

Samples: For each type of product, ingredient, or admixture requiring color selection.

Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

QUALITY ASSURANCE

Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

- Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" .

PRECONSTRUCTION TESTING

Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

PART 2 - PRODUCTS

CONCRETE, GENERAL

ACI Publications: Comply with ACI 301 unless otherwise indicated.

CONCRETE MATERIALS

Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

- Portland Cement: ASTM C 150/C 150M, white portland cement Type I .
- Fly Ash: ASTM C 618, Class C
- Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- .

Normal-Weight Aggregates: ASTM C 33/C 33M, uniformly graded. Provide aggregates from a single source.

Air-Entraining Admixture: ASTM C 260/C 260M.

Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

Water: Potable and complying with ASTM C 94/C 94M.

CURING MATERIALS

Absorptive Cover: AASHTO M 182,
Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

Water: Potable.

RELATED MATERIALS

Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

CONCRETE MIXTURES

Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

Fly Ash or Pozzolan: 25 percent.
Slag Cement: 50 percent.
Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

Air Content: 6 percent plus or minus 1-1/2 percent.

Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

Concrete Mixtures: Normal-weight concrete.

Compressive Strength (28 Days): 4000 psi
Maximum W/C Ratio at Point of Placement: 0.45
Slump Limit: 4 inchesplus or minus 1 inch.

CONCRETE MIXING

Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

EXAMINATION

Proof-roll prepared subbase surface below areas to be paved to identify soft pockets and areas of excess yielding.

PREPARATION

Remove loose material from compacted subbase surface immediately before placing concrete.

EDGE FORMS AND SCREED CONSTRUCTION

Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

STEEL REINFORCEMENT INSTALLATION

Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

JOINTS

General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated. Joints shall be spaced at intervals no greater than 12 feet.

Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness to match jointing of existing adjacent concrete paving

Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes.

CONCRETE PLACEMENT

Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

Screed paving surface with a straightedge and strike off.
Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

FLOAT FINISHING

General: Do not add water to concrete surfaces during finishing operations.

Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.

Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions.

Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.

After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

CONCRETE PROTECTION AND CURING

General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

Comply with ACI 306.1 for cold-weather protection.

Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

Curing Methods: Cure concrete by moisture-retaining-cover curing

PAVING TOLERANCES

Comply with tolerances in ACI 117 and as follows:

Elevation: 3/4 inch.

Thickness: Plus 3/8 inch, minus 1/4 inch.

Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch.

Joint Spacing: 3 inches.

Contraction Joint Depth: Plus 1/4 inch, no minus.

Joint Width: Plus 1/8 inch, no minus.

REPAIR AND PROTECTION

Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

Page Intentionally Left Blank