

# PROJECT MANUAL for

## NEW FIRE STATION NO. 111

3947 Jeffersonville Road  
Macon, Georgia

for the

**MACON-BIBB COUNTY BOARD OF COMMISSIONERS**



609 Cherry Street  
Macon, Georgia 31201

**BTBB #15-037**

**Date: April 12, 2016**



**SPECIFICATION INDEX**

**MACON-BIBB COUNTY FIRE STATION #111  
3947 JEFFERSONVILLE ROAD  
MACON, GEORGIA**

<b><u>SECTION</u></b>	<b><u>TITLE</u></b>	<b><u>NO. OF PAGES</u></b>
A	SPECIAL CONDITIONS AND TEMPORARY FACILITIES.....	5
01300	SUBMITTALS .....	2
01800	PROJECT RECORD DOCUMENTS .....	2
02120	SUBSURFACE INVESTIGATION .....	30
02200	EARTHWORK .....	23
02280	TERMITE TREATMENT .....	2
02514	CONCRETE PAVING, WALKS, AND CURBS .....	4
02530	EROSION AND SEDIMENTATION CONTROL .....	2
02632	STORM DRAINAGE .....	2
02700	WATER DISTRIBUTION SYSTEM .....	1
02710	SITE SEPTIC TANK CONSTRUCTION .....	1
03300	CAST-IN PLACE CONCRETE .....	18
03350	COLORED CONCRETE .....	5
04200	UNIT MASONRY .....	8
05500	MISCELLANEOUS METALS .....	3
06100	ROUGH CARPENTRY.....	5
06190	SHOP-FABRICATED WOOD TRUSSES .....	6
06200	FINISH CARPENTRY AND MILLWORK.....	4
06410	CABINETWORK .....	4
06651	SOLID SURFACE FABRICATIONS.....	5
07160	BITUMINOUS DAMPPROOFING .....	2
07210	BUILDING INSULATION.....	3
07250	PERIMETER FOUNDATION AND UNDERSLAB INSULATION .....	1
07260	VAPOR BARRIER .....	3
07311	FIBERGLASS SHINGLE ROOFING .....	5
07460	VINYL SIDING .....	4
07525	MODIFIED BITUMINOUS SHEET ROOFING.....	4
07600	METAL FLASHING AND SHEET METAL WORK.....	4
07650	FLEXIBLE FLASHING .....	2
07715	METAL SOFFIT SYSTEMS .....	3
07900	SEALANTS AND CAULKING.....	4
08110	STEEL FRAMES AND DOORS .....	6
08211	SOLID CORE FLUSH WOOD DOORS.....	3
08360	SECTIONAL DOORS .....	4
08410	ALUMINUM STOREFRONT SYSTEMS .....	4

<b><u>SECTION</u></b>	<b><u>TITLE</u></b>	<b><u>NO. OF PAGES</u></b>
08550	VINYL SINGLE-HUNG WINDOWS.....	5
08710	FINISH HARDWARE .....	13
08800	GLASS AND GLAZING.....	3
09260	GYPSUM BOARD SYSTEMS.....	5
09311	CERAMIC TILE AND MARBLE .....	5
09512	SUSPENDED ACOUSTICAL TILE CEILINGS .....	4
09650	RESILIENT BASE.....	2
09656	FLEXIBLE TERRAZZO TILE .....	4
09900	PAINTING.....	9
10155	TOILET COMPARTMENTS .....	3
10200	ARCHITECTURAL LOUVERS.....	2
10350	FLAGPOLES .....	2
10420	LETTERS AND SIGNAGE .....	3
10505	METAL LOCKERS.....	4
10522	FIRE EXTINGUISHERS AND ACCESSORIES.....	3
10800	TOILET ACCESSORIES.....	3
11450	EQUIPMENT .....	3
12510	BLINDS.....	4
15000	GENERAL MECHANICAL PROVISIONS .....	6
15050	BASIC MECHANICAL MATERIALS AND METHODS.....	5
15055	MOTOR CONTROLLERS FOR HVAC EQUIPMENT.....	4
15058	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT .....	2
15061	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT .....	13
15062	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT ..	12
15069	VIBRATION CONTROLS FOR HVAC.....	3
15076	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT .....	5
15077	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT.....	2
15085	PLUMBING PIPING INSULATION.....	20
15086	DUCT INSULATION .....	14
15088	HVAC PIPING INSULATION .....	8
15093	SLEEVES AND SLEEVE SEALS FOR HVAC PIPING.....	2
15097	ESCUTCHEONS FOR PLUMBING PIPING.....	3
15098	ESCUTCHEONS FOR HVAC PIPING .....	1
15113	BALL VALVES FOR PLUMBING PIPING .....	7
15115	CHECK VALVES FOR PLUMBING PIPING.....	6
15116	GATE VALVES FOR PLUMBING PIPING .....	5
15126	METERS AND GAGES FOR PLUMBING PIPING .....	6
15140	DOMESTIC WATER PIPING .....	14
15145	DOMESTIC WATER PIPING SPECIALTIES .....	21
15150	SANITARY WASTE AND VENT PIPING .....	14
15151	SANITARY WASTE INTERCEPTORS.....	4
15152	FACILITY SANITARY SEWERS.....	8
15155	SANITARY WASTE PIPING SPECIALTIES.....	11
15181	CONDENSATE DRAIN PIPING.....	6

<u>SECTION</u>	<u>TITLE</u>	<u>NO. OF PAGES</u>
15183	REFRIGERANT PIPING .....	9
15195	FACILITY NATURAL-GAS PIPING .....	21
15416	COMMERCIAL WATER CLOSETS .....	5
15417	COMMERCIAL URINALS .....	5
15421	COMMERCIAL LAVATORIES .....	6
15422	COMMERCIAL SINKS.....	3
15423	COMMERCIAL SHOWERS .....	4
15427	PRESSURE WATER COOLERS .....	6
15485	ELECTRIC WATER HEATERS.....	8
15486	FUEL-FIRED WATER HEATERS .....	9
15530	FURNACES .....	9
15544	GAS-FIRED UNIT HEATERS .....	5
15738	SPLIT-SYSTEM HEAT PUMP AIR-CONDITIONING UNITS.....	7
15792	PROPELLER UNIT HEATERS .....	4
15793	WALL AND CEILING UNIT HEATERS .....	3
15815	METAL DUCTS .....	12
15820	DUCT ACCESSORIES .....	8
15838	POWER VENTILATORS.....	7
15855	DIFFUSERS, REGISTERS, AND GRILLES.....	2
15856	HVAC GRAVITY VENTILATORS.....	3
15870	COMMERCIAL KITCHEN HOODS .....	10
15880	VEHICLE EXHAUST REMOVAL SYSTEM.....	7
15900	HVAC INSTRUMENTATION AND CONTROLS.....	11
15940	SEQUENCE OF OPERATION .....	3
15950	TESTING, ADJUSTING, AND BALANCING .....	12
16000	GENERAL.....	9
16010	LIGHTING AND POWER PANELBOARDS.....	2
16015	FUSES.....	1
16020	RACEWAYS .....	5
16030	CONDUCTORS .....	3
16040	OUTLETS .....	2
16050	WIRING DEVICES AND DEVICE PLATE .....	3
16060	LIGHTING FIXTURES AND LAMPS .....	2
16065	OCCUPANCY SENSORS.....	14
16070	DISCONNECT SWITCHES .....	2
16090	LIGHTING CONTROL SYSTEM .....	7
16100	PULL BOXES AND JUNCTION BOXES AND FITTINGS.....	1
16110	GROUNDING .....	4
16120	EQUIPMENT IDENTIFICATION .....	1
16130	DATA/VOICE CONDUIT AND OUTLET SYSTEM .....	1
16140	FIRE ALARM SYSTEM.....	4
16160	TRANSIENT VOLTAGE SURGE SUPPRESSORS FOR MAIN SERVICE AND DISTRIBUTION PANELS .....	4
16175	FIRESTOPPING .....	5
16190	ENGINE GENERATOR SET .....	7
16200	BUILDING COMMUNICATION AND PAGING SYSTEM.....	3
16210	DATA/VOICE NETWORK AND CABLING SYSTEM.....	7
16220	CONSTRUCTION REVIEWS INSPECTION AND TESTING .....	2
16230	ELECTRICAL SERVICE ENTRANCE.....	1



SECTION A  
SPECIAL CONDITIONS AND TEMPORARY FACILITIES

A.1 EXAMINATION OF SITE:

(a) Each bidder by making his bid represents that he has visited the site and familiarized himself with the local conditions under which the work is to be performed and that he has read and understands the bidding documents. Bidders shall examine the areas wherein work of this project is to be carried out and shall take into consideration all conditions that might affect his work.

(b) Failure of the bidder to inspect first-hand the areas affected by work in this project shall not relieve him of the obligation to comply fully with the scope of the work as defined herein.

(c) No consideration will be given any claim based on lack of knowledge of existing conditions, except where the Contract Documents make definite provisions for adjustment of cost or extension of time due to existing conditions that cannot be readily ascertained.

A.2 SCOPE OF WORK: In general, the scope of work involves all labor and materials necessary for construction of a new approx. 6,190 SF Fire Station, approx. 500 SF accessory building, and all associated site work.

A.3 TEMPORARY UTILITIES AND FACILITIES:

(a) Temporary utilities shall be the responsibility of the Contractor. The Contractor shall provide and maintain such temporary utilities as deemed necessary during the course of construction to include, but not necessarily be limited to power, water, and telephone service. The Contractor shall provide job telephone(s) with local number(s), fax, email, and postal address at his own expense.

(b) Toilet Facilities: At beginning of work, the Contractor shall provide on premises, in approved locations, adequate temporary enclosed toilet and washing facilities for use of employees. Facilities shall be maintained in a clean and sanitary condition throughout period of project.

(c) Temporary Heat: Contractor shall provide, at his own expense, temporary heat as necessary to protect all work and materials from damage due to dampness or cold.

(d) The Contractor shall, at his own expense, provide whatever measures he deems necessary to secure the site, the building, stored materials, etc.

(e) Unless otherwise stated in the specifications or on the drawings, the Contractor shall pay initial fees for all utility connections in the Contractor's name and shall pay all associated utility bills up to a date upon which the Contractor and Owner shall agree as the Date of Substantial Completion. Following the Date of Substantial Completion, the Owner shall have utilities transferred into their name and shall be responsible for associated utility costs from that time forward.

A.4 PROJECT SCHEDULE: Within ten (10) days of Notice to Proceed from the Owner, the Contractor shall submit to the Architect for approval, a complete Critical Path Schedule for completing the work.

A.5 TESTS: Unless specifically required otherwise, a recognized testing agency / Geotechnical Engineer will be selected by the Owner and the costs of all testing, except as otherwise specifically required, will be paid for by the Owner.

A.6 LAYING OUT WORK: The Contractor shall verify all existing conditions and contiguous work and lay out his work therefrom, providing for himself all other necessary measurements, lines and levels, and shall assume the responsibility for the correctness of the laying out of the work.

A.7 WORK AREAS: The Contractor shall confine his operations to as small an area as possible, using only the areas designated for on-site storage.

(a) The Contractor shall protect all surrounding adjoining private and public property, taking every precaution to prevent damage or injury to the surrounding properties.

(1) Should damage occur, the Contractor shall restore, at his expense, any such property damage or injuries by his operations to a condition equal to that existing before such damage or injury was done, by repairing, rebuilding or otherwise restoring as may be directed by, and to the satisfaction of the Owner.

(2) In case of failure on the part of the Contractor to restore such property, or make good such damages or injury, the Owner may, after forty-eight (48) hours written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the cost thereof shall be deducted from any monies due or which may become due the contractor under this contract.

A.8 VANDALISM: The Contractor shall take every precaution not to leave equipment and materials where they can be reached and used for defacing new or existing work at any time and in particular at night and on weekends.

A.9 HAZARDOUS MATERIALS:

(a) Architect's and Engineer's Responsibility: Specifications have been prepared by the Architect for the Owner without the Architect having conducted investigation as to the presence of asbestos or hazardous waste on the project. The Architect has not charged any fees and has not and will not advise the Owner with regard to the detection of any hazardous waste. The removal of all hazardous materials and encapsulation of remaining surfaces is the sole responsibility of the Owner and, if encountered, will be handled by a separate contract.

(b) Friable Materials: If the Contractor observes the existence of a potentially hazardous material which must be disturbed during the course of this work, Contractor shall promptly notify Owner and Architect. Owner shall make all arrangements regarding testing and removal or encapsulation of any hazardous material present. The Contractor shall not perform any work pertinent to hazardous material prior to receipt of special instructions from the Owner.

A.10 TRASH DISPOSAL: All materials, including brick, block, metal, steel, wood, stone, concrete, asphalt, and other materials present at the time work commences, plus all debris resulting from the demolition or site or clearing operations, shall become the property of the Contractor.

(a) The Contractor shall allow no trash to accumulate and shall maintain a neat, clean site. All building materials and trash shall be disposed of off the premises. Burning of material on the site will not be permitted. All costs of removing trash shall be borne by the Contractor. Place and method of disposal is the Contractor's responsibility, and all debris shall be disposed of in accordance with Federal, State, and Local laws.

(b) The Contractor shall submit landfill tickets to the Owner. In the event regulated materials exist, the Contractor shall file a Uniform Hazardous Waste Manifest from proper landfill site for each load of regulated materials removed, copies of which shall be submitted to the Owner.

(c) Transportation of waste shall be in accordance with applicable Dept. of Transportation (DOT) requirements.

A.11 SUBSTANTIAL COMPLETION: Substantial Completion is defined as "The stage in the progress of work when the work or designated portion is sufficiently complete in accordance with the contract documents so that the Owner can occupy or utilize the work for its intended use."

(a) In order to comply with the definition of Substantial Completion, all concrete paving that will be used by fire trucks (drives and apparatus bay) must be completely and properly installed in-place a minimum of 30-days prior to the contractual completion date.

(b) Prior to Substantial Completion there must be a "Report of Concrete Cylinder Test" filed with the Architect and Owner, signed by the Geotechnical Engineer, to verify that all such concrete paving meets the minimum specified compressive strength.

(c) Failure to complete the installation of such concrete a minimum of 30-days prior to the contractual completion date or any such concrete placed that does not meet the specified compressive strength will cause the work to be considered NOT substantially completed.

#### A.12 INSPECTION

(a) The Owner may appoint inspectors to inspect all materials used and all work performed. Such inspection may extend to all or any part of the work and to the preparation of manufacture of the materials to be used. The inspectors will not be authorized to revoke, alter, enlarge or relax the provisions of this specification, nor will they be authorized to approve or accept any portion of the completed work or to issue instruction contrary to the plans and specifications. The inspector shall have authority to reject defective material and to suspend work that is being improperly done, subject to the final decision of the Architect.

(b) It is mutually agreed between the parties to the contract that to prevent all disputes and misunderstandings between them in relation to any of the provisions contained in these specifications, or their performance by either of said parties, the Architect shall serve as the referee to decide all matters of construction of the specifications and of the terms of the contract, and as to all matters arising or growing out of said contract and his decision shall be final and binding upon both parties.

(c) The Architect, Owner, and Owner's inspectors shall have free access to all parts of the work, and to all material intended for use in the work. The work will be inspected as it progresses, but failure to reject or condemn defective work at the time it is done will in no way prevent its rejection whenever it is discovered before the work is finally accepted and approved, nor will final acceptance and approval constitute waiver by the County of any right of action for defective work or the failure to perform the contract according to its terms.

A.13 PERMITS, LICENSES, AND FEES:

(a) Unless specifically noted elsewhere in these specifications or on the drawings, the Contractor will be responsible for securing all permits and licenses necessary for construction of this project and shall pay all applicable fees. The Contractor is also responsible for paying any and all inspection fees during construction for local authorities having jurisdiction.

(b) The Contractor shall arrange for necessary inspections required by the City, County, State and other authorities having jurisdiction, and submit certificates of approval to the Architect.

A.14 SAFEGUARDS DURING CONSTRUCTION: Refer to the current edition of the International Building Code.

A.15 CODES, ORDINANCES, AND REGULATIONS: All work to be performed as part of this specification shall comply with all codes, ordinances, and regulations applicable to the contract, including, but not limited to:

- (a) Environmental Protection Agency (EPA)
- (b) Occupational Safety and Health Administration (OSHA)
- (c) State and Local Air Pollution Control Authorities/Agencies
- (d) State and Local Solid Waste or Hazardous Waste Authorities/Agencies
- (e) State and Local Health Departments
- (f) State and Local Building Code Authorities/Agencies
- (g) Southern Standard Building Code
- (h) State and Local Building Code
- (i) Other Federal, State, or Local Codes

A.16 STANDARDS:

(a) Any material specified by reference to the number, symbol, or title of a specific standard, such as a commercial standard, a federal specification, a trade association standard, shall comply with the requirements thereof and any amendment, supplement, or revision in effect on the date of Invitation for Bids. The standards referred to, except as modified in the specifications, shall have full force and effect as though printed in the specifications.

(b) Whenever a material, article, or piece of equipment is identified in the specifications by reference to manufacturer's or vendor's names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard, and any material, article, or piece of equipment of other manufacturers or vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or piece of equipment so proposed is, in the opinion of the Architect, of equal substance, appearance, and function. It shall not be purchased or installed by the Contractor without the Architect's written approval.

A.17 GUARANTEE: If, within one year after the date of substantial completion or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, any of the work is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. The guarantee shall include all materials, labor, and workmanship.

A.18 PROJECT SIGN: The Contractor shall, within ten (10) days after the receipt of Notice to Proceed, construct on the project site, at location designated by Architect, a project identification sign. The sign shall be constructed from 3/4" thick exterior plywood, 4' x 8' supported by 4" x 4" wood posts and shall:

- (a) Identify project by name
- (b) Identify Architect
- (c) Identify General Contractor
- (c) Identify Owner

A.19 COORDINATION FOR COMPLETE SYSTEMS OPERATIONS: The Contractor and the subcontractors shall be responsible for coordinating between trades as necessary to assure completion operation and functionality of all building components, systems, equipment, etc., that are included as a part of the work in this contractor. That coordination shall include all mechanical, electrical, plumbing, and other connections necessary to insure full and complete operation of all doors, fans, louvers, motors, HVAC equipment, plumbing systems equipment, vehicle exhaust system, lighting and electrical systems, telecommunications systems, etc.

END OF SECTION



SECTION 01300  
SUBMITTALS

PART 1 - GENERAL

1.1 Quality Assurance:

A. Reference Standards: Unless specifically modified hereinafter or in pertinent other sections of this Project Manual, the Contractor shall comply with the requirements of Article 13 of the Contract for Construction.

B. Definitions: Unless specifically noted otherwise hereinafter or in pertinent other sections of this Project Manual, all definitions shall be as enumerated in Article 3 of the Contract for Construction.

C. Submittals: Unless specifically noted otherwise in pertinent other sections of this Project Manual, make all submittals to Architect and in sufficient number as to allow the Architect to retain two (2) copies of the submittals, except for submittals relating to Structural, Plumbing, HVAC, and Electrical Systems and related information for which the Architect shall retain three (3) copies of all submittals.

1. Timing of Submittals: Make all submittals far enough in advance of scheduled dates of installation to allow at least twenty (20) full working days for review following Architect's receipt of the submittal.

2. Forward all submittals / samples requiring color selections at one time. All color selections shall be made together at one time and released as a complete color schedule.

3. Delays: Cost of delays occasioned by tardiness of submittals may be back charged to the Contractor and shall not be borne by the Owner.

PART 2 - PRODUCTS (OMITTED)

PART 3 - EXECUTION

3.1 Detail Requirements:

A. Identification: Completely identify each submittal by showing at least the following:

1. Name of Project and Architect as they appear on the Project Manual cover.
2. Name and address of submitter.
3. Sheet Number and/or Project Manual Section Number to which submittal applies.
4. Whether the submittal is an original submittal or a resubmittal.

B. Grouping: Unless otherwise permitted by the Architect, make all submittals in groups, containing all associated items. The Architect may reject partial submittals as not complying with the contract documents.

1. All submittals requiring exterior color selections shall be submitted together so that exterior color selections shall all be made at one time and a Color / Finish Schedule for the complete project shall follow.

2. All submittals requiring interior color selections shall be submitted together so that interior color selections shall all be made at one time and a Color / Finish Schedule for the complete project shall follow.

C. Contractor's Approval: The Contractor shall affix his stamp and signature to all submittals, indicating his approval of the submittal. Submittals that do not bear the stamp and signature of the Contractor will not be reviewed by the Architect.

1. The Contractor's stamp and signature shall indicate that the Contractor has fully-reviewed submittals and has coordinated the component system equipment associated with the submittal between all trades affected by the work so as to assure complete operating and functionality.

END OF SECTION

SECTION 01800  
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 Quality Assurance:

A. Qualifications of Workmen: Contractor shall designate one workman in his employ who shall maintain all Project Record Documents and who shall record all changes to the original contract documents.

B. Identification of Documents: All project record documents shall be clearly marked PROJECT RECORD COPY, not used for construction purposes and available to the Architect or his representative.

1.2 Submittal:

A. General: At least 10 days prior to date of final inspection and as a condition of acceptance of the work, submit all project record documents to the Architect.

PART 2 - PRODUCTS

2.1 Project Record Documents:

A. Description: Project record documents include but are not limited to:

1. Drawings
2. Project Manual
3. Addenda
4. Approved Shop Drawings / Product Data / Submittal (Section 01300)
5. Change Orders
6. Field Orders
7. Construction Drawings
8. Operation/Maintenance Manuals
9. Test Reports/Certifications/Inspection Reports
10. Agency Approvals secured by Contractor

PART 3 - EXECUTION

A. Marking: Mark the most appropriate document within twenty-four (24) hours of receipt of information to show.

1. Changes made during construction.
2. Details not shown on original Contract Documents.
3. Location of Underground Utilities and Appurtances, Reference to permanent surface improvements.
4. Location of all Internal Utilities and Appurtances concealed in the building structure, referenced to visible and accessible features of the structure.

B. Method of Marking and Recording:

1. Using colored markers for graphic work, conform to following:
  - a. Architectural Work - Red
  - b. Structural Work - Brown
  - c. Mechanical Work - Green
  - d. Electrical Work - Yellow
2. Use a red pen for all written work.

C. Quality Control: Documents shall be kept current; no work shall be concealed before required information has been recorded and documents shall be clearly marked "PROJECT RECORD DOCUMENTS", not used for construction purposes and available to Architect and/or his representative at all times.

1. Progress Payments nor Final Payment will be made until the Architect is satisfied that the status of documents is current.

D. Final Submittal of Project Record Documents: The Contractor shall submit to the Architect, Record Drawings reflecting all changes caused by addenda, field changes, change orders or observed changes by the Design Professional, the General Contractor, or subcontractor(s):

1. One (1) complete set of reproducible (bond) plans showing all information as noted in this section (As-Builts).

2. One (1) digital copy (.pdf format) on CD of all documents noted below, organized and labeled as noted below. Files shall be named such that the documents are clearly identifiable as to their content.

- a. As-Built Drawings
- b. Project Specifications, including addenda
- c. Approved Change Orders
- d. Approved Shop Drawings
- e. O&M Manuals (Mechanical, Plumbing, Electrical). Refer also to mechanical, plumbing, and electrical specifications for hard copy documentation to be submitted in addition to electronic closeout documentation.

f. Warranties: Label per project specifications.

(1) For manufacturer's warranties, include all required documentation required by the manufacturer (i.e. proof of purchase, invoice, etc.) should the Owner need to submit a claim.

(2) All warranty forms shall be filled out completely by the Contractor (include dates of installation, serial and model numbers, etc.).

3. The Contractor shall pay all costs for scanning/reproducing marked-up as-built plans and closeout documents into digital format.

END OF SECTION

SECTION 02120  
SUBSURFACE INVESTIGATION

PART 1 - GENERAL

1.1 Description:

A. Subsurface Investigation Report:

1. A subsurface (soils) investigation has been prepared for the site of this work by Geotechnical & Environmental Consultants, Inc., hereinafter referred to as the Geotechnical Engineer.

2. The subsurface (soils) investigation report is included hereinafter in its entirety.

B. Use of Subsurface Investigation Report Data:

1. The information and data contained in the subsurface (soils) investigation report is not a warranty of subsurface conditions and is included in this Section for Bidders' information only and to appraise him in general of the existing subsurface conditions as reflected by the report.

2. Bidders should visit the site and acquaint themselves with existing conditions.

3. Prior to bidding, bidders may make their own investigations to satisfy themselves as to site and subsurface conditions; such investigations may be performed only under time schedules and arrangements approved in advance by the Owner.

4. The Contractor shall perform operations described in this report, to include excavation of loose fill materials, undercutting of unsuitable soils, removal of organic matter, stumps, and other deleterious matter, predensification, compaction, etc.

**REPORT OF SUBSURFACE INVESTIGATION**

**SUBSURFACE EXPLORATION AND  
GEOTECHNICAL ENGINEERING EVALUATION  
MACON-BIBB FIRE STATION-JEFFERSONVILLE ROAD  
MACON, GEORGIA  
GEC PROJECT NO. 150863.210**

**PREPARED FOR**

**MR. CLAY MURPHEY  
MACON-BIBB COUNTY  
1191 FIRST STREET  
MACON, GEORGIA 31201**

**PREPARED BY**

**GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS, INC.  
514 HILLCREST INDUSTRIAL BLVD.  
MACON, GEORGIA 31204  
478-757-1606**

**DECEMBER 1, 2015**

**GEC**

# GEC

GEOTECHNICAL  
&  
ENVIRONMENTAL  
CONSULTANTS, INC

December 1, 2015

Mr. Clay Murphey  
Macon-Bibb County  
1191 First Street  
Macon, Georgia 31201

**SUBJECT: Subsurface Exploration and Geotechnical Engineering Evaluation  
Macon-Bibb Fire Station-Jeffersonville Road  
Macon, Georgia  
GEC Project No. 150863.210**

Dear Mr. Murphey:

Geotechnical & Environmental Consultants, Inc. (GEC) is pleased to present this report of our subsurface exploration and geotechnical engineering evaluation for the above site. The purpose of this exploration was to obtain data to evaluate the site and subsurface conditions in order to provide recommendations relative to the geotechnical aspects of the project.

Based on the results of the geotechnical testing performed at the site, it is our opinion that the site is suitable for the proposed construction. Due to the loose and sandy nature of the soils at the site, we recommend that all at grade and fill soils be compacted to at least 98% of the Standard Proctor. A soil bearing pressure of 1,500 psf is recommended for use in foundation design. Please see the attached report sections for further geotechnical recommendations.

We greatly appreciate the opportunity to provide these services to you. If you have any questions, or if we can be of further assistance, please do not hesitate to call.

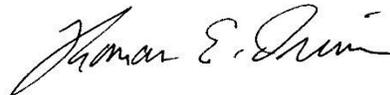
Sincerely,

GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS, INC.



Brad Thigpen, E.I.T.  
Project Engineer

BRT/TED/hm



Thomas E. Driver, P.E.  
President  
Ga. Reg. #17394



**TABLE OF CONTENTS**  
**MACON-BIBB FIRE STATION-JEFFERSONVILLE ROAD**  
**MACON, GEORGIA**  
**GEC PROJECT NO. 150863.210**

<b>1.0</b>	<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
<b>2.0</b>	<b>PROJECT INFORMATION .....</b>	<b>2</b>
<b>3.0</b>	<b>METHOD OF EXPLORATION .....</b>	<b>2</b>
<b>3.1</b>	<b>Site Conditions .....</b>	<b>2</b>
<b>3.2</b>	<b>Soil Test Borings .....</b>	<b>2</b>
<b>4.0</b>	<b>SITE AND SUBSURFACE CONDITIONS .....</b>	<b>3</b>
<b>4.1</b>	<b>Site Description .....</b>	<b>3</b>
<b>4.2</b>	<b>Local Geology .....</b>	<b>3</b>
<b>4.3</b>	<b>Subsurface Conditions.....</b>	<b>3</b>
<b>5.0</b>	<b>CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>4</b>
<b>5.1</b>	<b>Site and Subgrade Preparation.....</b>	<b>4</b>
<b>5.2</b>	<b>Earthwork.....</b>	<b>5</b>
<b>5.3</b>	<b>Foundations .....</b>	<b>6</b>
<b>5.4</b>	<b>Slab Design .....</b>	<b>7</b>
<b>5.5</b>	<b>Slopes.....</b>	<b>7</b>
<b>5.6</b>	<b>Pavement Recommendations .....</b>	<b>7</b>
<b>5.7</b>	<b>Seismic Design Criteria .....</b>	<b>8</b>
<b>5.8</b>	<b>Geotechnical Controls .....</b>	<b>8</b>
<b>5.9</b>	<b>Limitations.....</b>	<b>9</b>

**APPENDIX**

**SITE LOCATION MAP**

**BORING LOCATION PLAN**

**SOIL TEST BORING PROCEDURES**

**LABORATORY TESTING PROCEDURES**

**SOIL BORING RECORDS**

**SOIL CLASSIFICATION CHART**

## 1.0 EXECUTIVE SUMMARY

The following summary highlights our pertinent findings and recommendations concerning this project.

- A total of ten (10) soil test borings were drilled at the site. The borings, designated B-1 through B-10, were drilled on November 30, 2015.
- Site preparation will include the removal vegetation on the site, the striping of topsoil and the removal of any loose near-surface soils in the planned construction areas. All stripped materials, undercut soils, and debris should be disposed off-site or in non-structural areas.
- The on-site soils appear to be suitable for use as structural fill.
- Refusal to the auger process was not encountered within the depths evaluated at the site. Based on the proposed development, difficulties in excavation due to rock are not anticipated at the site.
- Groundwater was not encountered at the time of drilling. We do not anticipate that groundwater will impact construction activities.
- We recommend conventional shallow foundations for support of the proposed and future building additions. An allowable soil bearing pressure of 1,500 psf may be used for design of foundations bearing on competent existing soils or new engineered fill.
- The concrete slab-on-grade floor for the proposed structures may be designed using a modulus of subgrade reaction of 100 pci for the soil types encountered at the site compacted in accordance with the recommendations of this report.
- A site class D is recommended for seismic design at the site.

*This executive summary has been prepared solely to provide a general overview of the report. The executive summary should not be relied upon for any purpose except for a general overview. Please rely on the full report for information concerning the findings, recommendations and other concerns at the site.*

## **2.0 PROJECT INFORMATION**

Our understanding of the project is based on conversations with Mr. Clay Murphey with Macon-Bibb County and review of a provided site plan. The subject property is located at 3947 Jeffersonville Road in Macon, Georgia, as shown on the *Site Location Map* in the Appendix.

We understand the proposed development will consist of the construction of a fire station with associated parking and driveway areas. The proposed development is shown on the *Boring Location Plan* in the Appendix.

Structural plans have not been provided to GEC at this time. Based on our site reconnaissance and project information, we anticipate that cuts and fills will be on the order of 5 feet or less. For the purpose of this report, we assume that the structural loads will be typical for the proposed type of development, and that the maximum column loads will not exceed 100 kips and maximum wall loads will not exceed 2 kips per linear foot.

## **3.0 METHOD OF EXPLORATION**

### **3.1 Site Conditions**

GEC performed a general review of the proposed project site and surrounding areas prior to the performance of our subsurface exploration activities. The review was performed to evaluate surface conditions that could impact our exploration techniques or the proposed construction.

The locations and depths of the borings were selected by GEC based on the site plans provided. The boring locations were marked in the field by measuring from existing features and using a portable GPS unit.

No site clearing was required at the time of drilling.

### **3.2 Soil Test Borings**

A total of ten (10) soil test borings were performed at the project site. Borings B-1 through B-5 were performed within the proposed building footprint and were extended to a depth of 20 feet below the existing ground surface. Borings B-6 through B-10 were performed within the proposed parking lot and driveway areas and were extended to a depth of 10 feet below existing ground surface. The approximate locations of the borings are presented on the *Boring Location Plan* located in the Appendix.

All borings were backfilled with the auger cuttings prior to site demobilization. The split-spoon samples were returned to our laboratory and were manually and visually examined and

classified. The samples were classified according to the Unified Soil Classification System (USCS). Detailed records of the soil test borings, indicating the N-values (blow counts) obtained from the Standard Penetration Testing (SPT) and a more detailed description of the drilling and sampling processes, are presented in the Appendix.

## **4.0 SITE AND SUBSURFACE CONDITIONS**

### **4.1 Site Description**

The proposed project is located at 3947 Jeffersonville Road in Macon, Georgia. The site currently consists of cleared land. The site is relatively flat and level.

### **4.2 Local Geology**

The site is located in the Coastal Plain Physiographic Province of Georgia. Soils in the Coastal Plain are the result of deposition of sediments in a former marine environment. Coastal Plain sedimentary deposits make up about 60 percent of Georgia's surface area and consist of a southwardly thickening wedge of sediments that are bordered on the north by the parent rocks of the Piedmont Physiographic Province. The border between these provinces is known as the "Fall-Line." The Coastal Plain sediments range in age from the Cretaceous to the Recent, with the oldest exposed along the "Fall-Line" and the youngest along the coast. Typically, the surface soils consist of complexly interbedded sands, silts, and clays of various mixtures. Sandstones, shales, and limestones comprise the characteristic lithology of the Coastal Plain. These formations are usually found at depths greater than fifty feet but can also be found at or near the ground surface. They are not known to occur near the surface in the site area. Topography in this region of the Coastal Plain is generally flat to gently rolling.

### **4.3 Subsurface Conditions**

Details of the subsurface conditions encountered by the soil test borings are shown on the "Soil Boring Records" in the Appendix of this report. These records represent an estimate of the subsurface conditions based on our interpretation of the boring data using normally accepted engineering judgment. Stratification lines on the "Soil Boring Records" represent approximate boundaries between soil types. However, the in-situ transition is typically more gradual. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of the subsurface conditions at other locations or at other times. The general soil conditions and their pertinent characteristics are discussed in the following paragraphs.

## **General Stratigraphy**

The general subsurface stratigraphy of the site consisted of Coastal Plain Sediment soils extending to the depths explored.

### **Topsoil**

Topsoil was measured at approximately three (3) to five (5) inches in all of the borings. A practical topsoil stripping depth of six (6) inches is recommended for planning and budgeting purposes.

### **Coastal Plain Sediment Soils**

Coastal Plain Sediment soils were encountered in all borings. The Coastal Plain Sediment soils were encountered underneath the topsoil and extended to the maximum depths explored. The Coastal Plain Sediment soils generally consisted of very loose to loose silty sands (SM) with various silt contents. The SPT N-values in these soils ranged from 3 to 9 blows per foot (bpf).

### **Groundwater**

Groundwater was not encountered at the time of drilling. Groundwater is not anticipated to affect any construction activities.

## **5.0 CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Site and Subgrade Preparation**

General site preparation within the building area should consist of the removal of any vegetation, the stripping of any topsoil, and the removal of any debris. Any utility lines in the project area should be removed and relocated. Excavations or holes resulting from the removal of utilities, foundations or structures should be backfilled with structural fill to the compaction requirements presented in Section 5.2, *Earthwork*. Stripped topsoil should be moved outside of fill areas and may be used as landscaping materials.

Following site stripping, all at grade areas and areas to receive fill should be compacted using a heavy sheepsfoot vibratory roller. The use of the vibratory roller is recommended to consolidate the near surface sandy soils at the site. Moisture conditioning of the near surface soils may be necessary prior to compaction depending on climatic conditions at the time of construction. Following compaction, these areas should be proofrolled in the presence of a geotechnical engineer or his representative to evaluate subgrade stability. Proofrolling should be performed with a fully loaded tri-axle dump truck, 20-ton roller, or similar equipment in an overlapping

pattern to detect any soft or loose areas. Any areas that pump or rut excessively and cannot be densified by continued rolling should be undercut to a depth to be determined in the field by the geotechnical engineer, and be replaced with structural fill.

In general, if loose soils are encountered in structural areas, the soils will need to be reworked or undercut to a point 10 feet outside of the perimeters of the structural areas. The extent of the reworking necessary will depend on the final grading plans and the climatic conditions at the time of construction. All undercut areas should be backfilled with structural fill as described in Section 5.2, *Earthwork*, of this report.

Prior to fill placement, the subgrade should be scarified, moisture-conditioned to slightly above the optimum moisture content, and compacted to at least 98 percent of the standard Proctor maximum dry density (ASTM D698) in all structural or paved areas. All at-grade areas and cut surfaces should be scarified moisture conditioned to slightly above optimum moisture content, and compacted to at least 98 percent of the same criteria.

We recommend that construction grades be maintained throughout the project in such a manner so to establish positive drainage away from working surfaces and subgrades. Vehicular traffic should be avoided or minimized on exposed surfaces. Heavily trafficked areas may need to be stabilized to avoid construction delays due to climatic conditions. The degree of stabilization will depend on factors such as climatic conditions during construction and construction traffic and loads. Stabilization could include adequate compaction of the in-place soils, graded aggregate, geotextiles, geosynthetics or a combination of these. Actual techniques should be evaluated as construction progresses and variances in conditions are controlled and finalized.

## **5.2 Earthwork**

The soil test borings indicate the near-surface soils at the site can be graded with conventional earthmoving equipment such as self-loading or pusher-assisted pans and tracked dozers. The near-surface soils appear to be suitable for use as fill material. Wetting or drying of the soils at the site may be necessary to achieve the required compaction criteria. The contractor should be required to have equipment available on site for both wetting and drying of the soils.

In general, all fill placed at the site, including on-site soils, should not contain rocks or lumps larger than four (4) inches in greatest dimension and contain no more than 15 percent larger than 2.5 inches. Structural fill soils should have a liquid limit less than 40, plastic index less than 25 and a standard Proctor maximum dry density (ASTM D 698) greater than 90 pcf. Based on visual examination of the split-spoon samples, the majority of the soils at the site will be suitable for use as structural fill. Generally, soils classified as SP, SM, SC, ML or CL according to the Unified Soil Classification System, are considered suitable for fill providing they meet the above criteria.

Structural fill should be moisture-conditioned to slightly above the optimum moisture content, spread in relatively thin lifts (8 inch maximum loose lifts) and methodically compacted with heavy compaction equipment to at least 98 percent of the standard Proctor maximum dry density (ASTM D 698). Additionally, the upper one-foot of material in areas at-grade or cut surfaces should be scarified and compacted to the 98 percent criteria. Structural fill criteria should be utilized beneath proposed and future structural areas.

Structural fill should extend horizontally beyond the outer edge of the building foundations at least ten feet or a distance equal to the height of the fill to be placed, whichever is greater. In paved areas, fill slopes should extend horizontally at least five feet beyond the edge of pavement prior to sloping.

Utility trenches should be backfilled with materials satisfying the criteria described above for general fill, placed in lifts of approximately eight (8) inches in uncompacted thickness. However, thicker lifts may be used provided the method of compaction is approved by the project geotechnical engineer and the required minimum degree of compaction is achieved.

### **5.3 Foundations**

The proposed structures can be constructed on conventional shallow foundations bearing on the in-place soils, reworked soils, or structural fill meeting the compaction requirements of Section 5.2, *Earthwork*. Based on the soils encountered during our exploration, we recommend uniform net allowable soil bearing pressures of 1,500 psf be used for foundation design once the on-site soils are treated as outlined in this report. Exterior foundations should bear at a minimum of 18 inches below external grades to preclude damage due to frost penetration.

Using the preliminary or assumed structural loads provided, we estimate that total post construction settlement of up to 1 inch will occur. Differential settlement should be approximately 50% of the total settlement over a distance of 30 feet.

A Geotechnical Engineer or his representative should examine footing subgrades immediately prior to rebar placement to confirm that the foundation conditions are as anticipated and the design bearing pressure is available. Auger and hand held dynamic cone penetrometer testing augmented by hand probing should be used to determine whether conditions within these areas are consistent with those encountered by the borings.

#### **5.4 Slab Design**

Assuming that the upper 12 inches of subgrade consist of properly compacted and proofrolled existing soil or newly installed fill material compacted to a minimum of 98% of standard Proctor maximum dry density, concrete slab-on-grade floors for the proposed buildings may be designed using a modulus of subgrade reaction of 100 pci. A modulus of subgrade reaction of 200 pci may be used if at least 6 inches of No. 57 stone or compacted graded aggregate base is provided below the slab. A durable vapor barrier should be provided beneath soil supported slabs to reduce dampness due to soil moisture.

#### **5.5 Slopes**

Based on our experience with soils similar to those encountered during our exploration, we recommend excavated slopes less than 10 feet be laid back at least to a 2H:1V (Horizontal to Vertical) slope. Permanent fill slopes placed on suitable subgrade may be constructed at 2.5:1 or flatter. All fill slopes should be adequately compacted as recommended in this report. Permanent slopes of 3:1 or flatter may be used to facilitate mowing. All sloped surfaces should be protected from erosion by grassing or other means. All confined excavations should conform to the latest OSHA Regulations.

#### **5.6 Pavement Recommendations**

The following pavement recommendations are issued for preliminary purposes. We recommend that we be allowed to perform an actual design based on design traffic loads once determined.

A preliminary analysis for flexible pavements was performed in general accordance with the American Association of State Highway and Transportation Officials (AASHTO) "Guide For Design of Pavement Structures", 2006. The AASHTO method considers the effects of traffic by equating the traffic loading to an Equivalent Single Axle Load (ESAL) of 18 kips. This is done by Equivalent Axle Load Factors (EALF). The EALF is applied to the each axle that crosses the pavement in order to consider its individual effect on the life of the pavement. EALFs range from 0.004 for normal passenger cars to 2.15 for a 40 kip tandem axle load (two tandem axles for an 80 kip truck).

Based on the above assumptions, a design California Bearing Ratio (CBR) of at least four would be required for the reworked soils. We recommend that field and/or laboratory CBR testing be performed during construction to verify these recommendations. Based on the assumed loadings, the following pavement sections are recommended for this site:

RECOMMENDED PAVEMENT DESIGN SECTION				
Pavement Type	Anticipated Pavement Use	Pavement Components		Total Thickness (inches)
		Asphalt Concrete (inches)	Aggregate Base (inches)	
Flexible	Light Duty	2*	6	8
Flexible	Heavy Duty	3**	8	11

\* The light duty surface course should consist of 2 inches of 9.5 mm Superpave

\*\* The heavy duty surface course should consist of 1 inch of 9.5 mm Superpave over a 2" binder course of 19 mm Superpave.

Please let us know if a rigid pavement design is required and we will amend these recommendations.

Based on our analysis, using a CBR value of 4 for the reworked subgrade soils, the flexible pavement design for the paved areas will yield approximate ESAL values of 12400 (SN=1.72) and 105,000 (SN=2.44), respectively for the light and heavy duty paving sections. It is extremely important to remember that if the actual traffic loads are anticipated to exceed those presented above; the design sections should be re-evaluated for the actual design conditions. Our analysis assumes the pavement subgrades are prepared in accordance with the recommendations outlined in this report.

### 5.7 Seismic Design Criteria

The seismic site classification for the proposed project was evaluated using the criteria given in the 2012 International Building Code (IBC 2012). Based on the project information and soil test borings, we recommend the following parameters be used in design:

- |   |                                 |
|---|---------------------------------|
| • Site Classification   | <b>Class D</b>                  |
| • Maximum Considered Earthquake (MCE) spectral response acceleration for short period | <b>S<sub>MS</sub> = 0.264 g</b> |
| • MCE spectral response acceleration for 1-second period                              | <b>S<sub>MI</sub> = 0.197 g</b> |
| • Design spectral response acceleration for short period                              | <b>S<sub>DS</sub> = 0.176 g</b> |
| • Design spectral response acceleration for 1-second                                  | <b>S<sub>DI</sub> = 0.131 g</b> |

### 5.8 Geotechnical Controls

1. The Geotechnical Engineer should be provided the opportunity for a general review of the final design documents in order to assess proper interpretation of the earthwork and foundation recommendations.

2. The Geotechnical Engineer, or his qualified representative, should observe undercutting and proofrolling operations.
3. A qualified engineering technician, under the supervision of the Geotechnical Engineer, should observe fill operations and perform a minimum of one field density test per 2,500 square feet of area for each one-foot thickness of fill.
4. The Geotechnical Engineer, or his qualified representative, should check each foundation excavation utilizing hand probing and auger and dynamic cone penetrometer testing. This will reduce the risk of unsuitable or soft materials directly underlying the footings, which may be detrimental to the integrity of the structures.

### **5.9 Limitations**

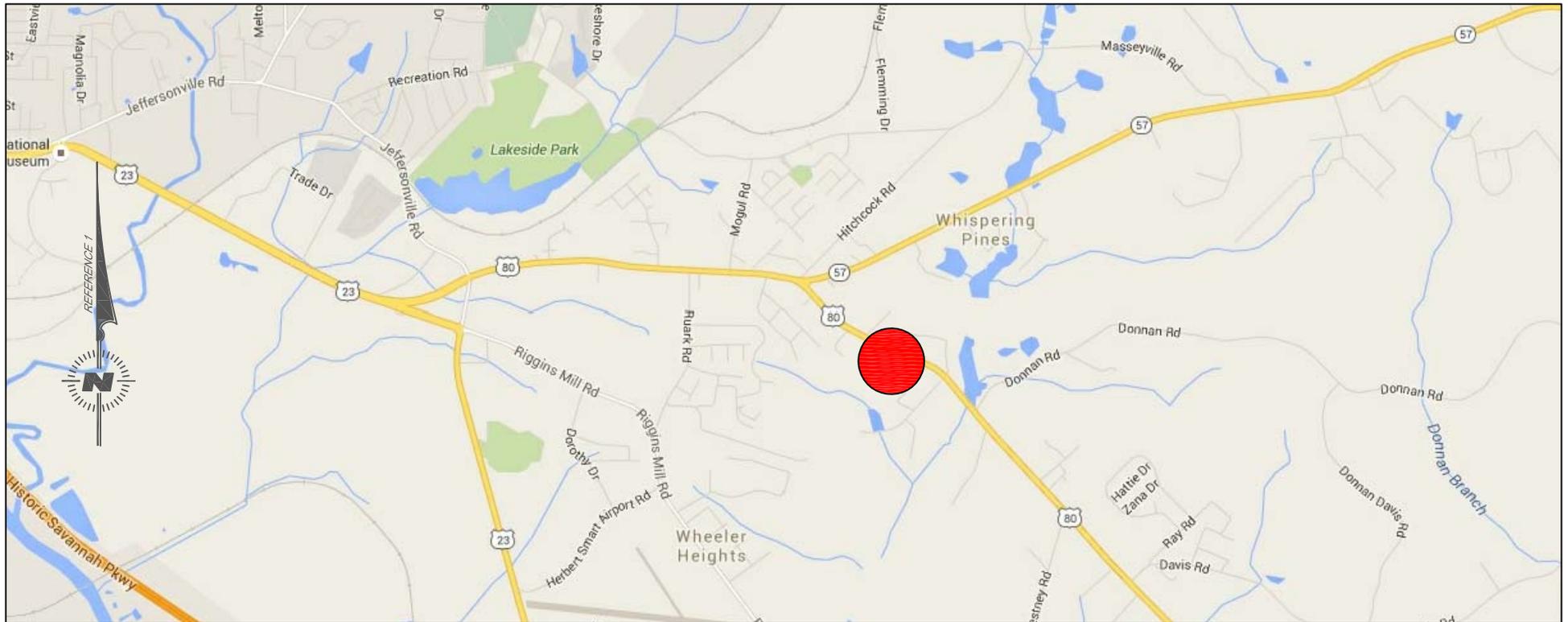
This report is for the exclusive use of Macon-Bibb County and the architect, engineers, and contractors for the project described herein, and may only be applied to this specific project. The analyses, conclusions and recommendations presented in this report are based on the preceding project information, and the results of this evaluation. Conditions may vary from those observed in the borings.

If it becomes apparent during construction that soil conditions differing from those discussed in this report are encountered, Geotechnical and Environmental Consultants, Inc. should be notified at once so that the effects may be determined and any remedial measures necessary may be prescribed.

This report has been prepared in accordance with generally accepted standards of geotechnical engineering practice in the State of Georgia. No other warranty is expressed or implied. Our firm is not responsible for conclusions, opinions or recommendations of others.

The right to rely upon this report and the data within may not be assigned without the written permission of Geotechnical and Environmental Consultants, Inc. If the design or location of the structure is changed, the recommendations contained herein must be considered invalid, unless our firm reviews changes and our recommendations are either verified or modified in writing. When design is complete, we should be given the opportunity to review the foundation plans, grading plans and applicable portions of the specifications to determine if they are consistent with the intent of our recommendations.

## **APPENDIX**

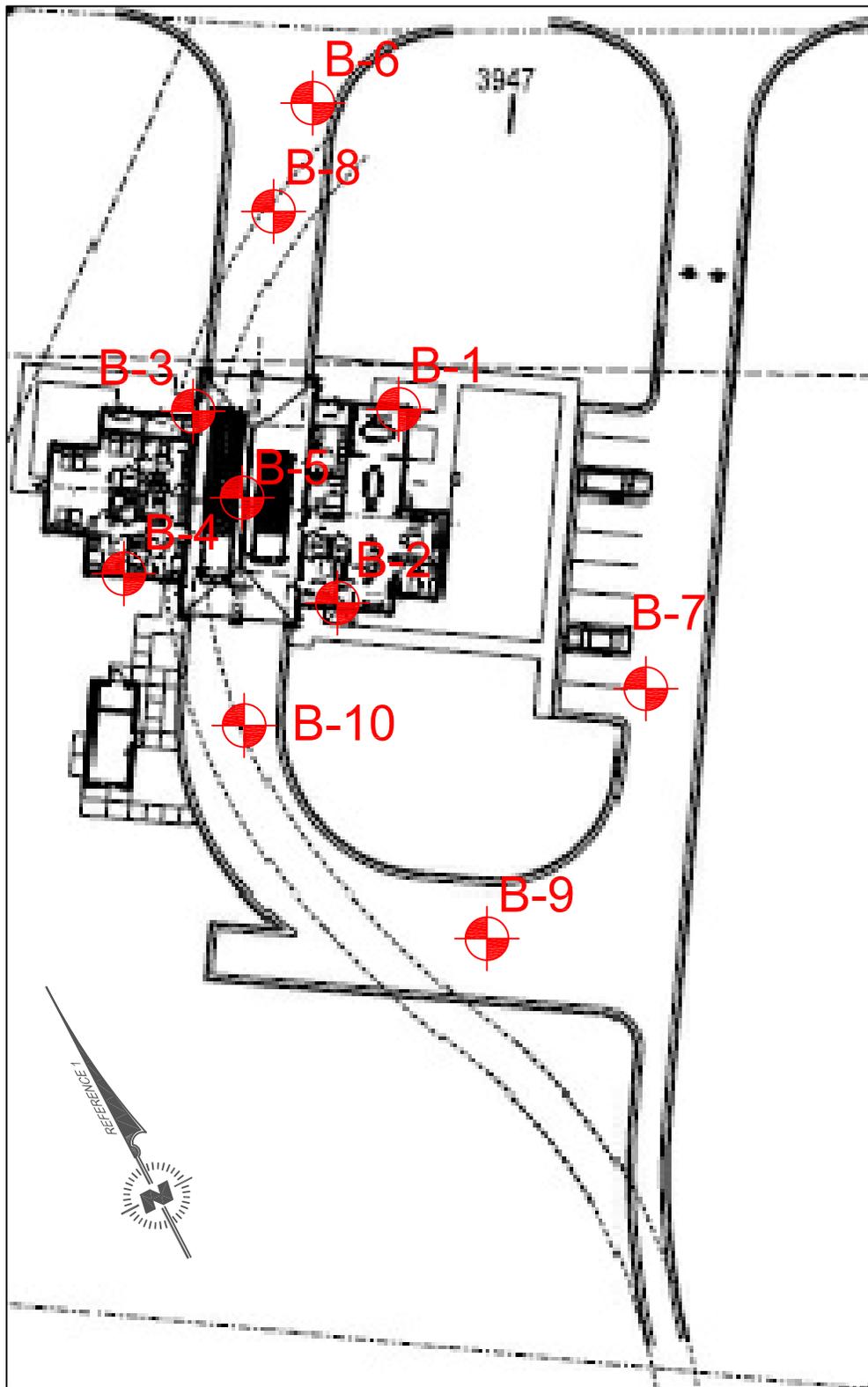


SCALE: 1" = 3000'

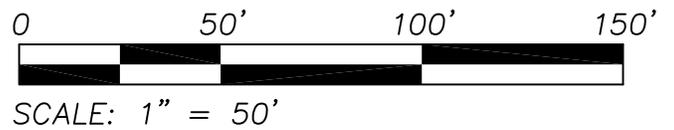
**SITE LOCATION MAP**  
**MACON-BIBB FIRE STATION**  
**JEFFERSONVILLE ROAD**  
**MACON, GEORGIA**  
**GEC PROJECT NO. 150863.210**

**GEC**  
**GEOTECHNICAL**  
**&**  
**ENVIRONMENTAL**  
**CONSULTANTS, INC.**

**514 HILLCREST INDUSTRIAL BLVD.**  
**MACON, GEORGIA 31204**  
**478-757-1606 (Fax) 478-757-1608**  
**WWW.GECONSULTANTS.COM**



 = APPROXIMATE BORING LOCATION



BORING LOCATION PLAN  
 MACON-BIBB FIRE STATION  
 JEFFERSONVILLE ROAD  
 MACON, GEORGIA

GEC PROJECT NO. 150863.210

**GEC**  
 GEOTECHNICAL  
 &  
 ENVIRONMENTAL  
 CONSULTANTS, INC.

514 HILLCREST INDUSTRIAL BLVD.  
 MACON, GEORGIA 31204  
 478-757-1606 (Fax) 478-757-1608  
 WWW.GECONSULTANTS.COM

## SOIL TEST BORING PROCEDURES

The borings were advanced by a hollow-stem auger process. At the desired depth in all borings, the borehole was cleaned out and the sample tools inserted through the auger stems. At assigned intervals, soil samples were obtained with a standard 1.4-inch inside diameter, 2-inch outside diameter split tube sampler. The sampler was first seated six inches to penetrate any loose cuttings; then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler the final foot was recorded and is designated as the standard penetration resistance (N-value). The penetration resistance, when properly evaluated, may be used as an index to the soil strength and foundation support capability. Soil sampling and penetration testing were performed in general accordance with ASTM D 1586.

The drilling method is not capable of penetrating material designated as “refusal materials.” Refusal, thus indicated, may result from hard cemented soil, soft weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of sound continuous rock. Core boring procedures are required to determine the character and continuity of refusal materials.

Representative portions of the split tube samples were placed in sample containers and transported to our laboratory. In the laboratory, the samples were examined and the visual classification was confirmed by a geotechnical engineer or geologist.

The final boring records represent our interpretation of the contents of the field records based on the results of the engineering examinations and testing of selected field samples. These records depict subsurface conditions at the specific locations and at the particular time drilled. Soil conditions at other locations may differ from conditions occurring at these boring locations. Also, the passage of time may result in changes in the ground water conditions at these boring locations. The lines designating the interface between strata on the records and on profiles represent approximate boundaries. The transition between materials may be gradual. The final boring records are included with this report.

A record of the sampling operations and the descriptions of the soils encountered in each boring are shown on the following Soil Boring Record sheets.

### CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

SOIL TYPE	BLOWS PER FOOT (bpf) <sup>1</sup>	RELATIVE DENSITY / CONSISTENCY DESCRIPTION
SANDS and GRAVELS	0 – 4	Very Loose
	5 - 10	Loose
	11 - 20	Firm
	21 - 30	Very Firm
	31-50	Dense
	Over 50	Very Dense
SILTS and CLAYS	0 – 1	Very Soft
	2 – 4	Soft
	5 – 8	Firm
	9 - 15	Stiff
	16-30	Very Stiff
	31-50	Hard
	Over 50	Very Hard

<sup>1</sup> Standard Penetration Resistance blow count, N, which is equal to the sum of the second and third six-inch increments of the SPT test.

## **LABORATORY TESTING PROCEDURES**

### **SOIL CLASSIFICATION**

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our evaluations, samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer or geologist. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our "Soil Boring" records.

The classification system discussed above is primarily qualitative. For detailed soil classification, two laboratory tests are routinely performed: grain size tests and Atterberg limits tests. Using these test results, the soil can be classified according to the AASHTO or Unified Classification Systems (ASTM D-2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior. The soil classification and physical properties obtained are presented in the report.

### **WATER LEVEL READINGS**

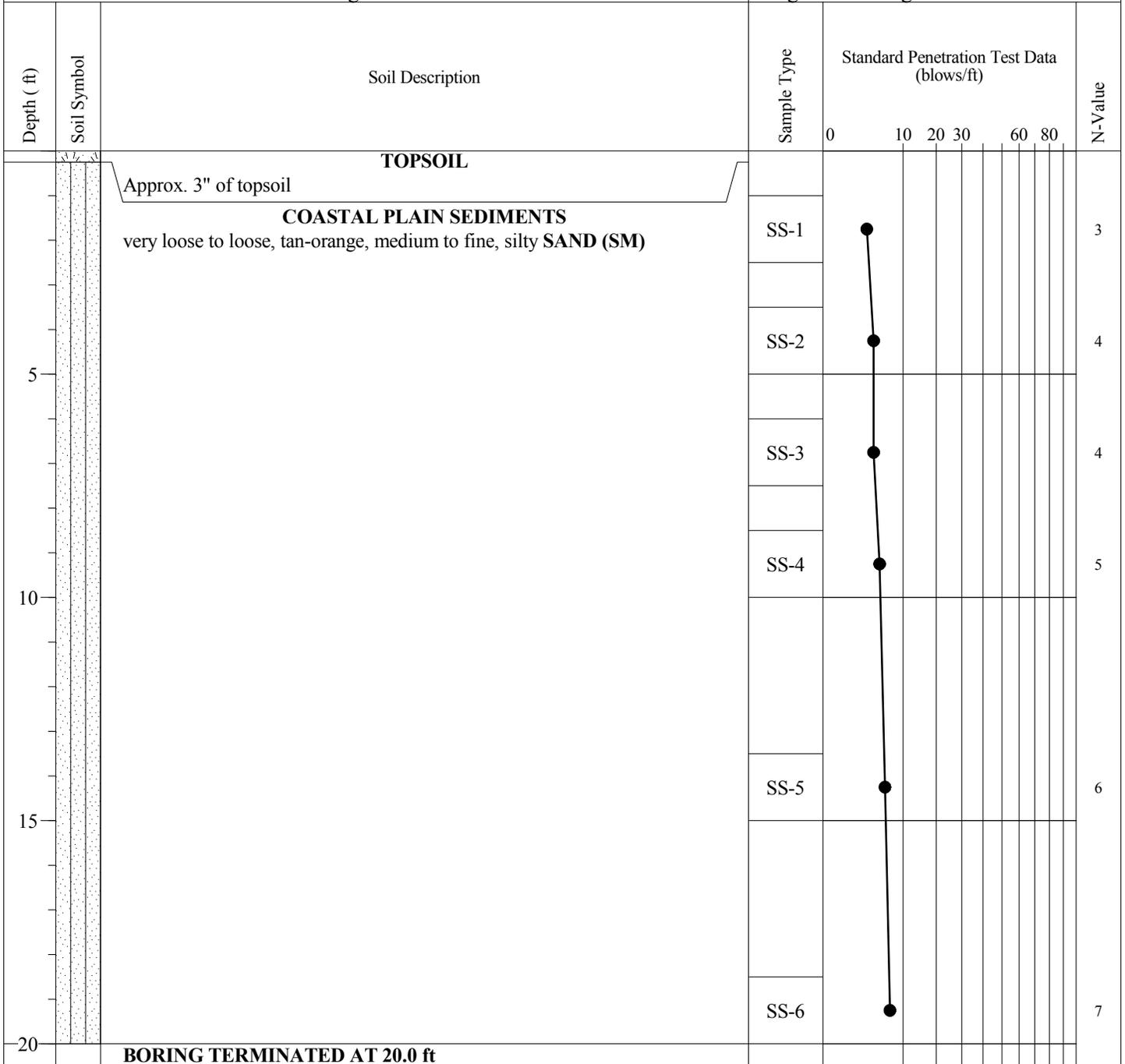
Water table readings are normally taken in conjunction with borings and are recorded on the "Soil Boring Records". These readings indicate the approximate location of the hydrostatic water table at the time of our field exploration. Where relatively impervious soils (clayey soils) are encountered, the amount of water seepage into the boring is small, and it is generally not possible to establish the location of the hydrostatic water table through water level readings. The ground water table may also be dependent upon the amount of precipitation at the site during a particular period of time. Fluctuations in the water table should be expected with variations in precipitation, surface run-off, evaporation and other factors.

The time of boring (TOB) water level reported on the boring records is determined by field crews immediately after drilling. Additional water table readings may be obtained at least 24 hours after the borings are completed. The time lag of at least 24 hours is used to permit stabilization of the ground water table which has been disrupted by the drilling operations. The readings are taken by dropping a weighted line down the boring or using an electrical probe to detect the water level surface.

Occasionally, the borings will cave-in, preventing water level readings from being obtained or trapping drilling water above the caved-in zone. The cave-in depth is often measured and recorded on the boring records.

# SOIL BORING RECORD

Project: <b>Macon-Bibb Fire Station-Jeffersonville Road</b> Macon-Bibb County, Georgia	Boring No: <b>B-1</b>
Location: <b>See Boring Location Plan</b>	Project No: 150863.210
Driller/Equipment: J. Waddell / C. Matthews/ CME 55, 2.25" HSA	GS Elevation:
Water Level: NGWE at time of boring	Drilling Date: November 30, 2015
Engineer/Geologist:	



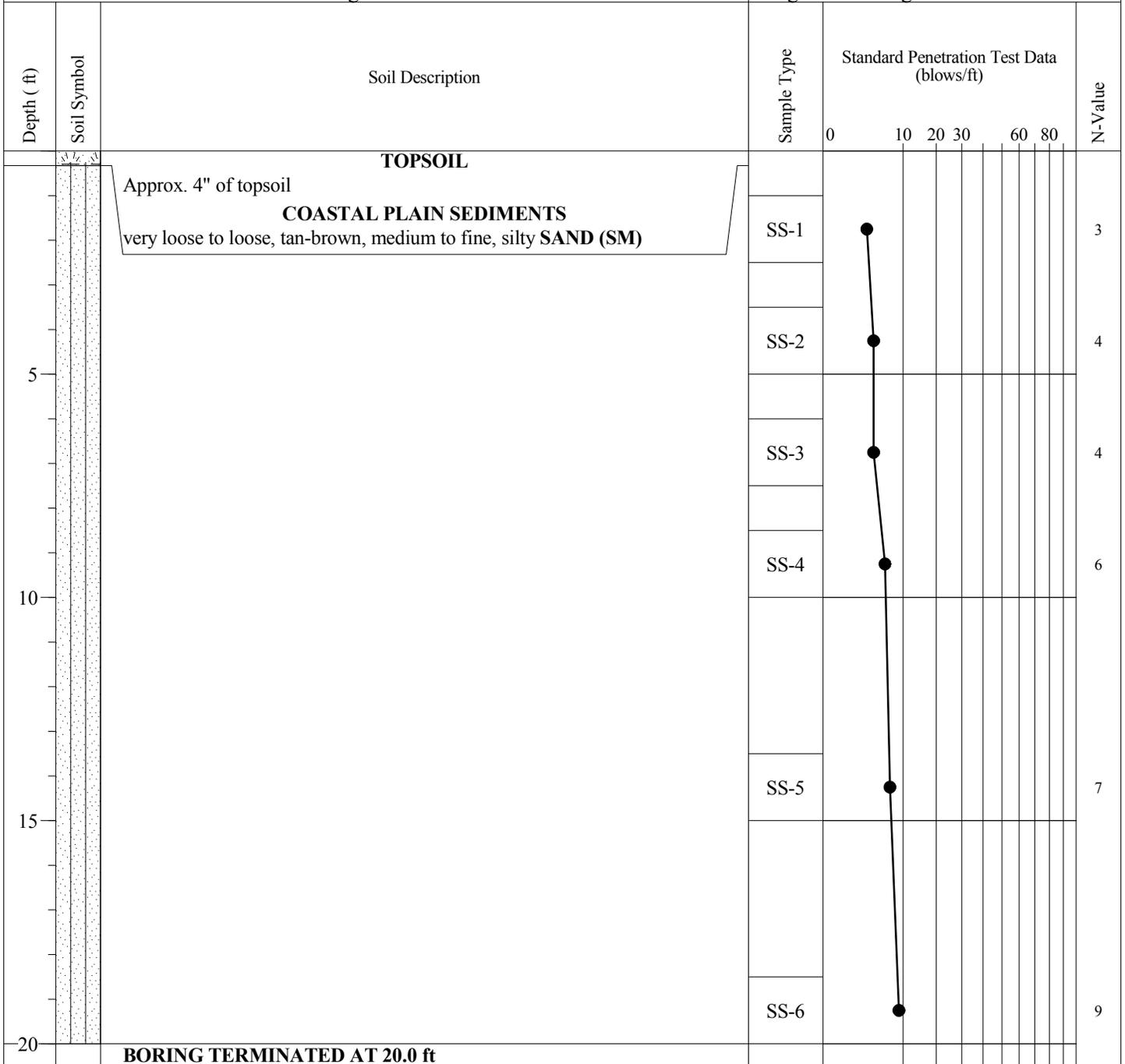
GEOTECH 150863.210 MACON-BIBB FIRE STATION-DONNAN ROAD.GPJ\_GEC.GDT 12/2/15

- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

NOTES:

# SOIL BORING RECORD

Project: <b>Macon-Bibb Fire Station-Jeffersonville Road</b> Macon-Bibb County, Georgia	Boring No: <b>B-2</b>
Location: <b>See Boring Location Plan</b>	Project No: 150863.210
Driller/Equipment: J. Waddell / C. Matthews/ CME 55, 2.25" HSA	GS Elevation:
Water Level: NGWE at time of boring	Drilling Date: November 30, 2015
Engineer/Geologist:	



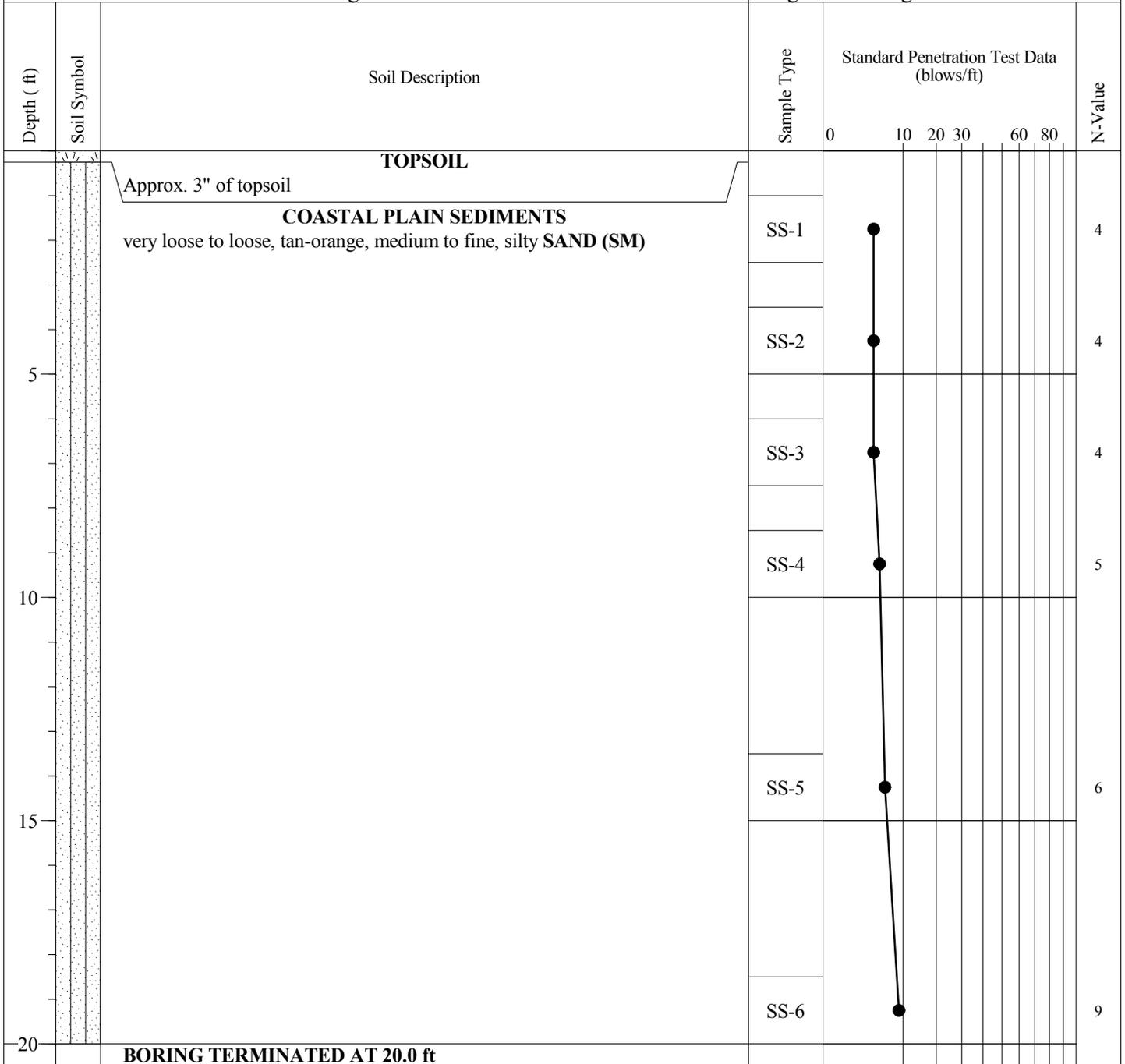
GEOTECH 150863.210 MACON-BIBB FIRE STATION-DONNAN ROAD.GPJ\_GEC.GDT 12/2/15

- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

NOTES:

# SOIL BORING RECORD

Project: <b>Macon-Bibb Fire Station-Jeffersonville Road</b> Macon-Bibb County, Georgia	Boring No: <b>B-3</b>
Location: <b>See Boring Location Plan</b>	Project No: 150863.210
Driller/Equipment: J. Waddell / C. Matthews/ CME 55, 2.25" HSA	GS Elevation:
Water Level: NGWE at time of boring	Drilling Date: November 30, 2015
Engineer/Geologist:	



GEOTECH 150863.210 MACON-BIBB FIRE STATION-DONNAN ROAD.GPJ\_GEC.GDT 12/2/15

- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

NOTES:

# SOIL BORING RECORD

Project: <b>Macon-Bibb Fire Station-Jeffersonville Road</b> Macon-Bibb County, Georgia	Boring No: <b>B-4</b>
Location: <b>See Boring Location Plan</b>	Project No: 150863.210
Driller/Equipment: J. Waddell / C. Matthews/ CME 55, 2.25" HSA	GS Elevation:
Water Level: NGWE at time of boring	Drilling Date: November 30, 2015
Engineer/Geologist:	

Depth ( ft )	Soil Symbol	Soil Description	Sample Type	Standard Penetration Test Data (blows/ft)						N-Value
				0	10	20	30	60	80	
		<b>TOPSOIL</b>								
		Approx. 4" of topsoil								
		<b>COASTAL PLAIN SEDIMENTS</b> very loose to loose, tan-orange, medium to fine, silty <b>SAND (SM)</b>	SS-1	●						4
5			SS-2	●						4
			SS-3	●						4
10			SS-4	●						5
15			SS-5	●						6
20			SS-6	●						8
		<b>BORING TERMINATED AT 20.0 ft</b>								

GEOTECH 150863.210 MACON-BIBB FIRE STATION-DONNAN ROAD.GPJ\_GEC.GDT 12/2/15

- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

NOTES:

# SOIL BORING RECORD

Project: <b>Macon-Bibb Fire Station-Jeffersonville Road</b> Macon-Bibb County, Georgia	Boring No: <b>B-5</b>
Location: <b>See Boring Location Plan</b>	Project No: 150863.210
Driller/Equipment: J. Waddell / C. Matthews/ CME 55, 2.25" HSA	GS Elevation:
Water Level: NGWE at time of boring	Drilling Date: November 30, 2015
Engineer/Geologist:	

Depth ( ft )	Soil Symbol	Soil Description	Sample Type	Standard Penetration Test Data (blows/ft)						N-Value
				0	10	20	30	60	80	
		<b>TOPSOIL</b>								
		Approx. 4" of topsoil								
		<b>COASTAL PLAIN SEDIMENTS</b> very loose to loose, tan-orange, medium to fine, silty SAND (SM)	SS-1	●						3
5			SS-2	●						4
			SS-3	●						4
10			SS-4	●						5
			SS-5	●						5
15			SS-6	●						7
20		<b>BORING TERMINATED AT 20.0 ft</b>								

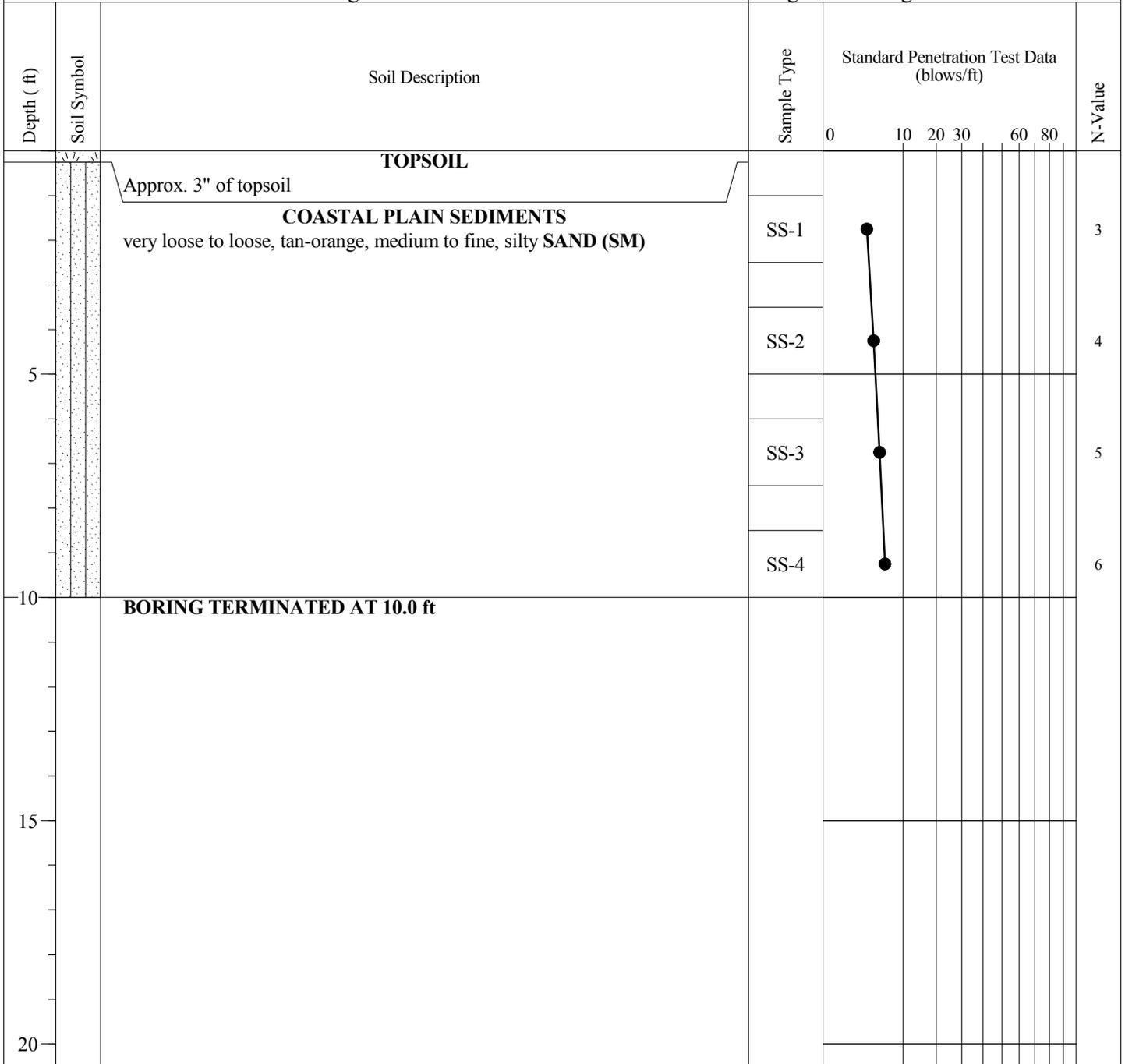
GEOTECH 150863.210 MACON-BIBB FIRE STATION-DONNAN ROAD.GPJ\_GEC.GDT 12/2/15

- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

NOTES:

# SOIL BORING RECORD

Project: <b>Macon-Bibb Fire Station-Jeffersonville Road</b> Macon-Bibb County, Georgia	Boring No: <b>B-6</b>
Location: <b>See Boring Location Plan</b>	Project No: 150863.210
Driller/Equipment: J. Waddell / C. Matthews/ CME 55, 2.25" HSA	GS Elevation:
Water Level: NGWE at time of boring	Drilling Date: November 30, 2015
Engineer/Geologist:	



GEOTECH 150863.210 MACON-BIBB FIRE STATION-DONNAN ROAD.GPJ\_GEC.GDT 12/2/15

- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

NOTES:

# SOIL BORING RECORD

Project: <b>Macon-Bibb Fire Station-Jeffersonville Road</b> Macon-Bibb County, Georgia	Boring No: <b>B-7</b>
Location: <b>See Boring Location Plan</b>	Project No: 150863.210
Driller/Equipment: J. Waddell / C. Matthews/ CME 55, 2.25" HSA	GS Elevation:
Water Level: NGWE at time of boring	Drilling Date: November 30, 2015
Engineer/Geologist:	

Depth ( ft )	Soil Symbol	Soil Description	Sample Type	Standard Penetration Test Data (blows/ft)						N-Value
				0	10	20	30	60	80	
		<b>TOPSOIL</b>								
		Approx. 5" of topsoil								
		<b>COASTAL PLAIN SEDIMENTS</b>								
		very loose to loose, tan-orange, medium to fine, silty SAND (SM)	SS-1	●						3
5			SS-2	●						4
			SS-3	●						4
10			SS-4	●						5
		<b>BORING TERMINATED AT 10.0 ft</b>								
15										
20										

GEOTECH 150863.210 MACON-BIBB FIRE STATION-DONNAN ROAD.GPJ\_GEC.GDT 12/2/15

- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

NOTES:

# SOIL BORING RECORD

Project: <b>Macon-Bibb Fire Station-Jeffersonville Road</b> Macon-Bibb County, Georgia	Boring No: <b>B-8</b>
Location: <b>See Boring Location Plan</b>	Project No: 150863.210
Driller/Equipment: J. Waddell / C. Matthews/ CME 55, 2.25" HSA	GS Elevation:
Water Level: NGWE at time of boring	Drilling Date: November 30, 2015
Engineer/Geologist:	

Depth ( ft )	Soil Symbol	Soil Description	Sample Type	Standard Penetration Test Data (blows/ft)						N-Value
				0	10	20	30	60	80	
		<b>TOPSOIL</b>								
		Approx. 5" of topsoil								
		<b>COASTAL PLAIN SEDIMENTS</b> very loose to loose, tan-orange, medium to fine, silty SAND (SM)	SS-1	●						4
			SS-2	●						4
5			SS-3	●						4
			SS-4	●						5
10		<b>BORING TERMINATED AT 10.0 ft</b>								
15										
20										

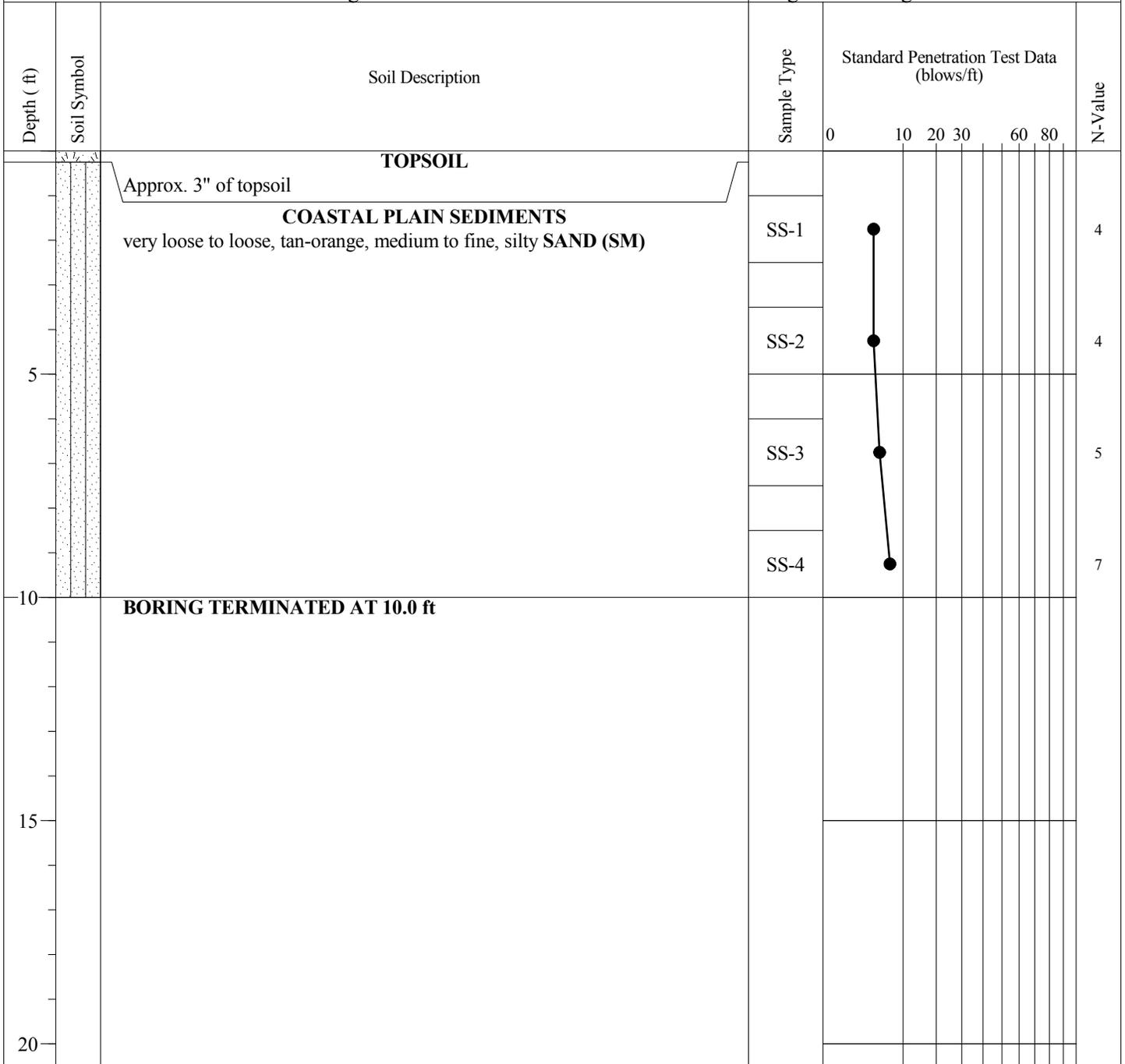
GEOTECH 150863.210 MACON-BIBB FIRE STATION-DONNAN ROAD.GPJ\_GEC.GDT 12/2/15

- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

NOTES:

# SOIL BORING RECORD

Project: <b>Macon-Bibb Fire Station-Jeffersonville Road</b> Macon-Bibb County, Georgia	Boring No: <b>B-9</b>
Location: <b>See Boring Location Plan</b>	Project No: 150863.210
Driller/Equipment: J. Waddell / C. Matthews/ CME 55, 2.25" HSA	GS Elevation:
Water Level: NGWE at time of boring	Drilling Date: November 30, 2015
Engineer/Geologist:	



GEOTECH 150863.210 MACON-BIBB FIRE STATION-DONNAN ROAD.GPJ\_GEC.GDT 12/2/15

- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

**NOTES:**

# SOIL BORING RECORD

Project: <b>Macon-Bibb Fire Station-Jeffersonville Road</b> Macon-Bibb County, Georgia	Boring No: <b>B-10</b>
Location: <b>See Boring Location Plan</b>	Project No: 150863.210
Driller/Equipment: J. Waddell / C. Matthews/ CME 55, 2.25" HSA	GS Elevation:
Water Level: NGWE at time of boring	Drilling Date: November 30, 2015
Engineer/Geologist:	

Depth ( ft )	Soil Symbol	Soil Description	Sample Type	Standard Penetration Test Data (blows/ft)						N-Value
				0	10	20	30	60	80	
		<b>TOPSOIL</b>								
		Approx. 3" of topsoil								
		<b>COASTAL PLAIN SEDIMENTS</b>								
		very loose to loose, tan-orange, medium to fine, silty <b>SAND (SM)</b>	SS-1	●						4
			SS-2	●						4
5			SS-3	●						5
			SS-4	●						6
10		<b>BORING TERMINATED AT 10.0 ft</b>								
15										
20										

GEOTECH 150863.210 MACON-BIBB FIRE STATION-DONNAN ROAD.GPJ\_GEC.GDT 12/2/15

- Boring and sampling performed in accordance with ASTM D 1586.
- Depths are measured from existing ground surface at time of drilling.
- Depths are shown to illustrate general arrangements of the strata encountered at the boring location.
- Do not use depths for determinations of quantities or distances.

NOTES:

# SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
<p><b>COARSE GRAINED SOILS</b></p> <p>MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE</p>	<p><b>GRAVEL AND GRAVELLY SOILS</b></p>	<p>CLEAN GRAVELS</p> <p>(LITTLE OR NO FINES)</p>		<b>GW</b>	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		<b>GP</b>	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		<b>GM</b>	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
	<p><b>SAND AND SANDY SOILS</b></p>	<p>CLEAN SANDS</p> <p>(LITTLE OR NO FINES)</p>		<b>SW</b>	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				<b>SP</b>	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		<p>SANDS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		<b>SM</b>	SILTY SANDS, SAND - SILT MIXTURES
			<b>SC</b>	CLAYEY SANDS, SAND - CLAY MIXTURES	
	<p><b>FINE GRAINED SOILS</b></p> <p>MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE</p>	<p><b>SILTS AND CLAYS</b></p> <p>LIQUID LIMIT LESS THAN 50</p>		<b>ML</b>	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				<b>CL</b>	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			<b>OL</b>	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
<p><b>SILTS AND CLAYS</b></p> <p>LIQUID LIMIT GREATER THAN 50</p>			<b>MH</b>	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	
			<b>CH</b>	INORGANIC CLAYS OF HIGH PLASTICITY	
			<b>OH</b>	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
<p><b>HIGHLY ORGANIC SOILS</b></p>				<b>PT</b>	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SECTION 02200  
EARTHWORK

PART 1 - GENERAL

1.1 General:

A. This section includes the following work:

1. Clearing and Grubbing / Site Demolition

a. Clearing work covered under this Section consists of cutting, removing and properly disposing of trees, grass, undergrowth, and debris. Trees specifically identified during on-site pre-construction meeting with the Owner to be preserved shall be adequately delineated and flagged by Contractor such that balance of work may be performed in a safe and harmless manner in vicinity of preserved trees. Such tree preservation will be considered part of work and shall be in conformance with applicable local codes and regulations.

b. Grubbing work covered by this section consists of removing and properly disposing of all surface vegetation and debris. Usable topsoil shall be retained as described in this section. The top 6" of surface material (at a minimum) shall be removed during grubbing. Additionally, remove remaining material containing roots, root mat, and vegetation.

c. Site demolition shall also include removal and satisfactory disposal of crops, weeds and other annual growth; removal and satisfactory disposal of fences, steps, walls, chimneys, column footings, other footings, foundation slabs, basements, other foundation components, signs, junked vehicles, and other rubble and debris and filling of holes and depressions. This work shall also be performed in all site areas within construction limits as shown on drawings.

d. This work shall be completed sufficiently in advance of grading operations as may be necessary to prevent any of debris from these operations from interfering with excavation of embankment operations.

e. Remove and demolish materials in orderly and careful manner. Make no departures from the scope of work without prior written approval from the Architect. Repair or replace all demolition work performed in excess to that required for the new construction unless shown otherwise on the drawings, at no cost to the Owner. Repair or replacement shall match and equal original construction, condition, and finish.

B. Earthwork / Site Grading:

1. The extent of earthwork is shown on drawings, and includes preparation of subgrades for building pad, sidewalks, landscape areas, pavement subgrades, and placement of topsoil.

a. Grade sub-soil and form to grades, contours and levels.

b. Rough grade for roadways, walks, curbs, parking areas, landscaped areas, and storm water ponds.

c. Provide dust and erosion control (refer to Section 02530).

C. Excavation, Trenching, and Backfill for Utility Systems

1 Excavate, trench, and backfill as required for all underground utility systems, to include sanitary sewers, storm sewers, water piping, electrical service, and all other underground utilities.

1.2 Related Sections:

- A. Section 02120, Subsurface Investigation
- B. Section 02514, Concrete Paving, Walks, and Curbs
- C. Section 02530, Erosion and Sedimentation Control
- D. Section 02632, Storm Drainage
- E. Section 02700, Water Distribution System
- F. Section 02710, Site Sanitary Sewer Construction

1.3 Quality Assurance:

A. Regulatory Requirements: Comply with applicable requirements of federal, state, and local laws, regulations and codes having jurisdiction at project site.

1. The Contractor shall secure all necessary permits and pay all applicable fees prior to commencing the work in this section.

B. The Contractor shall comply with all pertinent provisions of the Manual of Accident Prevention in Construction issued by the Association of Contractors of America, Inc., and the Safety and Health Regulations of Construction issued by the U.S. Dept. of Labor. Refer also to Section, Special Conditions.

C. The Contractor shall read and comply with the recommendations of the geotechnical report for the project (see Section 02120).

D. Soil tests, field density tests and testing of footing subgrades and observation and report of pre-densification shall be made by a materials testing laboratory/Geotechnical Engineer approved by the Owner and paid for by the Owner.

1.4 References:

A. American Society for Testing and Materials (ASTM):

1. ASTM D1557 – Test Methods for Moisture – Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 kg) Rammer and 18" (457mm) Drop.

2. ASTM D698 – Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 5.5 lb. (2.49 kg) Rammer and 12" (304.8mm) Drop.

B. American Association of State Highway and Transportation Officials (AASHTO):

1. M145 – The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

1.5 Job Conditions:

A. Verify existing site conditions prior to commencing operations. Locate all existing site utilities.

1. Examine areas for conditions under which work is to be performed. Report in writing to Architect all conditions contrary to those shown on the drawings or specified herein and all other conditions that will affect satisfactory execution of work such as improperly constructed substrates or adjoining work. Do not proceed with work until unsatisfactory conditions have been corrected.

2. Prior to starting construction the General Contractor shall be responsible for verifying that all required permits and approvals have been obtained. No construction or fabrication of any item shall begin until the Contractor has received all plans and any other documentation from all of the permitting agencies and other regulatory authority.

3. Starting work constitutes acceptance of the conditions under which work is to be performed. After such acceptance this Contractor shall at his expense, be responsible for correcting all unsatisfactory and defective work resulting from such unsatisfactory conditions.

B. Location and Protection of Utilities and Structures:

1. It shall be the responsibility of the contractor to acquaint himself with the location of all utilities and structures both present and proposed, also all existing surface structures which may be affected by work under the Contract. The location of any underground structures furnished, shown on the drawings or given on the site are based upon the available records but are not guaranteed to be complete or correct, and are given only to assist the Contractor in making a determination of the existence of underground structures.

2. Overhead utilities, poles, etc., shall be protected against damage by the Contractor, and if damaged by the Contractor, shall be replaced by him. The Contractor shall notify those who maintain utilities sufficiently in advance of the proposed construction so that they may locate, uncover and disclose such work. If the progress of construction necessitates the removal or relocation of poles, overhead utilities and obstructions, the Contractor shall make all arrangements and assume all costs of the work.

3. The Contractor shall provide for the continuance of the flow of any sewers, drains, water pipes, water courses, etc. Where such facilities, water courses, or electric overhead wires or conduits are interfered with by the work of the Contractor, the interruption shall be a minimum and shall be scheduled in advance with the utility owner.

4. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

5. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, except when permitted in writing by the Utility Owner and then only after acceptable temporary utility services have been provided.

6. The Contractor shall restore all facilities interfered with to the original condition or acceptable alternate approved by the Utility Owner. The cost of such restoration of services shall be the responsibility of the Contractor.

C. Protection of Persons and Property: Barricade open excavations occurring as part of this work, post with warning lights, and take other safety precautions as necessary.

1. Operate warning lights as recommended by authorities having jurisdiction.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
3. Contractor is responsible for any damage caused by his work on this project, including damage caused by his subcontractors.
4. The Contractor shall install and maintain for the duration of the project all necessary barricades and traffic control devices for the protection and safety of the public.
5. Install temporary barriers, fences, guard rails, enclosures, shoring, bracing, planking, barricades, lights, warning signs and other protections required to protect structures, utilities, landscaping, and other items that are to remain in place.
6. Protect trees, shrubs and lawns, and other features remaining as part of final landscaping.
7. Protect benchmarks and existing structure, fences, roads, underground utilities, and paving against damage from equipment and vehicular traffic.

D. Nuisances: Keep dirt, dust, noise and other objectionable nuisances to a minimum. Use temporary enclosures, coverings and sprinkling, or combinations thereof, as necessary to limit dust to lowest practicable level, except do not use water to the extent that it causes flooding, contaminated runoff, or icing.

E. Traffic: Conduct work to ensure minimum interference with streets, driveways, sidewalks, and access to operations of on-site facilities.

1. Do not close or obstruct streets, sidewalks, drives or other public passageways without permission.

F. Erosion Control: As detailed on the drawings and as specified in Section 02530.

1. Maintain erosion and dust control throughout the duration of the contract.

## PART 2 – PRODUCTS

### 2.1 Satisfactory Soil Materials:

A. Satisfactory soil materials for fill material shall be limited to soils specified in Section 02120.

- 1 Contractor shall be responsible for all testing including testing of borrow materials to determine suitability for use as fill materials.

2. Backfill and Fill Materials: Satisfactory soil materials described above free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter, and building debris consisting of sand, silty sand and clayey sand with less than 20% by dry weight passing the U.S. Standard No. 200 sieve.

3. Additional fill material shall be as specified in Section 02120, and as approved by the Geotechnical Engineer.

B. Topsoil shall be considered to mean original surface soil, typical of area, which is capable of supporting native plant growth, and shall be free of large stones, roots, brush, waste construction debris and other undesirable material or contamination.

### PART 3 – EXECUTION

#### 3.1 Clearing and Grubbing / Site Demolition:

A. Clearing and grubbing/site demolition shall be performed in areas as called for on drawings, the limits of which shall coincide with construction limits and in general shall extend 5' beyond top of cut or toe of fill. Grubbing shall be performed on all cleared excavation and embankment areas and shall include complete removal of all stumps, roots, and embedded debris.

B. Contractor shall perform all clearing and grubbing operations before construction operations begin.

C. Where adjacent areas within site but outside limits of construction are disturbed as a result of clearing and grubbing activities. Contractor shall remove all debris, re-establish original grades, and restore areas to a condition equal to or better than that existing prior to disturbance.

D. Contractor shall exercise caution to protect and maintain all existing utilities and underground works which are to remain. Any existing utilities or underground works which are to remain that are disturbed during construction shall be repaired or replaced at Contractor's expense.

E. Contractor must comply with all local, state, and federal laws and ordinances and regulations in removal and disposal of clearing and grubbing of all vegetation, timber, waste, and all surface debris that must be hauled from the project site. No burning or burying of materials will be allowed on site. Contractor shall properly dispose of all cleared materials at his expense, in conformance with all applicable local and state laws and ordinances, with exception of any materials to be reused or recycled if directed elsewhere in this contract.

F. Remove following from locations to extent shown on drawings:

1. Concrete: Saw cut to neat line, as required to separate from existing shown to remain. Remove all existing where noted.

2. Existing vegetation as required for new construction.

G. Backfill and compact areas excavated, open pits and holes resulting from demolition operations. Comply with requirements for backfill materials, compaction, and installation methods as specified herein.

H. Rough grade demolition areas to meet adjacent contours and to provide positive drainage. Leave site in clean condition acceptable for performance of subsequent construction operations.

I. Follow recommendation of the Subsurface Exploration and Geotechnical Engineering Evaluation (Section 02120) for stripping and stockpiling of topsoil for re-use on-site.

1. Stripping and Storage of Topsoil:

a. Stands of weeds and grasses shall be removed prior to stripping operations.

b. All topsoil suitable for reuse shall be stripped to its full depth. All topsoil to be reused shall be free of large stones, roots, brush waste construction materials and other undesirable matter.

c. Topsoil shall be kept separate from other excavated materials and stored in stockpiles, location of which shall be as direct by the Owner. Topsoil shall be stockpiled so that it shall not be subject to abnormal erosion and loss, and so that it does not impede flow of drainage runoff. Stockpiled soil shall be protected on its downstream side with a single row of silt fence.

d. Any excess topsoil shall be disposed of off-site at the Contractor's expense.

3.2 Earthwork / Site Grading:

A. Excavation: Consists of removal and disposal of material encountered when establishing required sub-grade elevations and invert elevations for utility trenches.

1. Earthwork excavation includes removal and disposal of material of any classification and other materials encountered that are not classified as unauthorized excavation or rock excavation.

2. Unauthorized excavation consists of removal of material beyond indicated subgrade elevations or dimensions without specific direction of the Geotechnical Engineer. Unauthorized excavation, as well as remedial work directed by the Geotechnical Engineer, shall be at Contractor's expense.

3. Rock excavation includes removal and disposal of materials classified as rock that are encountered when establishing required finish grades, subgrades elevations or invert elevations. Removal of materials classified as rock excavation, if encountered, will be paid for on basis of contract conditions relative to changes in work.

4. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the Geotechnical Engineer.

B. Additional Excavation:

1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by the Geotechnical Engineer.

2. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

C. Stability of Excavations: Slope sides of excavations shall comply with applicable codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

1. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

D. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good, serviceable condition.

1. Establish requirements for trench shoring and bracing to comply with applicable codes and authorities having jurisdiction.

2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

E. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

2. Convey water removed from excavations and rain water to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches. Do not permit construction drainage onto adjacent property.

F. Material Storage: Stockpile satisfactory excavated materials where directed, for backfill or fill. Place, grade, and shape stockpiles for proper drainage. Soil stockpiles shall be surrounded with a single row of silt fence.

1. Locate and retain soil materials away from edge of excavations.
2. Dispose of excess soil material and waste materials as herein specified.

G. Excavation for Structures and Pavements: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending 10 feet from foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. Contractor shall grade the buildings subgrades to allow for the required concrete slabs. Depth of subgrade below finished contours and elevations shall be as indicated in the Architectural Drawings. Refer to drawings and Section 02514 for concrete paving subgrade depths.

H. Pre-Densification and Proofrolling:

1. At completion of clearing, grubbing and stripping of topsoil, stump holes or other depressions shall be cleared of loose material and debris and shall then be backfilled with approved fill as necessary to achieve specified subgrades. The backfill shall be placed in eight-inch thick loose lifts and compacted to 95% density in accordance with ASTM D698.

2. Each building pad and all paving subgrade areas shall be compacted and pre-densified as recommended by the Geotechnical Engineer. All areas that are unstable under the compaction equipment shall be undercut to firm soil and replaced with clean fill compacted as specified in eight-inch loose lifts. Pre-densification shall be observed by the Geotechnical Engineer. Pre-densification shall be accomplished with a fully loaded dump truck (20 ton min.) or other rubber tired equipment. Over lapping passes of the vehicle shall be made across the site in one direction, and then at right angles to the original direction.

I. Compaction:

1. Control soil compaction during construction providing the percentage of density specified for each area classification.

2. Compact soil to not less than the following percentages of maximum dry density for soils which exhibit a well-defined moisture density relationship determined in accordance with ASTM standards; and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship.

a. Building Pads and Utility Trenches Outside of Pavement Subgrades: Compact to at least 95 percent of the maximum dry density. (ASTM D698).

b. Pavement Subgrade and Utility Trenches within Pavement Subgrades: Compact to at least 95 percent of the maximum dry density (Modified Proctor – ASTM D1557).

c. Pavement Graded Aggregate Base Courses: Compact to at least 100 percent of the maximum dry density (Modified Proctor – ASTM 1557).

d. Landscape Areas: Compact to at least 95 percent of the maximum dry density (ASTM D-698).

J. Backfill and Fill:

1. General: Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

a. In excavations, use satisfactory excavated or borrow material.

b. Under grassed areas, use satisfactory excavated or borrow material.

c. Under walks and pavements, use subbase material, or satisfactory excavated or borrow material, or combination of both.

2. Backfill excavations as promptly as work permits, but not until completion of the following:

a. Removal of concrete formwork.

b. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.

c. Removal of trash and debris.

K. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

1. When existing ground surface has a density less than the specified compaction for particular area classifications, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

L. Placement and Compaction: Place backfill and materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment and not more than 4" in loose depth for material compacted by hand operated tampers.

a. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

b. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying material uniformly around structure to approximately same elevation in each lift.

M. Grading:

1. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades. Grade areas adjacent to pavement to slope as indicated on the drawings and to prevent ponding of water in paved areas. Backfill against curbs and pavement edges flush to provide a smooth finish in areas to be grassed.

a. Establish and identify required lines, levels, contours, and datum.

b. Maintain benchmarks, monuments, and other reference points. Re-establish if disturbed or destroyed, at no cost to the Owner.

c. Before start of grading, notify all pertinent utility companies 48 hours prior to digging for location of underground utility lines. Establish the location and extent of utilities in the work areas.

d. Perform grading within contract limits, including adjacent transition areas to new elevations, levels, profiles, and contours indicated. Provide subgrade surfaces parallel to finished surface grades. Provide uniform levels and slopes between new elevations and existing grades.

e. Grade surfaces to assure areas drain away from structures and to prevent ponding and pockets of surface drainage. Provide subgrade surfaces free from irregular surface changes.

f. Perform grading within branch spread of existing trees to remain by hand methods to elevations indicated. Cut roots if necessary with an axe, and coat cut roots with tree paint.

g. Grade at excavations to prevent storm-water from draining into excavated areas.

2. Rough Grading:

- a. Sodded areas - 4" min. below finished grade elevations.
- b. Paved areas – To below base material.
- c. Shrub beds - 4" min. below finished grade elevations.
- d. Concrete sidewalks - 8" min. below finished grade elevations.

3. Prior to placing fill material over undisturbed subsoil, scarify surface to depth of 6".

4. Proof roll the underlying natural sub-grade layer beneath paved areas plus 5' beyond with a minimum of ten (10) passes of a heavy vibratory roller.

5. Dewatering may be required for some excavations. Dewatering shall be designed and operated to lower the ground water table to a depth of approximately 2' below the bottom of compaction surfaces. Dewatering discharges shall be directed to temporary sediment traps.

6. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Grade as per details on the Drawings.

a. Finish surfaces free from irregular surface changes, and as follows:

1) Lawn Areas: Finish areas to receive topsoil to within not more than 0.10' above or below required elevations. Areas shall be free of stones, pebbles, etc., 3/4" and larger. Finish grading of lawns and other areas to be grassed shall be fine graded using hand rakes and small rubber-tired tractors with box blades. Fine graded areas shall be pulverized with a Gill Pulverizer or equal equipment.

2) Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2" above or below required subgrade elevation.

b. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2" when tested with a 10' straightedge. Extend fill beyond perimeter of footings a minimum of 5 feet.

c. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

N. Field Quality Control:

1. Allow Geotechnical Engineer to inspect and approve subgrades and fill layers before further construction work is performed. The Geotechnical Engineer shall observe the pre-densification of the building pads and pavement subgrade areas. Submit one copy of results of all Compaction Test and observations of pre-densification to the Owner and Architect.

a. Perform field density tests in accordance with ASTM D 2937 (drive cylinder method), ASTM D 2167 (rubber balloon method), as applicable, or nuclear method ASTM D 2922.

b. Building Subgrade Areas: Geotechnical Engineer shall have a qualified representative on site on a full-time basis during subgrade evaluation and fill placement for all building subgrade areas. Make at least one field density test for each 12" layer of subgrade for every 2,500 sq. ft. of subgrade area.

c. Pavement Subgrade Areas: Make at least one field density test for each 12" layer of subgrade for every 5,000 sq. ft. of pavement subgrade area.

d. Footings Subgrades: All footing subgrades shall be examined by the Geotechnical Engineer immediately prior to placement of reinforcing steel. Auger and penetrometer testing, augmented by hand probing, shall be performed on all footings in accordance with the following:

2. Auger and penetrometer testing: One test for each 25 lineal feet of footing subgrade.

3. Probe rod testing: One test for each spread footing and one test for each 10 lineal feet of continuous footing.

4. Landscape Areas: Make at least one field density test for each layer of subgrade for every 5,000 sq. ft. of landscape areas.

5. If in opinion of the Geotechnical Engineer, based on testing reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction as required and re-testing at no additional expense.

O. Maintenance:

1. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

a. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

2. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

P. Insufficient Fill Material: The Contractor shall be responsible for locating, testing, purchasing, hauling, spreading, and compacting all required fill material as specified herein.

Q. Excess Cut Material: If the quantity of onsite excavated material, is in excess of the quantities necessary to provide finish grade elevations indicated on the drawings, the excess material shall be disposed off-site by the Contractor at no additional cost to the Owner.

### 3.3 Excavation, Trenching, and Backfilling for Utility Systems:

A. Excavate all materials encountered as necessary for installation of underground utility systems.

1. Underground piping and utility systems which are to be installed in trenches whose lowest point of excavation is below the existing ground level, and are unaffected by an excavation for structures, may be installed at any time during the course of the work. Piping and systems to be installed in or over fill, backfill or new embankments shall not be installed until all earthwork has been completed to rough grade, nor until settlement of the fill or embankment has taken place.

2. Braced and sheeted trenches and open trenches shall comply with all applicable laws and regulations, and ordinances relating to safety, life, health and property.

3. The sides and bottoms of the trenches shall be protected against any instability which may interfere with the proper laying of the pipe and as necessary for the safety of the workmen and others and as may be necessary to protect adjacent structures. Refer to safety requirements of the General Conditions and Special Conditions.

B. Caution in Excavation: The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures and existing utilities in the trench zone may be determined before being damaged. He shall be held responsible for the repair or replacement of such structures when broken or otherwise damaged because of his or his subcontractor's operations.

C. Subsurface Explorations: The Contractor shall make explorations and excavations at no additional charge to the Owner to determine the location of existing underground structures.

D. Depth of Trench: Utilities and other piping shall be laid in open trenches as shown and specified. Trenches shall be excavated to the designated lines and grades, beginning at the outlet end and progressing toward the upper end in each case. Trenches for pipe shall be shaped to the lower 1/3 of the pipe and provide uniform and continuous bearing. Bell holes shall be dug to allow ample room for working fully around each joint.

E. Width of Trench: Trenches shall be of minimum width to provide ample working space for making joints and tamping backfill. Width on each side of barrel of pipe shall be not less than 8 inches or more than 12 inches. Sides of trenches shall be closely vertical to 12" above top of pipe and shall be sheet piled and braced where soil is of unstable nature. Above the top of the pipe, trenches may be sloped. The width of the trench above this level may be wider for sheeting and bracing and the performance of the work.

F. Alignment and Grade: Trenches shall be excavated on the alignments shown on the drawings, and to the depth and grade necessary to accommodate the pipes at the elevations shown. Where elevations of the invert or centerline of a pipe are shown at the ends of a pipe, the pipe shall be installed at a continuous grade between the two elevations.

G. Overexcavation:

1. Excavation in excess of the depth required for proper shaping shall be corrected by bringing to grade the invert of the ditch with compacted coarse, granular material at no additional expense to the Owner. Bell holes shall be excavated to relieve bells of all loads, but shall be small enough to insure that support is provided throughout the length of the pipe barrel.

2. Excavation in excess of the depths required for manholes and other structures shall be corrected by placing a subfoundation of 2000 psi concrete, at no additional expense to the Owner.

3. If trenches are excavated to widths in excess of those specified, or if the trench walls collapse, the pipe shall be laid in accordance with the next better class of bedding at the expense of the Contractor.

H. Solid Rock Excavation: Solid rock excavation or blast rock for trench excavation (if needed) shall be defined as any material which cannot be excavated with a backhoe having a bucket curling force rated of not less than 25,700 lb. (Caterpillar model 25 or equivalent) and occupying an original volume of at least 1/2 cubic yard.

I. Trenches:

1. Trenches shall be maintained in a safe condition to prevent hazardous conditions to persons working in or around the trench.

2. Braced and sheeted trenches and open trenches shall comply with all state and federal laws and regulations, and local ordinances relating to safety, life, health and property.

3. The top portion of the trench may be excavated with sloping or vertical sides to any width which will not cause damage to adjoining structures, roadways, utilities, etc. The bottom of the trenches shall be graded to provide uniform bearing and support each section of the pipe of undisturbed soil at every point along its entire length, except for the portions of the pipe sections excavated for bell holes and for the sealing of pipe joints. Bell holes and depressions for joints shall be dug after the trench bottom has been graded and in order that the pipe rests upon the trench bottom for its full length and shall be only of such length, depth and width for making the particular type of joints. The bottom of the trench shall be rounded so that at least the bottom one-third of the pipe shall rest on undisturbed earth for the full length of the barrel as jointing operations will permit. This part of the excavation shall be done manually only a few feet in advance of the pipe laying by workmen skilled in this type of work.

4. The sides of all trenches and excavation for structures shall be held by stay bracing, or by skeleton or solid sheeting and bracing according to conditions encountered, to protect the excavation, adjoining property and for the safety of personnel. Bracing and shoring may be removed when the level of the backfilling has reached the elevation to protect the pipe work and adjacent property. When sheeting or shoring above this level cannot be safely removed, it may be left in place. Timber left in place shall be cut off at least 2 feet below the surface. No sheeting below the level of the top of the pipe may be removed.

J. Dewatering and Protection Against Water:

1. The Contractor shall remove water from the site and shall lower the ground water level as necessary to complete the excavations to the required depths and so that all required work can be accomplished in the dry. The Contractor shall do such well construction, well pointing, sheeting, ditching, and pumping, and shall construct necessary drains, channels and sumps to keep his excavations and new structures clear of ground water, storm water or sewage and to keep his construction areas dry during the progress of the Work.

2. Adequate measures and protection shall be provided by the Contractor to protect his work from damage from uplift due to ground water, storm water, or flood water. Any damages which may result shall be the Contractor's responsibility. The Contractor shall accept all responsibility for damage to the work of this Contract because of floods and water pressures and other water damages and shall accept all risks of floods and other events which may occur.

3. All water discharged by pumping operations shall be discharged so as not to interfere with work under this Contract or with existing structures and operations. Water from dewatering operations shall be conveyed to the existing drainage features, using piping and pumping facilities provided by the Contractor. Discharge facilities and water quality shall comply with applicable regulations of state and federal agencies.

4. Dewatering operations shall be uninterrupted and continuous during the course of the work so as not to endanger any construction in place or to present a hazard to workmen in and around the site. The Contractor shall take all measures necessary including, but not limited to, standby equipment and constant attendance to insure that the dewatering system remains operational and effective throughout the period of time that it is required.

5. No water from dewatering operations shall be allowed to run over any uncompleted portions of the work. No work shall be constructed under water. The cost of dewatering shall be included in the price bid for the item of work for which it is required.

K. Piling Excavated Materials:

1. All excavated material shall be piled in a manner that will not endanger the work, avoid obstructing roadways, and be properly protected from erosion.

L. Limit to Length of Open Trench:

1. The routine of operation shall be so organized to keep the length of open trench to a practicable minimum.

M. Removal of Unsuitable Material:

1. Should overdepth excavation be necessary to remove unsuitable material and to replace with satisfactory material, the Contractor will be paid for this work based on the following requirements:

a. Unsuitable materials for filling and backfilling are defined in Section 02120. Excavated soils that are too wet to compact shall not be classified unsuitable due to high moisture content alone.

b. When the trench is excavated to the plan depth or as required by these Specifications, and soft or other material not suitable for bedding purposes is encountered in the trench, the Contractor shall immediately notify the Geotechnical Engineer for inspection and measurement of the unsuitable material to be removed.

c. No overdepth excavation or backfilling of the overdepth excavated trench shall start until proper measurements of the trench have been taken by the Geotechnical Engineer for the determination of the quantity in cubic yards of unsuitable material excavated. Backfill material and backfilling shall be as specified herein.

d. No payment will be made for any overdepth excavation of soft unsuitable material due to the failure of the Contractor to provide adequate means to keep the trench dry.

e. No payment will be made for any overdepth excavation of the unsuitable material and replacement not inspected and measured by the Geotechnical Engineer prior to excavation.

N. Bedding of Concrete, Ductile Iron, or Steel Pipe:

1. Pipe shall be laid on foundations prepared in accordance with ASTM C12 as modified herein, and in accordance with the various classes of bedding required by the trench width and trench depth for the size of pipe to be laid. Bedding shall be included in the appropriate unit price bid for clay, concrete, ductile iron or steel pipe.

a. Class "A" Bedding: Class "A" Bedding shall be achieved as follows:

1) The pipe shall be bedded in a monolithic cradle of plain or reinforced concrete having a minimum thickness under the pipe barrel of one-fourth the inside diameter of the pipe but in no case less than 4 inches and extending up the sides to a height of at least one-fourth of the pipe outside diameter. The cradle shall have a width equal to the full width of the trench as excavated. The pipe shall be laid to line and grade on concrete blocking after which the concrete shall be placed to the limits described. Concrete shall be 3,000 psi concrete.

b. Class "B" Bedding: Class "B" Bedding shall be achieved as follows:

1) The pipe shall be bedded in compacted granular material placed on a flat trench bottom. The crushed stone bedding shall have a minimum thickness of 6" below bottom of pipe and shall extend halfway up the pipe barrel at the sides. The remainder of the side fills and a minimum depth of 12 inches over the top of the pipe shall be filled with carefully compacted material. Where the Geotechnical Engineer directs the use of crushed stone bedding, the bedding shall be Class "B" bedding.

c. Class "C" Bedding: Class "C" Bedding shall be achieved as follows:

1) The pipe shall be bedded in compacted granular material placed on a flat trench bottom. The granular bedding shall have a minimum thickness of 6 inches under the barrel and shall extend 1/6 of the outside diameter up the pipe barrel at the sides. The remainder of the side fills and to a minimum depth of 12 inches over the top of the pipe shall be filled with compacted backfill. Class "C" Bedding shall be used except where the Geotechnical Engineer directs the use of crushed stone bedding.

d. Class "D" Bedding: Class "D" Bedding is achieved by shaping bell holes only on a flat trench and no care is taken to secure compaction at the sides and immediately over the pipe. This type bedding is not permitted.

e. Bell Holes: Bell holes shall be provided in all classes of bedding to relieve pipe bells of all load, but shall be small enough to insure that support is provided throughout the length of the pipe barrel.

f. Coarse Granular Bedding: Coarse Granular Bedding material shall consist of crushed stone or pea gravel, clean and graded, 95 to 100 percent of which shall pass a 3/4 inch sieve with 95 to 100 percent retained on a No. 4 sieve. Bedding material shall be placed on a flat bottom trench and thoroughly compacted by tamping or slicing with a flat blade shovel. Compacted bedding material shall be extended up the sides of the pipe to the heights shown for the various classes of bedding.

g. Overwidth Excavation: If trenches are excavated to widths in excess of those specified below, or if trench walls collapse, pipe shall be laid in accordance with the requirements for at least the next better class of bedding at the expense of the Contractor.

h. Borrow Backfill: Borrow backfill will be required if there is not sufficient suitable material available from other parts of the work to backfill the trenches. Borrow backfill from approved borrow pits shall be used. Only those soils in the borrow pits that meet the specified requirements for suitable material shall be used.

i. Trench Widths: Trench widths at the top of the pipe and depths for clay, concrete, and metal pipes using the various bedding classes, shall not exceed those shown below:

Ductile Iron, Concrete, or Steel Pipe

Pipe Size	Maximum Trench Width	MAXIMUM TRENCH DEPTH			
		Class D Bedding	Class C Bedding	Class B Bedding	Class A Bedding
6"	2'-6"	0	14'	20'	30'
8"	2'-6"	0	14'	20'	30'
10"	2'-6"	0	14'	22'	30'
12"	2'-8"	0	14'	22'	30'
15"	3'-0"	0	14'	22'	30'
21"	3'-6"	0	14'	22'	30'
24"	4'-0"	0	14'	22'	30'

O. Bedding of PVC Pipe:

1. Pipe shall be bedded true to line and grade with uniform and continuous support from a firm base in accordance with ASTM D2321 as modified herein. Blocking shall not be used to bring the pipe to grade. Bedding material shall be included in the unit price for plastic and FRP pipes.

2. Embedment materials listed here include a number of processed materials plus the soil types defined by the USCS Soil Classification Systems in ASTM D2487. These materials are grouped into categories according to their suitability for this application:

a. Class I: Angular 6 to 40 mm (1/4 to 1-1/2 inches), graded stone including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

b. Class II: Coarse sands and gravels with maximum particle size of 40 mm (1-1/2 inches), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW and SP are included in this class.

c. Class III: Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil types GM, GC, SM and SC are included in this class.

d. Class IV: Silt, silty clays and clays including inorganic clays and silts of medium to high plasticity and liquid limits. Soil types MH, ML, CH and CL are included in this class. These materials are not to be used for bedding, haunching or initial backfill.

e. Class V: This class includes the organic soils OL, OH and PT as well as soils containing frozen earth, debris, rocks larger than 40 mm (1-1/2 inches) in diameter, and other foreign materials. These materials shall not be used for bedding, haunching and initial backfill.

3. Compaction of foundation, bedding, haunching and initial backfill shall extend to the trench wall.

4. Embedment material in the area around the pipe shall be installed with care. Care shall be used to insure that sufficient material has been worked under the haunch of the pipe to provide adequate side support. Precautions must be taken to prevent movement of the pipe during placing of the material through the pipe haunch. Place initial backfill material in three stages: First, to the center line of the pipe; second, to the top of the pipe, and third, to a point 12 inches above the top of the pipe. Compact each stage of haunching and initial backfill by hand or mechanical tamping to a minimum of 90 percent Standard Proctor Density. Where unstable trench walls exist because of migratory materials such as waterbearing silts or fine sands, care shall be taken to prevent the loss of side support through the migratory action.

5. Avoid contact between the pipe and compaction equipment. Compaction of haunching, initial backfill and backfill material shall be done in such a way so that compaction equipment will not have a damaging effect on the pipe.

6. Trench depths, using the various bedding classes, shall not exceed those shown below:

MAXIMUM TRENCH DEPTH

Pipe Size	Class IV Bedding	Class III Bedding	Class I or Class II Bedding
All Sizes	Not to be used	16'	30'

a. Density (Standard Proctor) of 95 percent minimum in pipe zone.

7. ASTM D2321 "Underground Installation of Flexible Thermoplastic Sewer Pipe" shall be used in conjunction with the above.

P. Backfilling:

1. Backfilling consists of placing suitable materials removed during the excavation into the excavated areas, placing embedment materials and compacting the same to a density equal to or greater than what exists before excavation or as specified herein.

2. Backfilling operations also include removal of excess materials and debris from the site, leveling all depressions caused by operation of equipment and maintaining the backfilled areas until accepted by the Owner.

3. All backfill material shall be free of stones, concrete and clay lumps larger than 1/3 cubic foot. Roots, stumps and rubbish which will decompose will not be permitted in the backfill. Backfill material shall have its moisture content corrected, as may be necessary before being placed in the trench to bring the moisture content to approximately "optimum" for good compaction. Any rock, stone, concrete, clay lumps larger than 1/3 cubic foot in volume, rubbish and debris shall be removed from the site and disposed of by the Contractor in a lawful manner.

4. Backfilling operations in this work are referred to herein as Backfilling at the Pipe Zone, Type "A" and Type "B".

5. Backfilling in the excavated areas below parts of proposed structures shall be referred to hereinafter as Type "A" Backfilling.

6. Where trenches cross or extend under structures or into present roadways, future roadways or parking areas as shown on the Plans, the backfilling shall be referred to hereinafter as Type "A" Backfilling.

7. Backfilling in all other areas shall be referred to hereinafter as Type "B" Backfilling.

8. Backfilling at the Pipe Zone.

a. Throughout the entire construction, backfilling at the pipe zone shall include bedding and shall be as follows: Backfill material shall be placed below, around each side, and over the top of the pipe, in approximately horizontal layers to a height of 12 inches over the top of the pipe. Layers shall be of such thickness to facilitate the required compaction. This backfill shall be well compacted by using mechanical tamping equipment in such manner as not to damage the pipe, pipe joints or shift the pipe alignment. Workmen shall not be permitted to walk over the pipe until at least 12 inches of compacted fill has been placed over the pipe. The Contractor shall not use water to obtain compaction except for adding water to the backfill material before placing in the trench to bring the moisture content to approximately "optimum" for good compaction.

9. Type "A" Backfilling.

a. Type "A" Backfilling consists of placing sand and gravel or other suitable materials excavated from the trench in the trench in 6 inch thick layers from a point 12 inches above the top of the pipe and mechanically tamped or compacted by rolling until the backfill density after compaction is equal to 98 percent of the maximum density obtainable at optimum moisture content as determined by the Standard Proctor Test (ASTM D698). No water shall be used to secure compaction except for adding water to the backfill material before placing in the trench to bring moisture content to approximately "optimum" for good compaction. Each 6 inch thick layer shall be mechanically tamped before additional backfill material is placed in the excavated area.

10. Type "B" Backfilling.

a. Type "B" Backfilling consists of placing sand and gravel or other suitable material excavated from the trench in the trench in 12 inch thick compacted layers from a point 12 inches above the top of the pipe. Each 12 inch thick layer shall be compacted before additional backfill material is placed in the excavation. Only mechanical tamping, use of roller or small tractor will be allowed. The density of the backfilled material after compaction shall be equal to 95 percent of the maximum density obtainable at optimum moisture content as determined by the Standard Proctor Test (ASTM D698). Except in the upper 12 inches, water shall be added to backfill material only before being placed in the trench in order to bring the moisture content to approximately "optimum" for good compaction.

Q. Protection of Water Supply Pipes:

1. Horizontal Separation: Sewers and force mains shall be laid at least 10 feet horizontally from any existing or proposed watermain. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, such deviation may allow installation of the sewer or force main closer to a watermain, provided that the watermain is in a separate trench or on an undisturbed earth shelf located on the side of the sewer or force main and at an elevation so the bottom of the watermain is at least 18 inches above the top of the sewer or force main.

2. Crossings: Sewers and force mains crossing watermains shall be laid to provide a minimum vertical distance of 18 inches between the outside of the watermain and the outside of the sewer or force main. This shall be the case where the watermain is either above or below the sewer or force main. The crossing shall be arranged so that the sewer or force main joints will be equidistant and as far as possible from the watermain joints. Where a watermain crosses under a sewer or force main, adequate structural support shall be provided for the sewer or force main to prevent damage to the watermain.

3. Special Conditions: When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the sewer or force main shall be constructed equal to water pipe and in accordance with local standards, and shall be pressure tested to assure watertightness prior to backfilling.

R. Utility Construction in Other Excavation:

1. Where utilities are required to be constructed in areas also requiring excavation and backfill for other work, coordinate the scheduling of the work to eliminate the risk of any damage from other operations. Place bedding which will form bearing for pipes, using suitable material and shaping to the lower 1/3 of the pipe to provide uniform and continuous bearing. Compaction of backfill material which will form bearing shall be equal to that specified hereinbefore under Type "A" Backfilling. After the pipe or other utility is placed, backfilling shall proceed as specified hereinbefore following the requirements specified under "Backfilling at the Pipe Zone, " Type 'A' Backfilling", and "Type 'B' Backfilling" as applicable.

S. Testing:

1. General: The Owner shall select a qualified independent testing laboratory/Geotechnical Engineer for the purpose of identifying soils, checking densities, and classifying soils materials during construction and shall pay all costs for testing services. All reports shall be promptly filed with the Owner and Architect as soon as possible upon completion of required tests.

2. Moisture-Density Tests: Testing shall be in accordance with ASTM Methods D698 and D1557. A test shall be performed on each type of material used in the work regardless of source. Tests will be accompanied by particle-size analyses of the soils tested (ASTM Methods D421 and D422). Changes in color, gradation, plasticity or source of fill material will require the performance of additional tests.

3. Field Density Tests:

a. Tests shall be made in accordance with ASTM Method D1556. Tests shall be made in accordance with the following minimum schedule or as required by the Geotechnical Engineer.

1) One test for each lift of backfill for each 200 feet of trench or fraction thereof.

4. Submittals:

a. The Geotechnical Engineer will submit written reports of all compaction tests and retests.

b. This report information is to include but not be limited to the following:

- 1) Date of the test and date submitted.
- 2) Location of test.
- 3) Wet weight, moisture content and dry weight of field sample.
- 4) Description of soil.
- 5) Maximum dry density and moisture content of the lab sample which best matches the field sample in color, texture, grain size and maximum dry density.
- 6) Ratio of field dry density to maximum lab dry density expressed as a percentage.
- 7) Comments concerning the field density passing or failing the specified compaction.
- 8) Comments about recompaction if required.

5. Compaction Results.

a. If any compaction test reveals that fill or backfill is not compacted as specified, the Contractor shall scarify and recompact as required to achieve the specified density. Additional compaction tests shall be made to verify proper compaction. These additional tests, required due to failure of the original test, shall be paid for by the Contractor.

b. The Geotechnical Engineer shall notify the Architect and advise the Contractor immediately of any compaction tests failing to meet the specified minimum requirements. No additional lift is to be placed on a lift with any portion failing.

T. Construction along Highways, Streets and Roadways:

1. Excavation, Trenching and Backfilling Operations: Excavation, trenching and backfilling along highways, streets and roadways shall be in accordance with the applicable regulations of the governing jurisdiction with reference to construction operations, safety, traffic control, road maintenance and repair.

2. Protection of Traffic: Provide suitable signs, barricades and lights for protection of traffic, in locations where traffic may be endangered by construction operations. All signs removed by reason of construction shall be replaced as soon as condition which necessitated such removal has been cleared. No highway, street or roadway shall be closed without first obtaining permission from the proper authorities.

3. Construction Operations: The Contractor shall construct all work along highways, streets and roadways using the following sequence of construction operations, so as to least interfere with traffic:

a. Stripping: Where the pipe line is laid along road shoulders, sod, topsoil, and other material suitable for shoulder restoration shall be stripped and stockpiled for replacement.

b. Trenching, Laying and Backfilling: Excavate trenches, install pipe line and backfill. The trench shall not be opened any further ahead of pipe laying operations than is necessary for proper laying operations. Trenches shall be progressively backfilled and consolidated and excess material removed immediately.

c. Shaping: Immediately after completing backfilling operations, re-shape any damage to cut and fill slopes, side ditch lines, and replace topsoil, sod, and any other materials removed from shoulders.

4. Excavated Material: Excavated material shall not be placed along highways, streets, and roadways in such manner as to obstruct traffic. Roadways and pavement will be maintained free of earth material and debris.

5. Drainage Structures: All side ditches, culverts, cross drains, and other drainage structures shall be kept clear of excavated material and be free to drain at all times.

6. Maintaining Highways, Street, Roadways and Driveways:

a. The Contractor shall furnish a road grader which shall be available for use at all times for maintaining highways, streets, and roadways which shall be maintained in suitable condition until completion and final acceptance of the work.

b. Repair all driveways that are cut or damaged. Maintain them in suitable condition until completion and final acceptance of the work.

U. Removing and Resetting Fences: Where existing fences must be removed to permit construction, the Contractor shall remove such fences. As construction progresses, reset the fences in their original location and to their original condition. All costs of removing and resetting fences and such temporary works as may be required shall be included in the prices for the utility line.

V. Protecting Trees, Shrubbery and Lawns: Trees and shrubbery along trench lines shall not be disturbed unless absolutely necessary. Trees and shrubbery necessary to be removed shall be properly heeled-in and re-planted. Heeling-in and re-planting shall be done under the direction of an experienced nurseryman.

W. Remove and Replace Pavement:

1. Pavement and base course which must be removed for constructing sewers, manholes, forcemains, water lines, and all other appurtenances in streets shall be replaced as specified in Section 02514.

2. The top 18 inches of subgrade material immediately under the paving base and also road shoulder shall be carefully removed and kept separate from the rest of the excavated material. This material shall be placed in the top 18 inches of the backfill. Further compaction shall be accomplished by leaving the backfilled trench open to traffic while maintaining the surface with crushed stone or gravel. Settlement in trenches shall be refilled with crushed stone or gravel, and such maintenance shall continue until replacement of pavement.

3. Where utility lines are constructed on unpaved streets, roads or easements, the top 18 inches of soil shall be stripped and windrowed separate from the excavation from trenches. After the line has been installed and the backfill completed within 18 inches of the original grade, the salvaged surfacing shall be replaced. This work shall be considered as general clean up along with the removal of surplus excavated materials from the site and the restoring of the surface outside trench limits to its original condition, the cost of which shall be included in the price bid for the utility line.

X. Walks, Drives, Concrete Curb and Gutter:

1. Walks and drives removed or damaged during the course of construction shall be replaced in full sections as specified in Section 02514.

2. Concrete curb and gutter sections removed or damaged during the course of construction shall be replaced in full sections and as specified in Section 02514.

3.4 Finish Grading:

A. Landscaping (grassing and tree/shrub planting) will be done by the Owner under separate contract. Prior to substantial completion of project, the Contractor shall spread topsoil (either stockpiled or hauled-on if the stockpiled topsoil is insufficient for full coverage) to the minimum depth (specified in par. 3.2.M.2) over all site areas disturbed by construction activities. Additional haul-on topsoil, if required, shall be the responsibility of the Contractor to include locating, testing, purchasing, hauling, spreading, etc.

3.5 Clean-Up and Disposal:

A. Transport trash, rubbish and debris daily from site and legally dispose of.

1. Remove and promptly dispose of contaminated, vermin infested, or dangerous materials encountered.

2. Do not burn or bury materials on site.

B. Remove tools, equipment and protections when work is complete and when authorized to do so by local authorities having jurisdiction and Owner.

C. The Contractor shall restore all facilities interfered with to their original condition or acceptable equivalent. The cost of such restoration or damage caused directly by his work shall be paid for by the Contractor.

END OF SECTION



SECTION 02280  
TERMITE TREATMENT

PART 1 - GENERAL

1.1 Quality Assurance

A. Application: Licensed by State of Georgia and who has been in the business of termite control for a period of not less than five (5) years.

B. Guarantee:

1. Upon completion of the work and as a condition of its acceptance, furnish the Owner a guarantee in the form and with provisions as follows:

a. Guarantee shall be in form acceptable to the Owner and shall be drawn in favor of the Owner, his successor, and his assigns.

b. Effectiveness of treatment against termite infestation of the building and its contents will continue for not less than five (5) years form date of final acceptance of project by the Owner.

c. Guarantee shall contain an Owner optional renewal clause for continuing guarantee beyond the initial five (5) year period.

2. If infestation occurs under or in the building during the guarantee period, the contractor shall promptly and without expense to the Owner.

a. Retreat the soil to prevent termites from attacking the building and its contents, using means acceptable to the Owner.

b. Make good all damage to the building and its contents caused by termite activity.

1.2 Related Sections:

A. Section 03300, Cast-in-Place Concrete

1.3 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Specimen Copy of Guarantee.

1.4 Job Conditions:

A. Environmental: Do not apply chemicals when soil is wet or if there is an immediate likelihood of rain.

B. Signs: Post signs in areas of application warning workers that soil poison is being or has been applied; remove when treated areas are covered by other construction.

## PART 2 - PRODUCTS

### 2.1 Materials:

A. Working Solutions: Chemicals used for treatment shall be E.P.A. approved termiticides applied in water emulsion.

## PART 3 - EXECUTION

### 3.1 Installation:

A. Time: Apply during regular working hours.

B. Application: Apply working solutions as follows:

1. New slabs-on-grade within area at the rate of 1-1/2 gallons per 10 square feet.

2. Outside all new building perimeters.

3. Under new areaways, aprons, pads, landings, walls, paved extensions and where paving abutts perimeter of new buildings at the rate of one gallon per 10 square feet.

4. Under new foundations, footings and grade beams, including vertical and horizontal surfaces, at the rate of 2 gallons per 5 linear feet.

5. Interior side of new foundation walls at the rate of 2 gallons per 5 linear feet.

6. Both sides of new interior foundation walls at a rate of 2 gallons per linear feet.

7. Below new expansion joints, control joints and around penetrations through new slabs on grade at the rate of 2 gallons per 5 linear feet.

### 3.2 Field Quality Control:

A. Drying: Allow not less than twelve (12) hours for drying after application before proceeding with construction activities that will cover the treated areas.

B. Protection: Treated surfaces shall be protected from disturbance until covered by subsequent construction.

C. Retreatment: Should treated surfaces be disturbed, reapply chemicals to the disturbed areas at rates hereinbefore described.

END OF SECTION

SECTION 02514  
CONCRETE PAVING, WALKS AND CURBS

PART 1 - GENERAL

A. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions.

B. Related Sections:

1. Section 02200, Earthwork
2. Section 03300, Cast-in-Place Concrete

C. Description of Work:

1. Extent of concrete paving, curbs and walks are shown on the drawings.
2. Concrete and related materials are specified herein and Section 03300.

D. Quality Assurance:

1. Codes and Standards: All work and materials shall conform to Georgia Department of Transportation Specifications, latest Edition.

E. Submittals: Furnish samples, manufacturer's product data, test reports, and material certifications as required in referenced sections for concrete.

F. Job Conditions:

1. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - PRODUCTS

A. Materials:

1. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

a. Use flexible spring steel forms or laminated boards to form radius bends as required.

b. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.

B. Concrete Mix, Design and Testing: Design mix to produce normal-weight concrete consisting of portland cement, aggregate, air-entraining admixture and water to produce the following properties:

1. Compressive Strength: 4000 psi minimum –Concrete Paving (drives)  
3000 psi minimum – Walls, Walkways, Curb and Gutter

2. Compressive strength shown above is required minimum at 28 days, unless otherwise noted.

3. Slump Range: 3"-5" for all concrete.

4. Air Content: 5% to 8%.

### PART 3 - EXECUTION

A. Surface Preparation: Remove loose material from compacted subbase surface immediately before placing concrete.

1. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and area ready to receive paving.

B. Form Construction: Set forms to required grades and lines with gutter pitched to drain in locations indicated by the grades shown on the plans. Rigidly brace and secure all forms. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

1. Check completed formwork for grade and alignment to following tolerances:

a. Top of forms not more than 1/8" in 10'.

b. Vertical face on longitudinal axis, not more than 1/4" in 10'.

2. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

C. Concrete Placement:

1. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

2. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of joint devices.

a. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

b. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

3. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimum specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

D. Joints:

1. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

a. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

2. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints as indicated on the drawing. All joints shall be filled with flexible caulking. Construct weakened-plane joints for a depth equal to at least 1/3 concrete thickness, as follows:

3. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

4. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove strips after concrete has hardened.

5. Construction Joints: Place construction joints at end of placements and at locations when placement operations are stopped for a period of more than 1/2-hour, and at every third contraction joint.

a. Construct joints as shown or, if not shown, use standard metal keyway section forms.

b. Where load transfer-slip dowel devices are used, install so that one end of each dowel bar is free to move.

6. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

E. Concrete Finishing: After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

1. After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

2. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

3. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by the Architect.

F. Repairs and Protections:

1. Repair or replace broken or defective concrete, as directed by the Architect.

2. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

3. Sweep concrete curb and gutter and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION

SECTION 02530  
EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 Description:

A. This section consists of the furnishing and installing of silt fences, grassing, and other provisions as shown on the drawings for the purpose of governing land-disturbing activities. The measures implemented on site must, at a minimum, be in conformance with the requirements of the *Manual for Erosion and Sediment Control in Georgia*, latest edition.

1.2 Related Section:

A. Section 02200, Earthwork

PART 2 – PRODUCTS

2.1 Sediment Drainage Fabric:

A. Silt fence must meet the requirements of Section 171 Silt Fence for the Department of Transportation, State of Georgia, standard specification, latest edition, and must be a non-biodegradable, sunlight stabilized, woven polypropylene fabric, type which will retain sediment and reduce water runoff velocity; one of the following by listed manufacturer, or approved equal:

B. Manufacturers:

1. Mirafi 100x Sedimentation Control Fabric, MIRAFLI, INC.
2. Propex 1325 Embankment/Erosion Control Fabric, AMOCO FABRICS COMPANY.
3. Trevira Spunbond Engineering Fabric Style 1115 or 1120, HOECHST FIBERS INDUSTRIES.

PART 3 - EXECUTION

3.1 General:

A. During construction, the Contractor shall provide for adequate drainage and proper soil erosion control measures in accordance with the *Manual for Erosion and Sediment Control in Georgia*, latest edition. Positive drainage shall be provided during all phases of construction.

B. The Contractor shall install additional erosion control measures as necessary by actual site conditions, in order to provide the required erosion control.

C. The Contractor shall inspect erosion control measures at the end of each working day to insure that these measures are functioning properly. All sediment control will be maintained until the permanent vegetation and all roads and parking areas have been paved but not prior to Notice of Substantial Completion from Owner and/or Architect.

### 3.2 Vegetation:

A. Stripping of vegetation, regrading and other development activities shall be conducted in such a manner so as to minimize erosion and sedimentation. Whenever feasible, natural vegetation shall be retained, protected and supplemented.

### 3.3 Disturbed Soil:

B. The disturbed area and the duration of exposure to erosive elements shall be kept to a practical minimum. All disturbed soil shall be stabilized as quickly as practical. Temporary vegetation or mulching shall be employed to protect exposed critical areas during development.

### 3.4 Erosion Control Structures:

A. Structural erosion control measures must be installed as soon as practical. All structures shall be installed as described on the Drawings.

### 3.5 Surface Run-Off Water:

A. Sediment in run-off water must be trapped by the use of structural methods as described on the Drawings until the disturbed area is stabilized. Adequate provisions must be provided to minimize damage from surface water to the cut face of excavations or the sloping surfaces of fills.

### 3.6 Maintenance:

A. The site Contractor shall be responsible for maintaining all erosion and sediment control measures and structures during the construction period. Additionally, the Contractor is subject to the requirements of NPDES permit GAR 100001.

1. The Owner will approve a testing agency and the Contractor will pay all costs for inspections, record-keeping, stormwater sampling and reporting.

2. The Contractor shall be responsible for immediate compliance with all findings to correct any and all deficiencies noted.

### 3.7 Removal of Silt Fencing:

A. The Contractor shall remove and dispose of all silt fencing, stakes, hay bales and etc., once the grassed areas are stabilized and landscaping is completed, but not prior to receiving Notice of Substantial Completion from Owner and/or Architect.

END OF SECTION

SECTION 02632  
STORM DRAINAGE

PART 1 – GENERAL

1.1 Summary:

A. Handling and Storage: Handle, transport to the job, unload, store and place pipe in trenches to prevent their being damaged. Any damaged material will be rejected.

B. Submittals: The Contractor shall furnish to the Engineer, five (5) copies of the manufacturer's certification of materials.

1.2 Related Section:

A. Section 02200, Earthwork

PART 2 - PRODUCTS

2.1 Materials:

A. Refer to the Drawings for areas that a specific type of pipe is required. Unless a specific type of pipe is required by the Drawings, the Contractor shall have the option of installing either of the types of pipe listed below.

1. Bituminous Coated Corrugated Metal Pipe: Galvanized corrugated steel culvert pipe and connecting bands shall meet the requirements of the current AASHTO M-36. Galvanized coating shall meet the requirements of the current AASHTO M218.

a. All galvanized corrugated steel culvert pipe shall have 2-2/3" x 1/2" corrugations with the ends of pipe sections reformed to annular corrugations.

b. Culvert pipe shall meet the structural requirements for 2-2/3" x 1/2" corrugation, as outlined below:

<u>Pipe Diameter</u>	<u>Minimum Gauge</u>
12"-48"	16
54"-66"	12

c. Bituminous coated corrugated steel culvert pipe shall meet the requirements of the current AASHTO M-190.

d. All culvert pipe shall be fully bituminous coated .05", Type "A".

2. Reinforced Concrete Pipe: Reinforced concrete pipe (RCP) shall meet the requirements of ASTM Designation C-76, Class III or V and the latest revisions thereof. Pipe joints shall be either tongue and groove with mortar joint or "O" ring type joints. Pipe shall meet GA D.O.T. Specifications and shall be stamped by D.O.T.

3. Ductile Iron Pipe: Ductile Iron pipe, pressure class 350 with slip joints. Fittings shall be mechanical joint ductile iron.

4. Down spout Connector Piping Materials: Refer to Drawings for pipe size and locations. Piping and fittings shall conform to the following:

- a. Pipe and fittings shall be Schedule 40 PVC, ADS N12, or pre-approved equal.
- b. Connect to PVC downspout boots and grout downspout into PVC boot.

5. Cast-in-place concrete shall have minimum compressive strength of 3000 psi at 28 days. Slump shall be 3"  $\pm$  1".

6. Brick: Brick for manholes and catch basins shall be first quality, sound, hard burned, perfect shaped brick, presenting a smooth regular shape. Brick shall not absorb more than 16 percent of water by weight when submerged in water for 24 hours, having been in a thoroughly dry state prior to placing in water.

7. Mortar: All cement used in mortar shall conform to ASTM Designation C-150, and the latest revision thereof. All mortar used shall be composed of one part Portland Cement and two parts of fine sand.

8. Cast Iron: Cast iron for manhole frames and covers and catch basin frames and grates, and manhole steps shall conform to the shape and dimensions shown on the Plans, and shall be clean and perfect free from sand and blow holes or other defects. Cast iron shall conform to ASTM Designation A-48-74 for Class No. 20 gray cast iron.

9. Precast Concrete Structures: Precast concrete storm drainage structures shall conform to the requirements of ASTM C-478. Dimensions and reinforcement steel shall be as shown on the details.

### PART 3 - EXECUTION

#### 3.1 Installation:

A. Trenching: As specified in Section 02200.

B. Pipe Laying: Lay pipe to line and grade by the use of batter boards or laser. Set batter boards at intervals of 25 feet or less. Begin pipe laying at the lowest flow line elevation and continue toward the highest flow line elevation.

C. Backfilling: As specified in Section 02200.

D. Structures: Construct area drains, manholes catch basins, junction boxes, and headwalls to conform to the details shown on the plans. Precast structures shall conform to ASTM C-478 standards and specifications.

1. After the masonry work and/or concrete work have been completed to elevation, the cast iron frames shall be set in a full bed of mortar and adjusted to the elevation shown on the plans.

END OF SECTION

SECTION 02700  
WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

A. Under this heading shall be included the complete construction of the Water Distribution System. The Water Distribution System construction shall satisfy the requirements of the Macon Water Authority. "Standards for the Design and Construction Specifications for I. Water Distribution and II. Wastewater Collection", latest edition, shall be used for this section. The Contractor shall be responsible for securing this document from the Macon Water Authority. The Contractor will be responsible for complying with all requirements of that document. The Contractor will make application for the water service and pay all bills for that service until Substantial Completion. After Substantial Completion, the service will be transferred into the Owner's name and the Owner will be responsible for all remaining bills. The Owner will pay for all meters and tap fee(s). The Contractor will be responsible for paying all other fees and costs for water system.

END OF SECTION



SECTION 02710  
SITE SEPTIC TANK CONSTRUCTION

PART 1 - GENERAL

A. Related Documents: All of the drawings and general provisions of the contract, including General and Supplementary Conditions apply to this section. Included by reference are Bibb County Environmental Health Department Standard Requirements for Installations of Septic Tank Systems.

B. Scope: Products, materials and installation shall be governed by Bibb County Environmental Health Department Standard Requirements. Contractor shall coordinate installation of the Septic Tank System with the Bibb County Environmental Health Department. Contact: Mr. James Boecke at (478) 749-0106.

C. Fees: The Contractor will make application to the Bibb County Environmental Health Department and pay all fees and costs. After substantial completion, the permit will be transferred into the Owner's Name.

D. As-Built Drawings: The Contractor shall be responsible for providing as-built drawings of the installation.

END OF SECTION



SECTION 03300  
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Retaining Walls.

B. Related Sections:

1. Section 02200, Earthwork.
2. Section 02514, Concrete Paving, Walks, and Curbs.
3. Section 03350, Colored Concrete.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit MR 4.: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

2. Design Mixtures for Credit ID 1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements, and for equivalent concrete mixtures that do not contain portland cement replacements.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Provide ICC Evaluation Service Reports for all adhesive anchors and power actuated fasteners used to attach other items to concrete slabs and other concrete work.

F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

G. Minutes of preinstallation conference.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. 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.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. American Society for Testing and Materials (ASTM)

1. ASTM E1745 – Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

2. ASTM E154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.

3. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.

4. ASTM E1643 – Standard Practice for Installation of Water Vapor Retarders Used in Contact With Earth or Granular Fill Under Concrete Slabs.

5. ASTM F1249-01 – Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3. ACI 302.1R-latest edition, Vapor Barrier Component (plastic membrane) is not less than 10 mils thick.

4. ACI 302.1R-latest edition, Guidelines for layout of construction, isolation and contraction joints.

F. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

- a. Contractor's superintendent.
- b. Independent testing agency responsible for concrete design mixtures.
- c. Ready-mix concrete manufacturer.
- d. Concrete subcontractor.
- e. Owner's Representative

2. Review: special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending, corrosion and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

## PART 2 - PRODUCTS

### 2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

- a. High-density overlay, Class 1 or better.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch , minimum.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

## 2.3 REINFORCEMENT ACCESSORIES

A. 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 according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

## 2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I, gray.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

3. Aggregate shall be provided and classified as follows:

a. Footings, foundations, columns and beams not exposed to weather. Interior floor slabs with floor coverings: Class 1M.

b. Foundation walls above grade, retaining walls, piers and beams exposed to weather: Class 3M.

c. Pavements, driveways and curbs, walks: Class 4M.

C. Water: ASTM C 94/C 94M and potable.

## 2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. No other admixtures will be permitted without prior approval.

## 2.6 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber : fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1163M, Type III, 1 to 2-1/4 inches (25 to 57mm) long.

1. Products: Provide one of the following:

a. Fibrillated Micro-Fibers:

- 1) FORTA Coporation; FORTA Econo-Net.
- 2) Grace Construction Products, W. R. Grace & Co.; Grace Fibers.
- 3) Propex Concrete Systems; Fibermesh 300.

## 2.7 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Products: Provide one of the following :

- a. CETCO; Volclay Waterstop-RX.
- b. Greenstreak; Swellstop.
- c. JP Specialties, Inc.; Earth Shield Type 20.

## 2.8 VAPOR RETARDER (Horizontal Surfaces Under Slab)

A. See architectural specifications for under slab vapor retarder requirements.

B. Granular Fill: Clean mixture of crushed stone or uncrushed gravel; ASTM D448, Size 57, with 100% passing a 1½”(37.5 mm) sieve and 0 % passing a No. 8 (2.36 mm) sieve.

## 2.9 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products: Provide one of the following:
  - a. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
  - b. Euclid Chemical Co., an RPM company; Euco Diamond Hard.
  - c. Meadows, W.R., Inc.; LIQUI-HARD.
  - d. BASF Sonneborn Building Products; Lapidolith.
  - e. Davidson Chemicals; Concrete Hardener.

## 2.8 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet. Keep in place for 7 days, minimum.

B. Water: Potable.

## 2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) to 1/2 inch (12.7 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 5000 psi at 7 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 5000 psi at 7 days when tested according to ASTM C 109/C 109M.

## 2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Admixtures: Use admixtures according to manufacturer's written instructions.

## 2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.50.

3. Slump Limit: 4 inches plus or minus 1 inch .

4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.

2. Minimum Cementitious Materials Content 550 lb/cu. yd.

3. Slump Limit: 4 inches, plus or minus 1 inch .

4. Air Content: Do not allow air content of trowel-finished floors to exceed 3%.

5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

6. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd.

## 2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

- 1. When air temperature is between 85 and 90 deg F , reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F , reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

- 1. Class C, 1/2 inch for smooth-formed finished surfaces.

- D. Construct forms tight enough to prevent loss of concrete mortar.

- E. Fabricate 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.

- 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.

- F. 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.

- G. 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.

- H. Chamfer exterior corners and edges of permanently exposed concrete, unless shown otherwise on drawings.

- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 EMBEDDED ITEMS

A. 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.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

2. Post installed anchors shall comply with and meet requirements of ICC-ES AC308.

### 3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### 3.4 VAPOR RETARDER:

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.

1. Unroll vapor retarder with longest dimension parallel with the direction of the pour.

2. Lap vapor retarder over footings. Turn vapor barrier upward to top of slab and seal to perimeter wall per Figure 2, ASTM E1643.

3. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

4. Seal all penetrations (including pipes) with manufacturer's recommended pipe boot procedure.

5. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.

6. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches and taping all four sides with tape.

### 3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. 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.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

### 3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations as approved by Architect.

1. 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.

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Isolation Joints in Slabs-on-Grade: 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.

1. Terminate full-width joint filler strips not less than ½ inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07900, Sealants and Caulking, are indicated.

2. Install joint filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 3.7 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

### 3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be 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.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. 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.

E. 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.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. 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.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.9 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed the specified limits on formed surface irregularities.

1. Apply to concrete surfaces exposed to public view.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraighthening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces indicated and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighthening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish.

D. 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.

1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish surfaces to the following tolerances, according to ASTM E 1155 , for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

b. Levelness testing F(L), is not required at suspended slabs.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. 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.

### 3.11 MISCELLANEOUS CONCRETE ITEMS

A. 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.

B. 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.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

### 3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings and other surfaces.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

- a. Water.
- b. Continuous water-fog spray.
- c. Absorptive cover, water saturated, and kept continuously wet.

Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. 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. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to 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.

### 3.13 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.

2. Do not apply to concrete that is less than seven days old.

### 3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

### 3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: The Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. 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.

2. Slump: ASTM C 143/C 143M; 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.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Unit Weight: ASTM C 567, 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.

6. Compression Test Specimens: ASTM C 31/C 31M.

a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M;
    - a. Test one laboratory-cured specimen at 7 days and one set of two specimens @ 28 days.
    - b. When two specimens are tested, the compressive strength test shall be the average compressive strength from a set of two specimens obtained from the same composite sample and tested at the age indicated.
    - c. Retain one specimen for additional testing if requested by the Design Professional.
  8. Strength of each concrete mixture will be satisfactory if concrete has achieved the specified 28-day compressive strength.
  9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
  10. 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.
  11. 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 C 42/C 42M or by other methods as directed by Architect.
  12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

### 3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. 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.

END OF SECTION

SECTION 03350  
COLORED CONCRETE

PART 1 - GENERAL

1.1 Summary:

- A. Section Includes:
1. Dry-shake colored hardener applied to slabs-on-grade where indicated on drawings.
  2. Curing of colored concrete.
- B. References:
1. American Concrete Institute (ACI):
    - a. ACI 301 "Specification for Structural Concrete for Buildings"
    - b. ACI 302 IR "Recommended Practice for Concrete Floor and Slab Construction"
    - c. ACI 303.1 "Standard Specification for Cast-in-Place Architectural Concrete"
    - d. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing of Concrete"
    - e. ACI 305R "Recommended Practice for Hot Weather Concreting"
    - f. ACI 306R "Recommended Practice for Cold Weather Concreting"
  2. American Society of Testing and Materials (ASTM):
    - a. ASTM C309 "Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete"
    - b. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete"

1.2 Related Sections:

- A. Section 03300, Cast-in-Place Concrete
- B. Section 07900, Sealants and Caulking

1.3 Submittals:

- A. Product Data: Submit manufacturer's complete technical data sheets for the following:
1. Dry-shake colored hardener.
  2. Curing compound
- B. Color Charts: Manufacturer's color charts showing full range of colors available.

#### 1.4 Quality Assurance:

A. Manufacturer Qualifications: Manufacturer with 10-year's experience in manufacturer of specified products.

B. Install Qualifications: An installer with 5-year's experience with work of similar scope and quality.

C. Comply with the requirements of ACI 301.

D. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.

E. Notification of manufacturer's authorized representative shall be given at least 1-week before start of Work.

F. Colored Concrete Mockup:

1. At location on Project selected by the Architect, place and finish 10 feet by 10 feet sample area.

2. Construct mockup using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in sample panels. Mockup shall be produced by the individual workers who will perform the work for the Project.

3. Accepted mockup provides visual standard for work of Section.

4. Mockup shall remain through completion of the work for use as a quality standard for finished work.

5. Remove mockup when directed.

#### 1.5 Delivery, Storage, and Handling:

A. Deliver products in original factory unopened, undamaged packaging bearing identification of product, manufacturer, batch number, and expiration data, as applicable.

B. Store the product in a location protected from damage, construction activity, and precipitation in strict accordance with the manufacturer's recommendations.

#### 1.6 Field Conditions:

A. Schedule placements to minimize exposure to wind and hot sun before curing materials are applied.

B. Avoid placing concrete if rain, snow, or if frost is forecast within 24 hours. Protect fresh concrete from moisture and freezing.

C. Comply with professional practices described in ACI 305R and ACI 306R.

## 1.7 Pre-Job Conference:

A. One week prior to placement of concrete, a meeting with the Architect, General Contractor, Subcontractor, Ready-Mix Concrete Representative, and Manufacturer's Representative shall be held to discuss the Project and application methods.

## PART 2 – PRODUCTS

### 2.1 Materials:

A. Basis of Design: Products specified herein shall be equal to those of L. M. Scofield Company / Douglasville, GA. Dry-shake Colored Hardener, LITHOCHOME® Color Hardener factory proportioned, mixed, and packaged, ready-to-use surface hardener; color as selected by the Architect.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

B. Cast-in-Place Concrete: Comply with requirements of Section 03300, Cast-in-Place Concrete.

C. Curing Compound for Dry-Shake Colored Hardener Concrete: Comply with ASTM C309 and be of same manufacturer as colored admixture, for use with dry-shake colored hardener concrete.

1. Interior Dry-Shake Colored Hardener Concrete Curing Compound: Equal to "COLORCURE®" Concrete Sealer; color as selected by the Architect.

D. Curing and Sealing Compound: "Cureseal-W™" (semi-gloss); comply with ASTM C309 and be of same manufacture as colored admixture, for use with colored concrete.

E. Sealing Compound: "CEMENTONE®" Clear Sealer; waterborne, low VOC clear sealer formulated to protect colored concrete.

### 2.2 Concrete Mix Design:

A. Comply with requirements of Section 03300, Cast-in-Place Concrete.

B. Supplemental admixtures (including calcium chloride) shall not be used unless approved by Architect.

C. Do not add water to the mix in the field.

## PART 3 – EXECUTION

### 3.1 Concrete Placement:

A. Move concrete into place with square-tipped shovels or concrete rakes.

B. Vibrators, when used, shall be inserted and withdrawn vertically.

C. Concrete shall be struck to specified level with wood or magnesium straight edge or mechanical vibrating screed.

D. Concrete surface shall be further leveled and consolidated with highway magnesium straight edge and/or magnesium bull float.

E. Mechanically float concrete surfaces as soon as concrete surface has taken its initial set and will support weight of a power float machine equipped with float shoes or combination blades and operator.

### 3.2 Installation - Dry-Shake Colored Hardener:

A. Apply 2/3 of specified application rate to freshly floated concrete surface. Bleed water shall not be present during or following application of first and second shake.

B. Do not throw dry-shake; distribute evenly by hand or mechanical spreader designed to apply floor hardeners. Consult manufacturer for recommended manufacturers of mechanical spreaders.

C. As soon as dry-shake material has absorbed moisture, indicated by uniform darkening of surface, mechanically float concrete surface a second time, just enough to bring moisture from base slab through dry-shake color hardener.

D. Immediately following second floating, apply remaining 1/3 of specified application rate. If applied by hand, broadcast in opposite direction of first application for a more uniform coverage. If a mechanical spreader is used, apply the same manner as previously described.

E. As soon as dry-shake material has absorbed moisture, mechanically float concrete surface a third time.

F. Do not add water to the surface.

G. As surface further stiffens, remove float blades to expose the power finish blades or raise combination blades slightly. Flat trowel surface to remove marks and pinholes.

H. Final troweling shall be by hand in a uniform, consistent direction for a slip-resistant flat-trowel finish.

### 3.3 Curing:

A. Floors shall be cured with liquid membrane curing compound as recommended by manufacturer.

B. Apply immediately after floor surface has hardened sufficiently so that application of curing compound will not mar surface. Apply uniformly over entire surface at coverage rate recommended by manufacturer and meeting or exceeding the moisture retention requirements of ASTM C309.

C. There shall be no free water on surface at time of application.

3.4 Sealing:

- A. Prepare dry, cured concrete surfaces according to manufacturer's instruction.
- B. Apply sealer uniformly in two coats at manufacturer's recommended rate. After first coat has dried, apply second coat at 90 degrees from first coat.
- C. Verify adequacy of slip resistance.

3.5 Protection of Finished Work.

- A. Prohibit foot or vehicular traffic on floor surface for the time specified by manufacturer.
- B. Protect floor surface from damage until final inspection and acceptance.

END OF SECTION



SECTION 04200  
UNIT MASONRY

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to special conditions or limitations where specified hereinafter.

2. Referenced Publications: American Society for Testing and Materials (ASTM).

1.2 Related Sections:

A. Section 03300, Cast-in-Place Concrete

B. Section 05500, Miscellaneous Metals

C. Section 07160, Bituminous Dampproofing

D. Section 07210, Building Insulation

E. Section 07650, Flexible Flashing

F. Section 07900, Sealants and Caulking

G. Section 08110, Steel Frames and Doors

H. Section 08360, Sectional Doors

I. Section 08410, Aluminum Storefront Systems

J. Section 08550, Vinyl Single-Hung Windows

1.3 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Product Data: Manufacturer's detailed product specifications for:

1. Face Brick
2. Concrete Masonry
3. Horizontal Masonry Joint Reinforcement
4. Vertical Bar Positioner
5. Horizontal Bar Positioner
6. Vertical Bar Connector
7. Adjustable and Fixed Masonry Ties
8. Dove Tail Anchor
9. Weep/Ventilator

C. Certifications: Submit letter from all manufacturers of masonry units certifying that masonry units shipped to this job-site meet the specifications/ASTM requirements for each type of unit.

D. Samples: As follows:

1. Face Brick
2. Concrete Masonry Units: Full size for each type.
3. Horizontal Masonry Joint Reinforcement: Full size x 24 inches long, include preformed corner and tee.
4. Vertical Bar Positioner: Full size
5. Horizontal Bar Positioner: Full size
6. Vertical Bar Connector: Full size
7. Adjustable and Fixed Masonry Ties: Full size

E. Mock-Up Panels:

1. After review of the samples, but prior to commencing unit masonry operations, construct on the project site, at location selected by the Architect, construct a sample panel of approximately 3'-0" high x 2'-0" long x typical wall thickness for each brick type used.

2. The sample panel shall be typical of each type of face brick and back-up shall show coursing, bond, joints, and extremes in texture and color of the masonry units.

3. Upon the Architect's approval of the sample panels unit masonry work may commence.

4. The sample panel shall remain in place and be used as a guide until all unit masonry work is complete, and until its removal is approved by the Architect.

1.3 Product Handling:

A. Delivery and Storage:

1. Cementitious materials and masonry reinforcement shall be delivered to the project site in manufacturer's original, unopened packaging with labels.

2. Cementitious materials and metal items shall be stored in a housed, dry and ventilated area on a platform at least 12 inches above ground floor.

1.4 Job Conditions:

A. Temperature: Erect no masonry unless the ambient temperature is at least 40 degrees F and rising.

## PART 2 - PRODUCTS

2.1 Materials:

A. Face Brick Type 1: Cherokee M/S Jefferson, meeting ASTM C216.

1. Special Shaped Brick: Same as face brick used and in full color range.
  2. Solid Brick: Same as face brick used and in full color range.
- B. Face Brick Type 2: Cherokee M/S Velour "Light Gray", meeting ASTM C216.
1. Special Shaped Brick: Same as face brick used and in full color range.
  2. Solid Brick: Same as face brick used and in full color range.
- C. Building Brick: ASTM C62, Grade SW.
- D. Hollow Concrete Masonry Units:
1. Below grade and where exposed to weather: Normal weight, Type 1, Grade N-1, manufactured to meet ASTM C90.
  2. Above grade exposed to interior:
    - a. Light weight, two-cell type, meeting ASTM C90, Type 1 moisture controlled units; nominal face dimensions of 8-inches high x 16-inches long; thickness as required on the drawings; manufacturer's standard color and face texture.
  3. Special Shapes: Specially moulded units as required to meet conditions (i.e. lintel blocks, sash blocks, etc.) of same type as units with which used (i.e. normal weight/light-weight).
  4. Fire Rated Units: Comply with ASTM E 119 and shall be UL rated for rating required on the drawings.
- E. Masonry Reinforcement: Truss Type 2, 3, or 4 rod as required for width of masonry, fabrication from No. 9 deformed rod, hot-dip galvanized after fabrication in accordance with ASTM A153, Class B-2.
- F. Wall Ties:
1. Wall Ties: Equal to "2-Seal Thermal Wing-Nut Tie" as manufactured by Hohman & Barnard, Inc., organic polymer coated carbon steel single screw dual-diameter barrel veneer tie with factory-installed EPDM washers; with 3/16" Byna-Lok wire tie, length as required to adhere fully to steel studs and face brick a minimum of 3".
- G. Rebar: As described on drawings.
- H. Vertical Bar Positioner: Galvanized wire type, designed to hold vertical rebar in proper position.
- I. Horizontal Bar Positioner: Galvanized wire type designed to hold horizontal rebar in proper position.
- J. Vertical Bar Connectors: Galvanized metal type, designed to provide proper overlap of vertical rebar and allowing rebar placement after block has been laid.
- K. Tie Wire: 16 gauge, annealed.
- L. Sand: ASTM C144, White.

- M. Water: Clean and potable.
- N. Hydrated Lime: ASTM C207, Type S.
- O. Portland Cement: ASTM C150 and be of one manufacturer.
- P. Aggregate for Cement Grout: Fine aggregate conforming to ASTM C404.
- Q. Non-Shrink: One of the following:
  - 1. SonogROUT as manufactured by Sonneborn Building Products, Minneapolis, MN.
  - 2. Supreme as manufactured by Gifford-Hill and Company, Charlotte, NC.
  - 3. No. 588 as manufactured by W.R. Meadows, Inc., Elgin, IL.
- R. Masonry Mortars: ASTM C270, Type M and Type S, water-proof as tested by method of ASTM E514.
- S. Colored Mortar: ASTM C270, Type S, pre-mixed color. Color shall be Cherokee "Buff".
- T. Weep Ventilators as manufactured by Hohmann & Barnard, Inc., or equal.
  - 1. Weep Joints: #343 injection-molded flexible PVC.
  - 2. Weep Holes: #341 w/s medium density polyethylene with wick and screen.
- U. Cleaning Solution for Clay Masonry Units: One of the following:
  - 1. Sure Kleen No. 600 or Vana-Trol as manufactured by ProSoCo, Inc., Kansas City, KS.
  - 2. Brick-Klene as manufactured by Ecolab, Inc., St. Paul MN.
  - 3. Shield Clean 88 as manufactured by Shield Chemical.

## 2.2 Measurement and Mixing:

- A. General:
  - 1. Mortars shall be mixed in a power mixer, adding 1/2 the sand and water to the mixer, followed by the entire amount of masonry cement, mixing for approximately 3 minutes, followed by adding the balance of the sand and water; continue mixing for not more than five minutes nor less than three minutes after all materials are in the mixer; mortars used in exterior work shall have an internal water repellent included in their mix design.
  - 2. Mortar used in exposed to view face brick shall be of color as hereinbefore described.
- B. Masonry Mortars:
  - 1. Type 1: Proportioned to produce a Type M mortar complying with ASTM C270, 2,500 psi.
  - 2. Type 2: Proportioned to produce a Type S mortar complying with ASTM C270, 1,800 psi.

3. Type 3: Pre-mixed colors as described hereinbefore and complying with ASTM C270, 1,800 psi.

C. Pointing Mortar: By volume one part non-staining cement, two parts white sand, and sufficient lime or lime putty to make as stiff a mixture as can be worked; prepare one to two hours before using and do not retemper; pigment shall be added to match adjacent mortar where exposed to view in finish work.

D. Cement Grout: By volume in accordance with ASTM C476-83, one part Portland cement and one-tenth part lime to aggregate proportioned at not less than two and one-fourth to three times the sum of volumes of cementitious materials used.

E. Non-Shrink Grout: Mix prepared product with water as directed by its manufacturer to give a minimum compressive strength of 6,800 psi at 28 days.

### PART 3 - EXECUTION

#### 3.1 Installation:

##### A. Preliminary Requirements:

1. Cutting Wheel: Prior to commencing masonry work, a power operated carborundum cutting wheel shall be set up on the site and used for cutting off-sets, cut-outs, miters and for sizing units.

##### 2. Layout:

a. Horizontal coursing shall be laid out as shown on the drawings; lay up one course of unit masonry so that masonry jamb lines for all openings can be accurately located and marked on footing top and/or floor slab; after all guide lines and bond dimensions have been thus established, permanent work may then commence.

b. Vertical coursing shall be laid out as shown on the drawings; use storey pole, marked with all courses to maintain uniformity.

##### B. Precautionary Measures:

##### 1. Cold Weather Erection:

a. No masonry shall be erected when temperature is below the established minimum of 40 degrees F and rising.

b. Masonry shall be protected from freezing for at least 48 hours after it is in place.

c. No frozen materials shall be built upon or allowed to remain in the wall, but shall be removed and reconstructed.

##### 2. Hot Weather Erection:

a. Do not wet concrete masonry units.

b. If suction due to dryness of concrete masonry units is excessive, use high water-retentive mortar.

3. Protection of Unit Masonry During Erection:
  - a. Scaffolding shall be so constructed as to permit mortar droppings to fall clear of wall.
  - b. At end of each work period and at the stoppage of work at any time, install non-staining tarpaulins or heavy gauge, untoned, plastic membrane across top.
  - c. Care shall be exercised at all times not to smear mortar on face of unit masonry work, and no mortar shall be allowed to drop in cavity between face material and back-up material.

C. Laying Unit Masonry:

1. General:
  - a. Unit masonry shall be laid true to line, level, and plumb.
  - b. Coursing shall continue, unbroken, above and below openings.
  - c. Joints shall be filled solid with mortar as each course is laid.
  - d. Do not use chipped or broken units.
2. Mortars:
  - a. Lay below grade masonry in Type 1 (M) Mortar.
  - b. Lay above grade masonry other than face brick in Type 2 (S) Mortar.
  - c. Lay face brick in Type 3(S) Mortar.
3. Masonry Joints:
  - a. Joints in exposed to view face brick shall be uniform 3/8 inch wide, tooled "beaded".
  - b. Joints in unexposed to view masonry (i.e. below grade or not exposed in finished work) shall have uniform 3/8" wide joints, struck flush.
  - c. Joints in concrete block exposed to view shall have uniform 3/8-inch wide tooled vee-joint.
4. Masonry Bond: Unless specifically shown otherwise on the drawings, all unit masonry shall be laid in "Common Running Bond".
5. Horizontal Concrete Masonry Reinforcement:
  - a. Install masonry reinforcement every 16 inches o.c. vertically and in the top course, beginning at top of first course above top of finish floor slab.
  - b. Wall openings shall be reinforced in the first two courses above and in the first course below, and shall extend not less than 12 inches past each jamb.
  - c. At splice point, lap reinforcement 6 inches minimum.

6. Miscellaneous Built-in Items: Miscellaneous built-in items such as angle lintels, flashings, anchors, frames and all other items called for in other sections or on the drawings shall be installed as the masonry work progresses.

7. Vertical Bar Positioners: Locate at top of first course and course below top of masonry with maximum of 4 feet between positioners.

8. Horizontal Bar Positioners: Locate where horizontal rebars occur (i.e. bond beams) and space as per manufacturer for size bar being positioned.

9. Wall Ties for Brick Masonry: Install ties not-to-exceed 16" o.c. horizontally and 16" o.c. vertically.

10. Miscellaneous Built-in Items: Miscellaneous built-in items such as angle lintels, flexible flashings, anchors, frames and all other items called for in other sections of this Project Manual or on the drawings shall be installed as the masonry work progresses.

11. Weep Ventilators: Install weep ventilators in exterior brickwork at approximately 32-inches on center horizontally, bottom of ventilator located in joint where flexible flashing occurs; at heads of openings (i.e. windows, doors, louvers, etc.); at sills of opening (i.e. windows, louvers, etc.) where flexible flashing terminates immediately below sill (bed joint of sill). Where 32-inch spacing would allow for only one weep ventilator at opening head or sill, adjust spacing to provide for at least two weep ventilators.

- a. Install weep joints in all brickwork except at soldier courses.
- b. Install weep holes in brick soldier courses.

12. Hollow Metal Frames: Where hollow metal frames occur in unit masonry work, fill head and jambs solid with mortar unless otherwise noted on the drawings.

13. Anchoring of Items to Masonry Units: Where items are shown on the drawings or described in other sections of this Project Manual to be anchored through the masonry units, fill two cells above and one cell below with 3,000 psi concrete as described in Section 03300 of this Project Manual; hold concrete in place with standard galvanized hardware cloth.

14. Fire Rated Construction: Where the drawings call for fire rating of walls, the entire assembly shall be constructed and installed to comply with the UL rating called for thereon.

a. All new fire-rated walls shall be clearly labeled (in 2" HT painted, stenciled letters) indicating the hourly rating and including the words "PROTECT ALL OPENINGS"; lettering shall be above ceilings and located at every 12-feet and at least 1-location per wall.

D. Cleaning:

1. Face Brick:

a. After laying and as soon as practical, brush wall down with soft bristle brush (metal bristles not allowed).

b. A final cleaning shall take place after all masonry is complete using the herein specified cleaner, applied in accordance with the manufacturer's recommendations.

c. Protect adjacent work and materials from damage during cleaning operations.

d. Should damage occur, make all repairs or replacements at no additional cost to the Owner.

E. Cleaning of Concrete Block:

1. Mortar droppings which stick to hollow concrete masonry shall be allowed to dry before removing with trowel.

2. Remaining mortar shall be removed by brushing down with dry fiber brushes (metal bristles not allowed) and rubbing with small piece of concrete masonry.

3. Check entire building for efflorescence, mildew, etc., prior to project close-out. Clean as required in accordance with the Brick Institute of America "Technical Notes on Construction."

END OF SECTION

SECTION 05500  
MISCELLANEOUS METALS

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications or standards (with respective abbreviations used); these referenced publications may be subject to special conditions where specified hereinafter.

2. Reference Publications:

- a. The American Society for Testing & Materials (ASTM).
- b. Federal Specifications (FS).
- c. Code for "Welding in Building Construction" by American Welding Society (AWS).

1.2 Related Sections:

- A. Section 04200, Unit Masonry
- B. Section 09900, Painting

1.3 Submittals:

- A. General: Make all submittals in accordance with Section 01300.
- B. Shop Drawings: Full dimensioned, showing actual field measurements, details of fabrication and anchorage and relationship to abutting materials and finishes.
- C. Product Data: Manufacturer's descriptive and specification data and installation details for each manufactured item described hereinafter.

1.4 Job Conditions:

- A. Coordination: Coordinate with other trades so that necessary backing for anchorage may be provided at proper locations and at proper time in the sequence of the work.

PART 2 - PRODUCTS

2.1 Materials:

- A. Structural Steel: Steel shapes , bars and plates shall meet requirements of ASTM A36.
- B. High Strength Bolts, Nuts and washers: Meet requirements of ASTM A325.
- C. Other Bolts, Nuts and Washers: All other bolts, nuts and washers shall meet requirements of ASTM A449.

D. Expansion Shields: Sizes shown on the drawings and meet the requirements of FS FF-S-325.

E. Wedge Anchors: Sizes shown on the drawings.

F. Sheet Metal: Meet requirements of ASTM A366.

G. Cast iron as noted on drawings

H. Electrodes:

1. Electrodes shall be Mild Steel Arc-Welded Electrodes conforming to requirements of ASTM A233.

2. Electrodes for manual shielded arc welding shall be E70 18, subject to provisions as hereinafter described.

3. Electrodes for automatic inert gas shielded arc welding shall be No. 70.

4. Electrodes used in both shop and field shall be kept warm and dry after the seal is broken on the original container and shall not be used if exposed to atmospheric conditions for more than one hours.

I. Anchoring Grout: non-shrink type manufactured for this purpose.

J. Shop and Field Primer Paint: One of the following:

1. Products:

a. Tnemec Series 10 modified alkyd Metal Primer (99 Red) as manufactured by Tnemec Company.

b. Rust-Oleum 769 Damp-proof Red Primer as manufactured by Rust-Oleum Corp.

c. Southern Coatings RIP476 as manufactured by Southern Coatings and Chemical Company.

2. Coverage: Minimum dry mils thickness of 2.5.

2.2 Fabrication:

A. General: Fabricate metal items, including but not limited to angle lintels, bent plates, elevator pit ladders, holding cell benches to the designs shown on the drawings and from the materials shown thereon; all welds shall be ground smooth.

B. Shop Cleaning and Priming:

1. All ferrous metal items shall be thoroughly cleaned at the shop after fabrication and given one shop coat of paint.

2. Dry Film thickness of shop paint shall be 2.5 mils.

## PART 3 - EXECUTION

### 3.1 Installation:

#### A. General:

1. Work shall be erected plumb and true to line in relation to adjoining work unless otherwise shown.

2. The setting of items to be built into concrete or masonry work is included in their respective sections; the erection of all other items are included herein.

3. Fastening shall be concealed unless otherwise shown.

4. Provide holes and connections for the work of all other trades.

5. Use toggle bolts for anchoring into concrete masonry.

6. Use metal shields for expansion bolts and screws; steel drive bolts of same sizes as noted for expansion bolts, with split, closed ends, with threads at one end may be substituted for expansion bolts into concrete.

B. Welding: All welding shall be done in accordance with AWS standards using shielded arc electrodes.

### 3.2 Field Quality Control:

A. Touch-Up Priming: After installation is complete, touch-up all shop priming coats damaged during transportation and installation and prime all welds, using the priming paint specified for shop painting.

B. Finish Painting: Described in and is a part of Section 09900, Painting.

END OF SECTION



SECTION 06100  
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to special conditions or limitations where specified hereinafter.

2. Referenced Publications:

- a. American Plywood Association (APA).
- b. American Society for Testing and Materials (ASTM).
- c. American Wood Preservers Association (AWPA).
- d. Commercial Standards (CS)
- e. Federal Specifications (FS).
- f. National Institute of Standards and Technology (NBS).
- g. Southern Pine Inspection Bureau (SPIB).

B. Grade Mark: All lumber and plywood shall bear the grade mark as described hereinafter.

1.2 Related Sections:

- A. Section 07210, Building Insulation
- B. Section 07260, Vapor Barrier
- C. Section 07460, Vinyl Siding
- D. Section 07600, Metal Flashing and Sheet Metal Work
- E. Section 07715, Metal Soffit Systems
- F. Section 08110, Steel Frames and Doors
- G. Section 08550, Vinyl Single-Hung Windows
- H. Section 10155, Toilet Compartments
- I. Section 10420, Letters and Signage
- J. Section 10522, Fire Extinguishers and Accessories
- K. Section 10800, Toilet Accessories

1.3 Product Handling:

A. Storage and Protection: Store materials to insure protection from damage due to inclement weather and poor ventilation.

## PART 2 - PRODUCTS

### 2.1 Materials:

A. Miscellaneous Lumber: All lumber used for framing, blocking, roof edges and furring shall be SPIB Grade Marked No. 2, Southern Yellow Pine, kiln-dried with moisture content of not more than 19 percent; nominal sizes as indicated, complying with NBS PS 20, except where actual sizes are specifically required; surfacing shall be dressed (S4S).

B. Studs:

1. Sizes: As shown on the drawings.
2. Material: Any wood species/species group listed in National Design specification Supplement, except Southern Yellow Pine.
3. Grade: Standard (light framing).

C. Roof Decking: Unless specifically shown otherwise, 5/8-inch CD-EXT-APA Plywood.

D. Sheathing: CD-EXT-APA Structural I Plywood; thickness as noted on the drawings.

E. Backboard: 1/2" thick, interior B – C, APA plywood.

F. Fasteners:

1. Nails:
  - a. For Application to Wood: Annular thread, coated steel, meeting requirements of FS FF-N-105; where used with treated lumber or plywood nails shall be hot-dipped galvanized; sizes best suited for intended use.
  - b. For Application to Concrete and Masonry: Unless otherwise noted on the drawings smooth shank, harden steel, counter sunk heads, meeting requirements of FS FF-N-105; where used with treated lumber or plywood, nails shall be hot-dipped galvanized; sizes as best suited for intended use.
2. Bolts (lag, toggle, expansion and miscellaneous) and Screws: Types, sizes and finishes best suited for intended use and meet FS FF-N-105; bolt heads and nut bearings on wood shall be fit with washers.

G. Construction Adhesive: "Liquid Nail" or equivalent.

H. Wood Preservative: EPA approved copper naphthenate meeting AWPA P-8, containing not arsenic or chromium, equal to MCRS CuNap-8, as manufactured by Merichem Co. / Tuscaloosa, AL.

I. Framing Accessories: Accessories such as joist hangers, hurricane anchors, framing anchors, sheathing clips and similar items shall be equal to products manufactured by Simpson (Strong-Tile Connectors), San Leandro, CA of types, gauges and finishes best suited for intended use.

## 2.2 Fabrication:

A. Rough Carpentry: Fabricate all framing, furring, blocking roof edges and other items from lumber as described hereinbefore and to the designs required by the drawings.

### B. Wood Preservative Treatment:

1. All lumber and fabricated wood items that will be in contact with concrete or masonry.

2. All preservative-treated wood members shall bear a permanent ink stamp indicating the following:

- a. Name of wood treating company
- b. Treatment plant, city, and state
- c. Symbol for Alkaline Copper Quaternary (ACQ)
- d. Preservative retention level
- e. Approved use.
- f. Code report number.

## PART 3 - EXECUTION

### 3.1 Installation:

A. Workmanship: All rough carpentry shall produce joints that are true, tight and well fastened and with all members assembled in accordance with the drawings.

### B. Section of Lumber Pieces:

1. Carefully select all members; select individual pieces so that knots and obvious defects will not interfere with placing bolts or proper nailing or making proper connections.

2. Cut out and discard all defects which will render a piece unable to serve its intended function; lumber may be rejected by the Architect, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.

C. Shimming: Do not shim sills, joists, short studs, trimmers, headers, lintels or other framing components.

### D. General Framing:

1. Comply with sizes, spacing, and configurations indicated. Where not specifically indicated, comply with applicable codes and NFPA "Manual for Wood Frame Construction". Splice members only where specifically indicated or approved.

2. Space fasteners as indicated. Where not specifically indicated, comply with applicable codes and the "Recommended Nailing Schedule" of NFPA "Manual for Wood Frame Construction" and "National Design Specifications for Wood Construction".

3. In addition to all framing operations normal to the fabrication and erection indicated on the drawings, install all backing required for the work of other trades.

4. Set all horizontal or sloped members with crown up.
5. Do not notch, bore or cut members for pipes, ducts, conduits or other reasons except as shown on the drawings or as specifically approved in advance by the Architect.
6. Make all bearings full unless otherwise indicated on the drawings.
7. Finish all bearing surfaces on which structural members are to rest or as to give sure and even support; where framing members slope, cut or notch the ends as required to give uniform bearing surface.
8. Install all blocking, furring and similar items as shown on the drawings. Install solid blocking for all fire extinguishers, toilet accessories, toilet partitions, signage, and other such items to be installed, etc., as necessary for secure mounting.
9. Install roof edges and curbs in the locations shown on the drawings and in accordance with the details shown thereon.

E. Roof Decking: Install over framing, where called for on the drawings, securely anchored in place in accordance with APA, utilizing sheathing clips (plyclips) or solid blocking as recommended by APA.

F. Sheathing: Install plywood sheathing over studs in other locations shown on the drawings and in strict accordance with the Standard Specifications of American Plywood Association's Publication Design/Construction Guide, Residential and Commercial.

1. Corner and Intermediate Bracing: At all outside corners and at wood shear walls (shown on structural drawings), install one layer of 15/32" plywood sheathing nailed to studs as hereinbefore specified and overlay with 1/2" insulating wall sheathing, as specified in Section 07210.

2. Refer to Section 07600 for aluminum to be installed over sheathing, where shown on the drawings.

G. Backboard: Install plywood backboard all 3-walls of data closet (Space 111), full-height of walls.

H. Nailing: Using only the proper nails; do all nailing without splitting wood members, preboring as required, replace all split members.

I. Bolting:

1. Drill holes 1/16" larger in diameter than the bolts being used; drill straight and true from one side only.

2. Bolt threads must not bear on wood; use washers under head and nut where both bear on wood; use washers under all nuts.

J. Screws:

1. For lag screws and wood screws, prebore holes same diameter as root of thread; enlarge holes to shank diameter for length of shank.

2. Screw, do not drive, all lag screws and wood screws.

3.2 Field Quality Control:

A. Wood Preservative: Apply two brush coats of the approved preservative chemical all field cuts of treated lumber.

B. Clean Up:

1. At the end of each working day, or more often if necessary, thoroughly sweep all surfaces where refuse from this portion of the work has settled.

2. Remove the refuse to the area of the job set aside for its storage.

3. Upon completion of this portion of the work, thoroughly broom clean all surfaces.

END OF SECTION



SECTION 06190  
SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Wood roof trusses.
2. Wood girder trusses.
3. Wood truss bracing.

B. Related Sections:

1. Section 06100, Rough Carpentry
2. Section 07210, Building Insulation

1.3 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.

2. Indicate sizes, stress grades, and species of lumber.

3. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.

4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.

5. Show splice details and bearing details.

6. Submit truss shop drawing to Business Development Services for review prior to truss fabrication.

B. Delegated-Design Submittal: 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.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For metal connector-plate manufacturer and fabricator.
- B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.
- C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.
- D. Evaluation Reports: For the following, from ICC-ES:
  - 1. Metal-plate connectors.
  - 2. Metal truss accessories.

## 1.6 QUALITY ASSURANCE

A. 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.

- 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
- 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

- 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
- 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
- 3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design metal-plate-connected wood trusses.

B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated.
2. Maximum Deflection Under Design Loads:
  - a. Roof Trusses: Vertical deflection of  $L/240$  of span.

C. Comply with applicable requirements and recommendations of the following publications:

1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
3. TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

## 2.2 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Provide dressed lumber, S4S.
4. Provide dry lumber with 15 percent maximum moisture content at time of dressing.

B. Minimum Chord Size for Roof Trusses 2 by 6 inches nominal for both top and bottom chords. Trusses with a total clear span 12'-0" or less may have chords fabricated from 2x4 material if substantiated by engineer's calculations.

C. Minimum Specific Gravity for Top Chords: 0.55.

D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06100 "Rough Carpentry."

## 2.3 METAL CONNECTOR PLATES

A. Truss manufacturer shall furnish all clips, ties, metal connectors and required miscellaneous accessories to complete roof truss installation as part of this contract.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpine Engineered Products, Inc.; an ITW company.
2. Cherokee Metal Products, Inc.; Masengill Machinery Company.
3. CompuTrus, Inc.
4. Eagle Metal Products.
5. Jager Building Systems, Inc.; a Tembec/SGF Rexfor company.
6. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
7. Robbins Engineering, Inc.
8. Truswal Systems Corporation; an ITW company.

C. Source Limitations: Obtain metal connector plates from single manufacturer.

D. General: Fabricate connector plates to comply with TPI 1.

E. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for interior locations unless otherwise indicated.

## 2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.

B. Nails, Brads, and Staples: ASTM F 1667.

## 2.5 METAL FRAMING ANCHORS AND ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide light gauge metal anchors and clips for truss-to-truss connections by one of the following:

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated by Engineer's calculations. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

D. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below. Exact model of tie down to be selected based on Engineer's calculations.

E. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

F. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches (38 mm) wide by 1 inch (25 mm) deep by 0.040 inch (1.0 mm) thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

G. Roof Truss Girder Connectors: Prefabricated hanger type connectors for attaching secondary trusses to main roof girder trusses. Exact model of connector to be selected based on Engineer's calculations.

## 2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

## 2.7 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. 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.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

## 2.8 SOURCE QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.

1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.

2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.

B. Correct deficiencies in Work that special inspections indicate does not comply with the Contract Documents.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. 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.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses 24 inches on center nominally, with adjustments as required by floor plan. Adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

1. Anchor trusses to girder trusses as indicated by Engineer's calculations.

I. 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.

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

L. Replace wood trusses that are damaged or do not meet requirements.

1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

### 3.2 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION

SECTION 06200  
FINISH CARPENTRY AND MILLWORK

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to special conditions where specified hereinafter.

B. Referenced Publications:

1. Architectural Woodwork Quality Standards 6th Edition, Version 1.1, 1994 Edition as published by Architectural Woodwork Institute (AWI).

1.2 Related Sections:

A. Section 07600, Metal Flashing and Sheet Metal Work

B. Section 07900, Sealants and Caulking

C. Section 08110, Steel Frames and Doors

D. Section 08550, Vinyl Single-Hung Windows

E. Section 09900, Painting

1.3 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Shop Drawings: Fully dimensioned drawings, showing profiles of all standing and running trim at full size; shop drawings shall show method of installation and relationship of the items described hereinafter with adjacent and abutting surfaces and finishes.

C. Product Data: Manufacturer's descriptive literature, specifications and installation recommendations for each item specified hereinafter by manufacturer's catalog number.

1.4 Job Conditions:

A. Temperature: For a period of not less than 10 days prior to commencing installation of interior items, throughout the installation and until date of Architect's Certificate of Substantial Completion, provide heat to maintain a temperature of not less than 50 degrees F.

B. Humidity: In areas where items are being installed, throughout the installation and until date of Architect's Certificate of Substantial Completion, maintain a relative humidity of not more than 60%.

## PART 2 - PRODUCTS

### 2.1 Material:

#### A. Exterior Materials:

1. Exterior Columns: Design is based on products as manufactured by HB&G of the sizes and designs shown on the drawings.

a. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

b. Columns shall be "Permacast" fiber-reinforced polymer composite, waterproof, insect-proof; columns shall be plain-shaft, square as shown on drawings; columns shall be designed to structurally support loads as shown on the drawings. Sizes shall be as scheduled on the drawings.

(1) Pilasters: Match column design.

c. Column Capital and Base: Columns shall be designed fiberglass polymer construction; Tuscan design.

2. Solid Wood: #2 Spruce or better, sizes as shown on the drawings.

#### B. Interior Wood:

1. Opaque Finish: AWI Section 100, Grade 1, Ponderosa Pine (finger joints permitted).

2. Plywood: APA MDO (exterior) plywood, thicknesses as shown on the drawings.

C. Construction Adhesive: Heavy-duty construction adhesive, meeting South Coast Air Quality Management District Rule 1168 VOC limits.

#### D. Fastening Devices:

1. Nails:

a. For application to wood, nails shall be annular thread, coated steel and meet the requirements of FS FF-N-101.

b. For application to concrete or masonry, nails shall be smooth shank, hardened steel, with counter-sunk heads and meet the requirements of FS FF-N-101.

c. Finish nails shall be helical thread, hardened steel, bright finish, except coated nails shall be used in exterior work, and meet the requirements of FS FF-N-101.

E. Bolts: All bolts shall be of the sizes and types called for on the drawings; except where used in exposed to view work heads shall be round.

F. Wood Preservative: EPA approved copper naphthenate meeting AWPA P-8, containing not arsenic or chromium, equal to MCRS CuNap-8, as manufactured by Merichem Co. / Tuscaloosa, AL.2.2.

## 2.2 Fabrication:

A. General: Items of wood trim marked on the drawings with numbers prefixed by RB (Randall Brothers) or W (Willingham). These numbers are used to establish size and profile required only.

B. Standing and Running Trim: Fabricate to designs and sizes shown and in accordance with AWI for specified finish.

C. Columns: Fabricate to sizes and designs shown on drawings and in accordance with manufacturer's published specifications. All components shall be factory-primed.

## PART 3 - EXECUTION

### 3.1 Installation:

A. General: Install in the locations shown on the drawings and in compliance with the details shown thereon, plumb, true to line, level and fitted together, with joints mitered and glued, except interior corners may be coped and unless otherwise shown on the drawings, wood shall be attached to wood with nails, using only finishing nails in exposed to view work and to masonry and/or concrete with expansion bolts; thru bolts and expansion shields or toggle bolts. Exposed-to-view finish work shall have concealed fasteners.

B. Standing and Running Trim: Install in lengths as long as possible, attaching to blocking or backing materials at 24" o.c. maximum; all joints shall be staggered, mitered and glued.

1. Aluminum-Covered Trim: As specified in Section 07600.

C. Columns: Install in locations shown on drawings and in accordance with the manufacturer's written instructions.

1. All porches shown with columns shall also have pilasters as shown on drawings.

### 3.2 Finishing:

A. General:

1. All items shall be shop sanded.

2. After installation, all nails shall be counter-sunk, filled with putty and resanded for a smooth finish.

3. Where called for on the drawings, bolt heads shall be recessed and plugged with hardwood caps.

4. Seal all joints and junctures with adjacent materials. Refer to Section 07900, Sealants.

5. All exposed-to-view work shall be left ready to finish (opaque) as scheduled on the drawings or described in Section 09900.

3.3 Field Quality Control:

A. Debris Removal:

1. After work of this section is complete, remove all debris and leave areas broom clean.

2. Place of disposal is Contractor's responsibility.

B. Cleaning: Prior to final inspection, clean all finished surfaces, removing maskings, soil of other foreign materials from decorated surfaces.

END OF SECTION

SECTION 06410  
CABINETWORK

PART 1 - GENERAL

1.1 Quality Assurance

A. Industry Standards:

1. Some products and execution are specified in this Section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to special conditions where specified hereinafter.

2. Referenced Publications:

a. Architectural Woodwork Quality Standards and Guide Specifications 1985 Edition as published by Architectural Woodwork Institute (AWI)

b. Commercial Standards (CS)

c. Federal Specifications (FS)

d. National Institute of Justice (N.I.J.) 0108.01

3. Referenced Specifications: Section 08800, Glass and Glazing.

1.2 Related Sections:

A. Section 06651, Solid Surface Fabrications

B. Section 07900, Sealants and Caulking

C. Section 09900, Painting

D. Section 11450, Equipment

1.3 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Shop Drawings: Fully dimensioned drawings, showing profiles of all standing and running trim at full size; shop drawings shall show method of installation and relationship of the items described hereinafter with adjacent and abutting surfaces and finishes.

C. Catalog Cuts: Manufacturer's catalog cuts for all items of hardware described hereinafter.

D. Samples: Full color range available for cabinet finishes and plastic laminate.

#### 1.4 Job Conditions:

A. Temperature: For a period of not less than ten days prior to commencing installation of products of this section, throughout installation and until date of Architect's Certificate of Substantial Completion, provide heat to maintain a temperature of not less than 50 degrees F.

B. Humidity: In spaces where the products are being installed, throughout installation and until date of Architect's Certificate of Substantial Completion and occupancy permit, maintain relative humidity of not more than 60%.

C. Coordination with Other Trades: Because equipment and fixtures scheduled to be installed in cabinetwork are furnished under other section of this Project Manual as is utility hook-ups, coordinate with all trades to ensure installation and anchorage of the equipment and fixtures and to insure provisions for the utility sizing and locations.

### PART 2 - PRODUCTS

#### 2.1 Material:

##### A. Solid Wood:

1. Exposed to View: AWI Section 100 Grade 1, Select Red Oak, kiln-dried with moisture content of not more than 8%.

2. Unexposed to View: AWI Section 100, Grade 11, Southern Yellow Pine, plain cut, kiln-dried with moisture content of not more than 11%.

##### B Plywood:

1. For Transparent Finish: AWI Section 200, Veneer Core Grade A, Select Red Oak, veneer on exposed to view faces.

C. Plywood Underlayment: For stainless steel tops, solid surface tops, and plastic laminate surfaces, AWI Section 200, backing grade, mill option face veneers; thicknesses as shown on the drawings.

D. Laminated Plastic: 1/16" thick, meeting requirements of NEMA GA50 Grade 10/HCS.

E. Glue: CS 35, Type, 1, fully waterproof.

##### F. Hardware:

1. Hinges: One of the following:

- a. Clip 125 (125°) - Julius Blum, Inc., Stanley, NC.
- b. G383 (120°) - Grass America, Inc., Kernersville, NC.

2. Drawer Guides: One of the following

- a. No. 1429 - Knap & Vogt, Grand Rapids, MI.
- b. Model 7432 - Accuride International, Santa Fe Springs, CA.

3. Pulls: One of the following:
  - a. No. 1014 - Hager, St. Louis, MO.
  - b. No. 137 B26D - Ives, New Haven, CT.
4. Cabinet Shelf Hardware: Equal to No. 255 Standards with No. 256 Supports, ZC finish - Knappe & Vogt / Grand Rapids, Michigan.
5. Linen Shelf Hardware: Equal to 85 Series heavy-duty commercial grade standards with 185 Series brackets, depth as required for shelving; white finish – Knappe & Vogt / Grand Rapids, MI.
6. Grommets: 1-piece round with spring closure; 2-3/8" diameter hole, No. 429-99-324, by H'A'FELE America, Archdale, NC, or equal; color as selected by the Architect.

## 2.2 Fabrication:

### A. Cabinetwork:

1. Fabricate all cabinetry to the designs shown on the drawings and from the materials described hereinbefore. Fabrication shall be in accordance with AWI Section 400 Premium Grade for transparent finish.
2. Fabricate all shelving to designs shown on drawings and from materials described herein.
  - a. Fabrication shall be in accordance with AWI Section 400, Premium Grade for transparent finish where exposed to view surfaces are either plywood or solid wood; laminated plastic covered work shall be in accordance with AWI Section 400, Premium Grade.
3. Wood Items shall be shop-sanded, with all nail holes set and left ready to putty and finish as described in Section 09900.
4. Cabinet hardware shall be shop installed by the fabricator.
  - a. All cabinet shelf standards shall be recessed
5. Install one (1) grommet at each counter where knee space is shown (min. typical one (1) per counter at each knee space) except at desk in Control Room. Install a total of four (4) grommets at knee space in Control Room.
  - a. Grommet locations will be determined by the Owner in the field.

## PART 3 - EXECUTION

### 3.1 Installation:

#### A. Cabinetwork:

1. Install cabinetwork, including but not limited to base cabinets, wall cabinets, lavatory counters, and other cabinetwork, etc., in the locations shown on the drawings, in accordance with the details shown thereon, and securely anchored in place; items shall be installed level, plumb and true to line.

2. Cut-outs for Other Trades: Cut-outs for items described in other sections of this Project Manual shall be made by the fabricator at the job site after all cabinet work has been installed.

3. Solid Surface Counter Tops, Backsplashes, etc: As specified in Section 06651.

4. Stainless Steel for Covering Counter Tops, Backsplashes, etc.: As specified in Section 11450.

### 3.2 Field Quality Control

#### A. Applied Finishes:

1. All hardware shall be removed or masked prior to finishing.
2. Finishes are described in and are a part of Section 09900.

B. Hardware Adjustment: After finishing has been completed, reinstall hardware that was removed prior to finishing and remove all maskings and then inspect all hardware and adjust for proper operation.

END OF SECTION

SECTION 06651  
SOLID SURFACE FABRICATIONS

PART 1 - GENERAL

1.1 Summary:

- A. This Section includes vanity and desk tops and faces.

1.2 Related Section:

- A. Section 06410, Cabinetwork

1.3 Definition:

A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.4 Submittals:

A. Product Data: Submit product data for each type of product indicated, in accordance with Section 01300.

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

1. Show full-size details, edge details, thermoforming requirements, attachments, etc.

2. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.

3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in solid surface.

C. Samples: For each type of product indicated:

- 1. Submit minimum 6-inch by 6-inch sample.
- 2. Cut sample and seam together for representation of inconspicuous seam.
- 3. Submit full range of color and pattern variation for selection by the Architect.

D. Maintenance Data:

1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions.

a. Maintenance kit for finishes shall be submitted with close-out documents.

## 1.5 Quality Assurance:

A. Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

B. Fabricator/Installer Qualifications: Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

### C. Applicable Standards:

#### 1. Standards of the following, as referenced herein:

- a. American National Standards Institute (ANSI)
- b. American Society for Testing and Materials (ASTM)
- c. National Electrical Manufacturers Association (NEMA)
- d. NSF International

#### 2. Fire Test Response Characteristics:

a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:

- 1) Flame Spread Index: 25 or less.
- 2) Smoke Developed Index: 450 or less

## 1.6 Delivery, Storage, and Handling:

A. Deliver no components to project site until areas are ready for installation.

B. Store components indoors prior to installation.

C. Handle materials to prevent damage to finished surfaces.

1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

## 1.7 Warranty:

A. Provide manufacturer's warranty against defects in materials.

1. Warranty shall provide material and labor to repair or replace defective materials.

2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

## PART 2 - PRODUCTS

### 2.1 Manufacturers:

A. Basis of Design: "Corian®" surfaces from the DuPont Company.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed product.

B. Materials:

1. Solid Polymer Components:

a. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.

b. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.

c. Color shall be selected by the Architect from price group A or B.

2. Thickness: 1/2-inch

3. Edge Treatment: As selected by the Architect from the manufacturer's standard edges.

4. Performance Characteristics:

Property	Typical Result	Test
Tensile Strength	6,000 psi	ASTM D 638
Tensile Modulus	$1.5 \times 10^6$ psi	ASMT D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	$1.2 \times 10^6$ psi	ASTM D 790
Hardness	>85  56	Rockwell "M" Scale ASTM D 785 Barcol Impressor ASTM D 2583
Thermal Expansion	$3.02 \times 10^{-5}$ in./in./°C ( $1.80 \times 10^{-5}$ in./in./°F)	ASTM D 696
Gloss (60° Gardner) Light Resistance	5-75 (matte-highly polished) (Xenon Arc) No effect	ANSI Z124 NEMA LD 3-2000 Method 3.3
Wear and Cleanability	Passes	ANSI Z124.3 & Z124.6
Stain Resistance: Sheets	Passes	ANSI Z124.3 & Z124.6
Fungus and Bacteria Resistance Boiling Water Resistance	Does not support microbial growth No visible change	ASTM G21 & G22 NEMA LD 3-2000 Method 3.5
High Temperature Resistance	No change	NEMA LD 3-2000 Method 3.6
Izod Impact (Notched Specimen) Ball Impact Resistance: Sheets	0.28 ft.-lbs./in. of notch  No fracture – ½ lb. ball: 1/4" slab - 36" drop 1/2" slab - 144" drop	ASTM D 256 (Method A) NEMA LD 3-2000 Method 3.8
Weatherability Specific Gravity Water Absorption	$\Delta E^*_{94} < 5$ in 1,000 hrs. 1.7 Long-term 0.4% (3/4") 0.6% (1/2") 0.8% (1/4")	ASTM G 155  ASTM D 570

Toxicity	99 (solid colors) 66 (patterned colors)	Pittsburg Protocol Test ("LC50" Test)
Flammability	All colors (Class I and Class A)	ASTM E 84, NFPA 255 and UL 723
Frame Spread Index	<25	
Smoke Developed Index	<25	

5. Plywood Underlayment: As specified in Section 06410.

## 2.2 Accessories:

A. Joint Adhesive: Manufacturer's standard one or two part adhesive kit to create inconspicuous nonporous joints.

B. Sealant: Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant UL-listed silicone sealant in colors matching components.

## 2.3 Factory Fabrication:

### A. Shop Assembly:

1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.

a. Dimensions, shapes, and design shall conform with the counter details shown on the drawings.

2. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.

a. Reinforce with strip of solid polymer material, 2" wide.

3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.

4. Route and finish component edges with clean, sharp returns.

a. Route cutouts, radii and contours to template.

b. Smooth edges.

c. Repair or reject defective and inaccurate work.

## PART 3 – EXECUTION

### 3.1 Examination:

A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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

### 3.2 Installation:

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

1. Provide product in the largest pieces available.
2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
  - a. Exposed joints/seams shall not be allowed.
3. Reinforce field joints with solid surface strips extending a minimum of 1-inch on either side of the seam with the strip being the same thickness as the top.
4. Cut and finish component edges with clean, sharp returns.
5. Route radii and contours to template.
6. Anchor securely to base cabinets or other supports.
7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
8. Carefully dress joints smooth, remove surface scratches and clean entire surface.
9. Install countertops with no more than 1/8-inch sag, bow or other variation from a straight line.
10. Install grommets as specified in Section 06410.

#### B. Backsplashes and Applied Sidesplashes:

1. Install applied backsplashes and sidesplashes using manufacturer's standard color-matched silicone sealant.
2. Adhere applied backsplashes and sidesplashes to vanity and desk tops using manufacturer's standard color-matched silicone sealant.

### 3.3 Cleaning and Protection:

- A. Keep components clean during installation.
- B. Remove adhesives, sealants and other stains.

END OF SECTION



SECTION 07160  
BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications and standards (with respective abbreviations used). These referenced publications may be subject to special conditions or limitations where specified hereinafter:

2. Reference Publications

- a. American Society for Testing and Materials (ASTM).
- b. Federal Specifications (FS).

1.2 Related Sections:

- A. Section 04200, Unit Masonry
- B. Section 07210, Building Insulation

1.3 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Product Data: Manufacturer's detailed specifications, installation and maintenance instructions.

1.4 Product Handling:

- A. Delivery: Deliver products in original and unopened packaging with brand names and manufacturer's labels intact and legible.
- B. Storage and Protection: Store and protect products from damage as per their manufacturer's instructions.

1.5 Job Conditions:

- A. Environmental:
  - 1. Weather: Do not apply in damp or wet weather conditions:
  - 2. Temperature: 41 Degrees F or higher

PART 2 - PRODUCTS

2.1 Materials:

A. Bituminous Dampproofing: An asphalt base, non-fibered, clay emulsion and meeting requirements of ASTM D 1227, Type I and FS SS-R-1781.

B. Spray Applicator: Pump, hose, and pole gun as recommended by the manufacturer of the dampproofing being installed.

### PART 3 - EXECUTION

#### 3.1 Installation:

##### A. Surface Preparations:

1. Clean surfaces that are to receive bituminous dampproofing of all scale, loose mortar, dirt, oil, grease and other foreign matter.

2. Fill voids, cracks and holes with cement mortar and allow to dry.

B. Locations: All concrete masonry back-up, unless otherwise specifically noted, shall receive bituminous dampproofing.

C. Application of Bituminous Dampproofing: Spray apply to surfaces, including but not limited to any exposed footing areas, slots or groves, producing a continuous unbroken film, free of voids and pinholes and having a finished thickness of 1/8 inch.

END OF SECTION

SECTION 07210  
BUILDING INSULATION

PART 1 - GENERAL

1.1 Quality Assurance:

- A. Referenced Publication(s): American Society for Testing and Material (ASTM).

1.2 Related Sections:

- A. Section 04200, Unit Masonry
- B. Section 06100, Rough Carpentry
- C. Section 06190, Shop-Fabricated Wood Trusses
- D. Section 07160, Bituminous Dampproofing
- E. Section 07260, Vapor Barrier

1.3 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Product Data: Manufacturer's detailed descriptive and specification data, and installation instructions.
- C. Samples: 6 inches x 6 inches x full thickness for each insulation described hereinafter.

1.4 Product Handling:

- A. Delivery: Deliver materials in original and unopened packages, containers or bundles with brand names and manufacturer's labels intact and legible.
- B. Storage and Protection: Store and protect the products of this section from damage as per their manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 Materials:

- A. Batt / Blanket Insulation: Glass fiber insulation with foil facing formed with flanges at edges permitting either face or inset stapling, and meeting ASTM C 665, Type III, Class A and, exclusive of facing, passing ASTM E 136 combustion test requirements; required R-value of 19 for walls and 38 for attics; facing shall provide a vapor transmission (perm) rating of 0.50 maximum; R-values shall be printed directly on the face of the insulation.

- 1. Fasteners for Batt Insulation: Only those recommended by the manufacturer of the insulation.

B. Cavity Insulation: 1-inch thick closed cell moisture-resistant extruded polystyrene rigid foam insulation, Type X, meeting requirements of ASTM C578 R = 5.0; min. compressive strength of 15 psi.

1. Adhesive for Cavity Insulation: Only those recommended by the manufacturer of the insulation.

C. Exterior Wall Sheathing (Rigid Insulation): 1-inch thick (or ½-inch thick where specifically noted on the drawings and described in Section 06100) extruded polystyrene (XPS) rigid foam insulating wall sheathing, Type X, meeting the requirements of ASTM C-578; R = 5.0 (1-inch thick) and 3.0 (½-inch thick); minimum compressive strength of 15 psi; GREENGUARD-certified.

1. Mechanical Fasteners: As recommended by the insulation manufacturer.
2. Construction Tape: Same manufacturer as insulation products.

### PART 3 - EXECUTION

#### 3.1 Installation:

##### A. General:

1. Do not install insulation which is damaged, wet or soiled.
2. Comply with insulation manufacturer's recommendations and sequence, providing permanent placement and support.
3. Install insulation in a manner which will maximize continuity of thermal envelope; use single layer of insulation wherever possible to achieve indicated R-Value.
4. Cut insulation neatly to fit tightly around obstructions.

##### B. Batt Insulation:

1. Install batt insulation in metal studs at all exterior walls and in attic space. Installation of insulation shall be done in such a way as to provide a completely insulated building "envelope".
2. Unless specifically indicated otherwise on the Drawings, install facing side toward the winter warm side of construction.
3. If tears or punctures occur repair same immediately, using insulation manufacturer's procedure to restore insulation integrity.

##### C. Cavity Insulation:

1. Mount insulation on exterior face of back-up masonry walls (after installation of bituminous dampproofing as specified in Section 07160), adhering to surfaces with specified adhesive.
2. Joints shall be tightly butted, staggered and filled with same adhesive as was used to adhere insulation to back-up material.

D. Exterior Wall Sheathing:

1. Mount insulation on exterior face of stud wall framing, attaching to framing with mechanical fasteners of sufficient length to penetrate framing a minimum of  $\frac{3}{4}$ -inch; space fasteners at 6-inches o.c. around perimeter supports at 12-inches o.c. on intermediate supports.

2. Joints shall be tightly-butteted, staggered and sealed with construction tape.

3. At all outside building corners, install  $\frac{1}{2}$ -inch insulating wall sheathing over plywood wall sheathing (as specified in Section 06100) as shown on the drawings.

3.2 Field Quality Control:

A. Protection: Protect installed materials from damage and damaging weather elements until permanent concealing work is complete. Remove and replace all insulation damaged or exposed to rain, etc.

END OF SECTION



SECTION 07250  
PERIMETER FOUNDATION AND UNDERSLAB INSULATION

PART 1 - GENERAL

1.1 Scope: Furnish and install perimeter and underslab insulation shown on the drawings and/or described hereinafter.

1.2 Related Section:

A. Section 03300, Cast-in-Place Concrete

1.3 Submittals:

A. Advance Submittals:

1. Prior to delivery of any products of this Section, submit in accordance with Section 01300, the following:

- a. Manufacturer's data and installation instruction.
- b. Samples: Not less than 6" x 6" of actual insulation proposed.

PART 2 - PRODUCTS

2.1 Materials:

A. Basis of Design: Insulation equal to Foamular 250 as manufactured by Owens Corning, 1-inch thick, R-5 with minimum compressive strength of 25 psi. R-value shall be printed directly on the face of the product.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed product.

B. Adhesive as recommended and approved by the insulation manufacturer.

PART 3 - EXECUTION

3.1 Installation:

A. Install on the interior side of all perimeter foundation walls, extending full height from top of footing to underside of all slabs on grade and extending from interior face of foundation wall for 30-inches to the interior of the building; all joints tightly butted; adhere to foundation wall with approved adhesive.

END OF SECTION



SECTION 07260  
VAPOR BARRIER

PART 1 – GENERAL

1.1 Section Includes:

- A. Reinforced vapor retarders for wall applications.

1.2 Related Sections:

- A. Section 06100, Rough Carpentry
- B. Section 07210, Building Insulation

1.3 References:

- A. American Society for Testing and Materials (ASTM)

1.4 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Product Data: Manufacturer's detailed product specification and installation instructions.
- C. Sample: 12" x 12" of proposed product to be installed.
- D. Warranty: Manufacturer's Standard 5-year Warranty.

1.5 Delivery, Storage, and Handling:

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in a clean, dry area in accordance with manufacturer's instructions.
- C. Handling: Protect materials during handling and installation to prevent damage.

PART 2 – PRODUCTS

2.1 Materials:

- A. Vapor Barrier:
  - 1. Basis of Design: Griffolyn Type 65 Reinforced Vapor Barrier as manufactured by Reef Industries / Houston, Texas.
    - a. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

2. Properties:

- a. Material: 3-ply laminate, combining 2 layers of high-density polyethylene and 1-high-strength non-woven cord grid.
- b. Weight, ASTM D-751: 40 LB/1,000 ft<sup>2</sup>
- c. 3" Tensile Strength, ASTM D-882: 100 LBF
- d. Puncture Strength, ASTM D-4833: 24 LBF
- e. PPT Resistance, ASTM D-2582: 30 LBF
- f. Dart Impact Strength, ASTM D-1709: 1.1 LBS
- g. Cold Impact Strength, ASTM D-1790: -40°F
- h. Permeance, ASTM E-96: 0.038 Grain/Hr•Ft<sup>2</sup>•in.Hg

B. Accessories:

1. General: Ensure accessories are from same manufacturer as reinforced vapor retarders.
2. Mastic Tape: Equal to Griffolyn Fab Tape.
  - a. Description: Black, double-sided, asphaltic, pressure-sensitive, mastic tape.
  - b. Thickness: 35 mils.
  - c. 3-inch Seam Shear: 31 pounds.
3. Self-Adhesive Repair Tape: Of same manufacture as vapor barrier.
4. Pipe Boots: Of same manufacture as vapor barrier.

C. Fasteners: As recommended by the manufacturer of the material being installed.

PART 3 – EXECUTION

3.1 Installation:

A. Preliminary Requirement: Install vapor barrier over all exterior wall sheathing and cavity insulation. Do not install barrier until all exterior wall sheathing/insulation is in place. Insure insulation is smooth with no sharp projections.

B. Vapor Barrier:

1. Install vapor barrier in accordance with manufacturer's instructions.
2. Install vapor barrier continuously at all exterior walls. Ensure there are no discontinuities in vapor barrier at seams and penetrations, overlapping in accordance with manufacturer's recommendations.

3. Install vapor barrier in largest practical widths.
  4. Join sections and seal penetrations in vapor barrier with self-adhesive tape. Ensure surfaces to receive tape are clean and dry.
  5. Immediately repair holes with self-adhesive repair tape.
  6. Seal around pipes and other penetrations with pipe boots in accordance with manufacturer's instructions.
- C. Install in accordance with manufacturer's written instructions.

### 3.2 Field Quality Control:

- A. Protection: Protect vapor barrier from damage during subsequent work; should damage occur, make replacements and repairs as necessary to maintain integrity of the vapor barrier.

END OF SECTION



SECTION 07311  
FIBERGLASS SHINGLE ROOFING

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to conditions or limitations where specified hereinafter.

2. Referenced Publications:

- a. American Society for Testing and Materials (ASTM).
- b. National Roofing Contractors Association (NRCA).
- c. Underwriter's Laboratories, Inc. (UL).

B. Installer Qualifications: A company which has been successfully engaged in the installation of materials as described hereinafter for a period of not less than 5 years immediately prior to performing the work of this section.

C. Project Installation Guarantee: Furnish to the Owner a written agreement signed by the installer and the Contractor, guaranteeing to correct failures in product and workmanship for a period of not less than 2 years from date of Architect's Certificate of Substantial Completion.

D. Manufacturer's Warranty: Furnish manufacturer's standard warranty guaranteeing to correct failures in product which may occur during the warranty period, without reducing or otherwise limiting any other rights to correction which the Owner may have under the Contract Documents.

1. Warranty Period: Lifetime limited transferable warranty with 5-year non-prorated material and installation labor coverage.

- a. Wind Warranty: 130 mph limited wind warranty.
- b. Ridge Vents: 40-year limited warranty.

1.2 Related Sections:

- A. Section 06100, Rough Carpentry
- B. Section 07525, Modified Bituminous Sheet Roofing
- C. Section 07600, Metal Flashing and Sheet Metal Work

1.3 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Product Data: Manufacturer's detailed descriptive and specification data, and installation instructions FOR PRODUCTS OF THIS SECTION.

- C. Samples: Manufacturer's full range of colors and textures available.
- D. Specimen Copies: Furnish specimen copies of:
  - 1. Project Installation Guarantee.
  - 2. Manufacturer's Warranty.
- E. Extra Stock: Twenty (20) bundles of the shingle type and color used in the work.

#### 1.4 Product Handling:

- A. Delivery: Deliver products in manufacturer's original packaging with labels intact and legible.
- B. Storage and Protection: Store materials separated from the ground and in a dry location, protected until installation in accordance with manufacturer's instructions.

#### 1.5 Job Conditions:

- A. Sequencing: Coordinate shingle installation with flashing and other work integral with shingles.
- B. Environmental Conditions: Follow manufacturer's instructions regarding acceptable weather conditions for installation of the products of this section.

### PART 2 - PRODUCTS

#### 2.1 Materials:

A. Basis of Design: "Timberline Natural Shadow" shingles as manufactured by GAF Materials Corporation.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

B. Characteristics: UV resistant, mineral-surfaced, self-sealing, glass fiber mat base meeting ASTM D3018 Type 1:

- 1. Size: 12' x 36" with 5-5/8" exposure
- 2. Wind resistance: UL 997 meeting ASTM D3161 Type I wind resistance.
- 3. Fire Resistance: Class A, UL 790, certified to meet ASTM D3462
- 4. Color: Selected by Architect from manufacturer's standard colors.
- 5. Fungus-Resistant: Manufacturer's standard treatment to prevent fungus spore growth on shingle surface.
- 6. Accessories:
  - a. Hips and Ridges: Furnish factory prefabricated hip and ridge cap shingles.

b. Ridge Vents: Equal to GAF "Cobra Rigid Vent 2" (18 square inches per linear foot), designed for installation of manufacturer's ridge cap shingles.

c. Soffit Vents: As detailed on the drawings.

d. Eave Vents: Equal to Smartvent, as manufactured by D.C.I. Products, 9 sq. inches per linear foot; provide end caps at terminations.

e. Roof Vents: Equal to No. 135 roof louver as manufactured by Lomanco, Inc., or equal; all-aluminum construction with rain guard and screen; 144 square inches net free area.

B. Roofing Deck Underlayment: Fiberglass-reinforced, water-repellant breather-type building paper, U.L. classified for Class A shingles, equal to GAF "Shingle-Mate."

C. Asphalt Cement: Fibrated asphalt cement, asbestos free and meeting ASTM D4586.

D. Waterproofing Underlayment: Sheet barrier of self-adhering fiberglass-reinforced membrane shingle underlayment having "split" back plastic release film, equal to GAF "StormGuard."

1. Underlayment shall have warranty equal in duration to that of shingles applied.

E. Nails: Standard round wire shingle type, zinc-coated steel or aluminum; 10 to 12 gauge, barbed or deformed shank, with heads 3/8 inch to 7/16 inch in diameter; length sufficient to penetrate through roof deck.

### PART 3 - EXECUTION

#### 3.1 Preparation:

A. Examination: Review substrate to receive shingles for obstructions, loose sheathing, or voids in sheathing. Repair or replace unacceptable work which may affect proper material installation.

#### B. Preparation:

1. Remove projections and debris from substrate before starting installation. Lay sheet metal over minor voids (cracks over 1/2", loose knots, etc.) and nail to substrate.

2. Secure all vent stacks, curbs, and other penetrations to substrate before starting shingle installation.

3. Clean deck surfaces thoroughly prior to installation of underlayments.

4. At areas to receive waterproofing underlayment, fill knot holes and cracks with latex filler as recommended by the manufacturer.

5. Refer to Section 07600, Metal Flashing and Sheet Metal Work, for eave drip and other flashing.

### 3.3 Installation of Roofing:

A. Roof Deck Underlayment shall be installed in accordance with manufacturer's instructions. Apply one layer of underlayment horizontally over substrate, with 2-inch minimum side laps and 4-inch minimum end laps. Secure with roofing nails until shingles are installed.

#### B. Waterproofing Underlayment:

1. Eaves, Rakes, etc.: Install one layer of waterproofing underlayment in accordance with manufacturer's instructions, to a min. of 36" around complete perimeter roof edge (eaves, rakes, etc.). Lap over roof deck underlayment a min. of 6" at rakes; lap roof deck underlayment over waterproofing underlayment a minimum of 6" at eaves.

2. Junctures with Vertical Surfaces: Where any roof abuts a vertical surface, install one layer of waterproofing underlayment a min. of 36" wide and to 24" beyond each direction. Lap over roof deck underlayment a min. of 6".

3. Valleys: Install one layer of waterproofing underlayment in accordance with manufacturer's instructions, a min. of 36" wide centered over valleys; lap joints a min. of 6" and lap over roof deck underlayment a min. of 6".

4. For roof slopes less than 4:12, apply waterproofing underlayment to complete roof deck surface and to a min. of 24" beyond each direction. Lap over roof deck underlayment a min. of 6".

a. At modified bituminous sheet roofing (Section 07525), lap waterproofing underlayment over separation board a minimum of 6" at all perimeters.

5. Roof Penetrations: Install waterproofing underlayment at all roof penetrations, to a minimum of 20-inches beyond the penetration in all directions.

C. Roof Vents, Soffit Vents, and Eave Vents: Install in accordance with manufacturer's instructions.

#### D. Shingles:

1. Start shingle installation with row of inverted shingles without tabs or layer or roll roofing placed along full length of eave and fastened.

a. Shingles at eaves shall overhang the eave drip metal a min. of 1/4" and a max. of 1/2".

2. Secure shingles with a minimum **6-nails** per shingle.

a. Shingles must be nailed within 2-1/2" from each edge and a nominal 5-5/8" from the bottom of the shingle, above the cut-out.

b. No nails shall be exposed.

3. Coursing - Roof:

a. Install shingles in accordance with "The NRCA Steep Roofing Manual", and in accordance with manufacturer's instructions.

b. Pattern: Cutouts to break joints on center of shingle tab of shingle course below.

c. Valley Construction: Closed cut valley in accordance with Figure 22 of the NRCA Steep Roofing Manual, except as modified on the drawings.

d. Hips and Ridges: Boston.

(1) Install ridge cap shingles and hip shingles as recommended by manufacturer.

### 3.2 Field Quality Control:

A. Cleaning: Remove construction debris from roof surfaces.

B. Replacements: Replace any shingles broken or damaged during installation.

END OF SECTION



SECTION 07460  
VINYL SIDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Solid vinyl siding.

1.2 RELATED SECTIONS

- A. Section 06100, Rough Carpentry
- B. Section 07260, Vapor Barrier
- C. Section 07600, Metal Flashing and Sheet Metal Work
- D. Section 07900, Sealants and Caulking

1.3 REFERENCES

- A. ASTM D 256 - Standard Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
- B. ASTM D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
- C. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
- D. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load.
- E. ASTM D 696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 Degrees C. and 30 Degrees C.
- F. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- G. ASTM D 2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
- H. ASTM D 3679 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding.
- I. ASTM D 4477 - Standard Specification for Rigid Unplasticized Poly(Vinyl Chloride) (PVC) Soffit.
- J. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- K. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2000.
- L. UBC STD 26-9 - Method of Test for the Evaluation of Flammability Characteristics of Exterior, Nonload-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus; 1997.

## 1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Maintenance and care requirements.
- C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Provide installer with not less than three years of experience with products specified.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store on a flat surface under cover, stacked no more than 12 boxes high. Do not store in location where temperatures may exceed 130 degrees F.

## 1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## 1.8 WARRANTY

- A. Provide manufacturer's standard limited lifetime warranty.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: "Cedar Discover" hand-split shake siding as manufactured by Mastic Home Exteriors / Ply Gem.

- B. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

### 2.2 MATERIALS

- A. Siding - General Requirements: Polyvinyl chloride products with the following characteristics:

1. Siding: Comply with ASTM D 3679, Class 2.
2. PVC cell classification in accordance with ASTM D 1784: 13334.
3. Coefficient of linear expansion in accordance with ASTM D 696: 0.000029 inch per inch per degree F.
4. Tensile strength when tested in accordance with ASTM D 638: Minimum 7,100 pounds per square inch.
5. Modulus of elasticity when tested in accordance with ASTM D 638: Minimum 360,000 pounds per square inch, average.
6. Izod impact, standard 1/8 inch bar when tested in accordance with ASTM D 256: 3.30 foot-pounds per inch, average.
7. Shore D Hardness: Minimum 73.
8. Specific Gravity: Minimum 1.39.
9. Deflection temperature when tested in accordance with ASTM D 648: 170 degrees F, 264 pounds per square inch.
10. Smoke density rating when tested in accordance with ASTM D 2843: 48 percent, average.
11. Horizontal flammability, when tested in accordance with ASTM D 635:
  - a. Burn distance: 20 mm.
  - b. Burn time: Less than 5 seconds.
12. Surface burning characteristics when tested in accordance with ASTM E 84: Flame spread less than 20, fuel contribution 0, smoke density 400.
13. Fire Resistance - Siding: 1 hour, when tested in accordance with ASTM E 119, with siding applied over gypsum sheathing.
14. Flammability - Siding: Comply with requirements of UBC Std 26-9.
15. Structure Insulation System, foamed backed siding with EPS foam backing has a Permeability Rating of 5.
  - B. Fasteners: Aluminum nails, alloy 5056 or 6110, having minimum tensile strength 63,000 pounds per square inch.
  - C. Substrate: Specified in Section 06100.
  - D. Vapor Retarder: Specified in Section 07260.
  - E. Joint Sealers: Specified in Section 07900.

## 2.3 VINYL SIDING AND TRIM

- A. Vinyl Siding : "Cedar Discovery" Hand-split Shake Siding: Double 9-3/8 profile, 18-3/4 inches exposure; nominal 0.080 inch material thickness; 67-3/4 inch lengths.

1. Finish: Cedar wood grain texture.
  2. Color: As selected from manufacturer's full range of available colors.
- B. Vinyl Trim:
1. J-Trim: Channel, 1-3/4" nailing leg, 3/4" forward leg, 5/8" channel width; color to match siding.
- C. Accessories: Other accessories, trim, etc., for complete installation.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared. Verify dimensions and acceptability of substrate

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Installation of vapor retarder is specified in Section 07260.
- C. Attach vinyl products to substrate for weathertight installation; ensure that horizontal components are installed true to level, that vertical components are installed true to plumb.
- D. Stagger lap joints in horizontal siding in uniform pattern as successive courses of siding are installed.
- E. Install joint sealers are specified in Section 07900.

### 3.4 ADJUSTING AND CLEANING

- A. Clean dirt from surface of installed products, using mild soap and water.
- B. After completing installation, remove from project site excess materials and debris resulting from installation of vinyl products.

### 3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07525  
MODIFIED BITUMINOUS SHEET ROOFING

PART 1 - GENERAL

1.1 Quality Assurance

A. Industry Standards:

1. Some products and execution are specified in this Section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to special condition where specified hereinafter.

2. Referenced Publications:

- a. Factory Mutual (FM)
- b. Federal Specifications (FS)
- c. American Society for Testing and Materials (ASTM)

B. Qualifications of Contractor: Certified installer of the manufacture of the roofing system being installed.

C. Manufacturer's Guarantee: Non-prorated 10-year bond.

1.2 Related Sections:

- A. Section 06100, Rough Carpentry
- B. Section 06190, Shop Fabricated Wood Trusses
- C. Section 07311, Fiberglass Shingle Roofing
- D. Section 07600, Metal Flashing and Sheet Metal Work

1.3 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Samples:

- 1. 12"x 12" of each sheet component of the roofing and flashing membranes.
- 2. 12"x 12" of each insulation type.

C. Product Data:

1. Latest edition of roofing system manufacturer's detailed material specifications and installation instructions.

2. Latest edition of installation manufacturer's specifications and installation instructions.

1.4 Product Handling:

A. Delivery: Deliver materials in manufacturer's original containers or packages with labels intact and legible.

B. Storage: Store materials in a weather-protected environment, clear of ground and moisture.

1.4 Job Conditions:

A. Environmental: Comply with the roofing system manufacturer's requirements.

PART 2 - PRODUCTS

2.1 Materials:

A. Roof Insulation: Closed cell polyisocore integrally-laminated to heavy black (non-asphaltic) fiber reinforced felt facers, thickness as required, meeting ASTM C-1289, Type II. Use tapered insulation where necessary to provide positive slope of 1/4 inch per foot minimum.

B. Separation Board: 1/2" thick, perlite.

C. Modified Bituminous Sheet Roofing System:

1. Manufacturer:

a. Modified Bituminous sheet roofing systems as manufactured by the following are acceptable subject to the terms and conditions of the specifications:

- (1) Soprema Roofing & Waterproofing, Inc., Atlanta, GA
- (2) Siplast, Irving, TX

2. Base Sheet: Type IV Glass Fiber Felt, 1 ply.

3. Second Ply Sheet: Intermediate ply - A 180 gram polyester mat reinforced, SBS modified bitumen sheet, meeting ASTM D-5147 and ASTM D-6164.

4. Top Sheet (Field Sheet): A 250 gram polyester mat reinforced granular surfaced, SBS modified bitumen cap sheet, white granular mineral surface, meeting ASTM D 5147 and ASTM D 6164.

5. Flashing: A 250 gram polyester mat reinforced granular surfaced, SBS modified bitumen cap sheet, meeting ASTM D 5147 and ASTM D 6164, Type 1, Grade S.

6. Asphalt ASTM D 312-84, Type III or IV

7. Termination Bars: Unless specifically shown otherwise on the drawings shall be roof manufacturer's standard galvanized metal with caulking receptor.

8. Lead Flashing: 4 lbs. sheet lead.

9. Sealant: Single-component polyurethane, gun grade, complying with FS TT-S-0023C, Type II, Class A and ASTM C920, Types, Grade NS, Class 25; color as selected by Architect.

### PART 3 - EXECUTION

#### 3.1 Preliminary Requirements:

A. Inspection: Contractor shall examine surfaces receiving roofing and flashing and accept them as being satisfactory before proceeding with the work. Surfaces shall be dry, smooth, clean and free of debris and loose materials.

#### 3.2 Installation:

A. Insulation: Install layer of insulation mechanically fastened to roof deck; meet requirements of FL Class 1, 1-90; stagger joints; install tapered insulation as necessary to provide positive drainage as required hereinbefore.

1. Crickets: Form from tapered stock and installed over separation board with slope sufficient to provide drainage to the formed valleys (1/4 inch per foot minimum slope); install in solid mopping of hot steep asphalt.

2. Joints: All joints in the insulation system shall be tightly butted and tightly fitted to projections and terminations.

B. Separation Board: Over insulation install 1/2" thick layer of separation board (Perlite), in solid mopping of hot steep asphalt; stagger joints and stagger all joints between layers.

#### C. Roofing System and Flashings:

1. Lap waterproofing underlayment (as specified in Section 07311) a minimum of 6" over all perimeter edges of separation board.

2. Over separation board install base sheet, side lapping 3 inches and end lapping 3 inches, in mopping of Type III or IV asphalt; stagger joints.

3. Over base sheet install intermediate ply sheet in accordance with specification 3 PID (Alternate).

4. Over intermediate ply install top sheet in accordance with specification NF-605.

5. Flashings shall be installed in accordance with the details shown on the Drawings and the applicable details contained in manufacturer's "SBS Modified Bitumen Specification".

6. Where "All" asphalt bleeds occur, apply matching mineral granules to produce a roofing and flashing system with no visible bleeds showing.

D. Binder Bar: Install where called for on the drawings or as required by the manufacturer of the roofing system being installed.

E. Caulking: Install sealant in locations shown on the drawings or as required by the manufacturer of the roofing system being installed.

3.3 Field Quality Control:

A. Clean-up: Remove all debris and leave roof broom clean.

END OF SECTION

SECTION 07600  
METAL FLASHING AND SHEET METAL WORK

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to special conditions where specified hereinafter.

2. Referenced Publications:

a. Architectural Sheet Metal Manual as published by Sheet Metal and Air Conditioning Contractors, National Association, Inc., (SMACNA).

b. Federal Specifications (FS).

1.2 Related Sections:

- A. Section 06100, Rough Carpentry
- B. Section 06200, Finish Carpentry and Millwork
- C. Section 07260, Vapor Barrier
- D. Section 07311, Fiberglass Shingle Roofing
- E. Section 07460, Vinyl Siding
- F. Section 07525, Modified Bituminous Sheet Roofing
- F. Section 07715, Metal Soffit Systems
- G. Section 07900, Sealants and Caulking

1.3 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Shop Drawings: Fully dimensioned, showing actual field dimensions, and showing method of installation and relationship to abutting materials and finishes.
- C. Samples: Submit samples as follows (full size x 6" long):
  - 1. Eve drip
  - 2. Flashing / Step-Flashing / Counter-Flashing
  - 3. Aluminum cladding for covering trim materials, eaves, soffits, etc.
  - 4. Gutters and Downspouts

#### 1.4 Product Handling:

A. Protection: Deliver products in such a way as to prevent damage during transporting.

B. Storage and Protection: Store materials separated from the ground in a housed, dry and ventilated area and protect from damage.

#### 1.5 Job Conditions:

A. Sequencing: Coordinate installation of flashing and sheet metal work with installation of other work integral with the work of this section.

B. Environmental: Adhere to requirements of the manufacturer regarding acceptable weather conditions for installation of the products of this section.

### PART 2 - PRODUCTS

#### 2.1 Materials:

A. Sheet Metal: Except as otherwise shown on the drawings or required hereinafter, all sheet metal shall be factory finish in baked enamel over aluminum in gauges as specified herein.

1. Exposed-to-View: Color(s) shall be as selected from manufacturer's standard.

2. Concealed Flashing: "Clear finish" aluminum.

B. Felt: Asphalt saturated, weighing 15 pounds per 100 square feet.

C. Building Paper: Smooth saturated quality, rosin-sized, weight not less than 6-pounds per 100 square foot.

D. Fastening Devices: Those best suited for particular use intended, of non-corrosive, compatible metal.

1. For Use with Aluminum:

a. All nails, rivets, screws, expansion inserts, bolts and similar fastenings shall be best grade stainless steel.

b. Nails for application to wood shall be flat head, "stronghold" type, not less than 12 gauge and not less than 1" long.

c. Screws and bolts shall have round heads and shall be of proper size for the specific application.

E. Sealant: As described in Section 07900.

#### 2.2 Fabrication:

A. General: Fabricate and install all components in maximum length practical. (In General)

B. Miscellaneous Flashings: Install all other metal flashings where called for on the drawings and in accordance with the details shown thereon, lapping joints not less than 4 inches unless otherwise shown.

### 2.3 Detail Requirements:

A. Eave Drip: Profile as detailed. Fabricate from .032 aluminum in 10'-0" lengths.

B. Cladding (fascia / soffit, etc.): Fabricate from .032 aluminum trim coil; profile(s) as detailed.

C. Flashing: Profile as detailed. Fabricate from .032 aluminum SMACNA Figure 4.7A.

D. Gutter: Profile and size as detailed, fabricated from .032 aluminum in 10'-0" length with expansion joint per SMACNA, Figure 1-3.

E. Down Spouts: Profile and size as detailed. Fabricate from .032 smooth aluminum in 10'-0" length with supports per SMACNA F16.1-35B.

F. Accessories: Provide joint covers, continuous hold-down clips, etc., as necessary for complete installation. Accessories shall match adjacent material and finish, except where noted otherwise herein.

## PART 3 - EXECUTION

### 3.1 Preliminary Requirements:

A. Coordinate installation of metal flashings and sheet metal work with erection of wall construction and installation of the roofing systems.

B. Prior to installing any metal flashings or sheet metal work over wood blocking or roofing felts, apply layer of building paper, using a minimum number of fasteners, to separate metal items from wood or felts.

### 3.2 Installation:

A. General: All sheet metal items shall be separated from asphaltic roofing materials with building paper, installed just prior to installation of the sheet metal items.

1. Install sheet metal work with joints at corners and symmetrically spaced at all faces.

B. Eave Drip: Install in locations shown on the drawings, in lengths not exceeding 10-feet; each joint shall have back-up plate and over plate; cover plate to be 8-inches in width as is back-up plate; joint to be ¼-inch; set back-up plate in mastic; hold molding in place with continuous cleats.

1. Eave drip shall be installed in maximum possible lengths so as to minimize short pieces.

2. Joints shall be located symmetrically.

3. Inside corners and outside corners shall be neatly cut and sealed. Do not bend eave drip around corners.

4. Eave drip shall be securely snugged against the roof edges and fascia and shall follow the fascia in neat, straight lines.

5. At joints, provide a min. 4" wide cover plate to cover face nails at the joints.

6. Exposed face nails at eave drip will not be allowed.

7. Seal all joints at eave drip. Refer to Section 07900.

C. Clad wood (fascia/soffit, etc.) using brake formed sections of aluminum cladding per details. Formed sections shall be one continuous length, limiting joints wherever possible. Install in accordance with manufacturer's instructions using non-ferrous nails and aluminum "pop-rivets". Telescope joints and conceal fasteners. Installation shall be free of "kinked", creased or warped surfaces. Lap and telescope joints to shed water.

1. Metal trim shall be installed in maximum possible lengths so as to minimize short pieces.

2. Joints shall be located symmetrically.

3. Inside corners and outside corners shall be neatly cut and sealed. Do not bend metal trim around corners.

4. Metal trim shall be securely snugged against adjacent materials and surfaces, and shall run in neat, straight lines.

5. Exposed face nails at metal trim will not be allowed.

6. Seal all joints at metal trim. Refer to Section 07900.

D. Flashings: Install in locations shown on the drawings and in accordance with the details shown thereon, in lengths not exceeding 20 feet; each joint shall be a slip joint, except for mitered corners shall be soldered; joints shall be lapped 3-inches minimum and sealed.

E. Gutters and Downspouts: Install in locations shown on drawings and in accordance with details shown thereon. Furnish gutter sections in 10'-0" lengths with 6" wide concealment joint covers. Furnish hangers at 30" o.c. at gutters and 1-1/2" wide straps at 5' o.c. at downspouts, equally and symmetrically spaced. For gutters provide corners, end caps, expansion joints, outlets, elbows, etc., as required for complete installation. Install strainer at each downspout.

### 3.3 Field Quality Control:

A. Clean-up: After sheet metal work is complete remove all debris generated as a result of this work from the project site.

B. Disposal: Place of disposal is Contractor's responsibility.

END OF SECTION

SECTION 07650  
FLEXIBLE FLASHING

PART 1- GENERAL

1.1 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Product Data: Manufacturer's detailed descriptive and specifications data and installation instructions.
- C. Samples: 12" x 12" minimum of the membrane.

1.2 Related Sections:

- A. Section 04200, Unit Masonry
- B. Section 06100, Rough Carpentry
- C. Section 07210, Building Insulation
- D. Section 07260, Vapor Barrier

1.3 Product Handling:

- A. Delivery: Deliver the products of this section in manufacturer's unopened packaging with labels intact and legible.
- B. Storage and Protection: Store and protect the products of this section in order to prevent damage from any source.

PART 2 - PRODUCTS

2.1 Materials:

A. Flexible Flashing:

1. Basis of Design: Design shall be equal to Vycor Plus as manufactured by Grace Construction Products.

a. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

2. Properties:

a. Cross-laminated HDPE, 25 mil thickness, with rubberized asphalt back and paper release liner.

B. Primer: As recommended by the product manufacturer for the specific project substrates.

C. Fasteners: Smooth shank fasteners as recommended by the product manufacturer.

### PART 3 - EXECUTION

#### 3.1 Installation:

A. Locations Flexible flashings shall be installed in the following locations:

1. In exterior walls at heads of doors, windows, louvers, and similar openings.
2. In exterior walls at floor lines and where wall terminates above finish spaces.
3. In exterior walls at sills of windows, louvers, and similar openings.
4. Other locations as shown on the drawings.

B. Flexible Flashings:

1. Flexible flashings shall be installed in full height or width strips with a minimum of running joints.
  - a. Apply primer to exterior wall sheathing and other substrate materials as recommended by the manufacturer.
2. Seal to substrate per manufacturer's instructions.
3. Joints shall be lapped not less than 6", fully sealed, and installed such that all laps shed water.
4. Mechanically fasten membrane at all vertical terminations.
5. The top edge of the membrane shall be mechanically attached to the framing prior to installation of the wall sheathing.
6. The bottom edge of the membrane shall extend horizontally to within 1/2" of the exterior wall face. Seal according to manufacturer's instructions.
7. At head of doors, windows, louvers and other openings, extend membrane 12" beyond each jamb and at sill shown on the drawings, extend membrane 12" beyond each jamb.

END OF SECTION

SECTION 07715  
METAL SOFFIT SYSTEMS

PART 1 – GENERAL

1.1 Section Includes:

- A. Preformed, prefinished metal soffit panels.
- B. Miscellaneous trim, flashing, closures, drip flashing, and accessories.
- C. Fastening devices.

1.2 Related Section:

- A. Section 06100, Rough Carpentry
- B. Section 06200, Finish Carpentry and Millwork
- C. Section 07600, Metal Flashing and Sheet Metal Work

1.3 References:

- A. American Iron & Steel Institute (AISI) Specification for the Design of Coldformed Steel Structural Members.
- B. ASTM A-653 & ASTM A924 Steel Sheet, Zinc-Coated (Galvanized).
- C. Spec Data Sheet – Galvalume Sheet Metal by Bethlehem Corp.
- D. SMACNA – Architectural Sheet Metal Manual.

1.4 Assembly Description:

- A. The assembly includes preformed sheet metal panels, related accessories, corners, miscellaneous flashing and attaching devices.

1.5 Submittals:

- A. Submit detailed drawings showing layout of panels, anchoring details, joint details, trim, flashing, and accessories in accordance with Section 01300.
- B. Submit a sample of each type of panel, complete with factory finish.

1.6 Quality Assurance:

- A. Manufacturer: Company specializing in Architectural Sheet Metal Products with ten (10) years minimum experience.

1.7 Delivery, Storage and Handling:

- A. Upon receipt of panels and other materials, installer shall examine the shipment for damage and completeness.

B. Panels should be stored in a clean, dry place. One end should be elevated to allow moisture to run off.

C. Panels with strippable film must not be stored in the open, exposed to the sun.

D. Stack all materials to prevent damage and to allow for adequate ventilation.

#### 1.8 Warranty:

A. Paint finish shall have a 20-year guarantee against cracking, peeling and fade.

### PART 2 – PRODUCT

#### 2.1 Soffit System:

A. Basis of Design: Berridge VEE-Panel Soffit System as manufactured by Berridge Manufacturing Company.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

B. Panels shall have 12-3/4" exposure, 3/8" deep vee grooves at 4-1/4" on center, with concealed fasteners and interlocking sidelap; vented and non-vented panels are required.

C. Panels shall be site formed with the Berridge VEE-14 Portable Roll Former in continuous length per soffit length or factory fabricated to full length required.

D. Attachment to metal supports with #8 x 12" TEKS screws at maximum spacing of 2'-0" on center.

E. Vented panels to have a Net Free Vent Area (NFVA) of 9.88 square inches for square foot of panel.

#### 2.2 Sheet Materials:

A. Prefinished Metal shall be Hot-Dipped Galvanized – ASTM A446-85 Grade C G90 Coating A525-86 24 Gauge core steel.

B. Finish shall full strength Kynar 500 Fluoropolymer coating, applied by the manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.70 to 0.90 mil over 0.25 to 0.35 mil prime coat, to provide a total dry film thickness of 0.95 to 1.25 mil. Bottom side shall be coated with primer with a dry film thickness of 0.25 mil. Finish shall conform to all test for adhesion, flexibility, and longevity as specified by the Kynar 500 finish supplier.

C. Strippable film shall be applied to the top side of the painted coil to protect the finish during fabrication, shipping and field handling. This strippable film must be removed before installation.

#### 2.3 Accessory Materials:

A. Fasteners: As recommended by the manufacturer for the specific installation.

B. Accessories, closure pieces, edge trim, etc., as required for complete installation: Manufacturer's standard 16-gauge.

2.4 Fabrication:

- A. All exposed adjacent flashing shall be of the same material and finish as the panels.
- B. Hem all exposed edges of flashing on underside, ½ inch.

PART 3 – EXECUTION

3.1 Installation:

A. Comply with manufacturers standard instructions and conform to standards set forth in the Architectural Sheet Metal Manual published by SMACNA, in order to achieve a watertight installation.

B. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb.

C. Install starter and edge trim before installing panels.

D. Remove protective strippable film prior to installation of panels.

E. Attach panels using manufacturer's standard clips and fasteners, spaced in accordance with approved shop drawings.

F. Do not allow panels or trim to come into contact with dissimilar materials.

G. Protect installed panels and trim from damage caused by adjacent construction until completion of installation.

H. Remove and replace any panels or components which are damaged beyond acceptable repair.

I. Refer to drawings for layout and pattern of vented and non-vented panels.

3.2 Cleaning:

A. Clean any grease, finger marks or stains from the panels per manufacturer's recommendations.

B. Remove all scrap and construction debris from the site.

END OF SECTION



SECTION 07900  
SEALANTS AND CAULKING

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to special conditions or limitations where specified hereinafter.

2. Reference Publications:

- a. American Society for Testing and Materials (ASTM).
- b. Federal Specifications (FS).

1.2 Related Sections:

- A. Section 04200, Unit Masonry
- B. Section 06200, Finish Carpentry and Millwork
- C. Section 06410, Cabinetwork
- D. Section 07460, Vinyl Siding
- E. Section 07600, Metal Flashing and Sheet Metal Work
- F. Section 08110, Steel Frames and Doors
- G. Section 08360, Sectional Doors
- H. Section 08410, Aluminum Storefront Systems
- I. Section 08550, Vinyl Single Hung Windows
- J. Section 08710, Finish Hardware
- K. Section 09260, Gypsum Board Systems
- L. Section 09311, Ceramic Tile and Marble
- M. Section 09900, Painting
- N. Section 10200, Architectural Louvers

1.3 Definitions:

A. Sealant: A weatherproof elastomer used in filling and sealing joints, having properties of adhesion, cohesion, extensibility under tension, compressibility and recovery.

B. Caulk: Term used to denote the process of filling and sealing the joints, without regard to type of material.

1.4 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Product Data: Manufacturer's detailed descriptive and specification data for each type of sealant and joint filler described hereinafter; furnish color card showing full range of colors available.

1. For each sealant type, submit manufacturer's certification that product complies with South Coast Air Quality Management District Rule 1168 (Low / No VOC).

C. Samples: For each type and color of sealant required accompanied by sample of joint filler.

1.5 Product Handling:

A. Delivery: Deliver the products of this section in manufacturer's original unopened packaging with labels intact and legible.

B. Storage and Protection: Store and protect products of this section in accordance with manufacturer's instructions.

1.6 Job Conditions:

A. Temperature: Do no caulking if ambient temperature is 32 degree F or below.

PART 2 - PRODUCTS

2.1 Materials:

A. Basis of Design: Products as listed in par. 2.1.B.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

B. Sealants:

1. Type 1: Single-component polyurethane, gun-grade, complying with FS TT-S-00230C, Type II, Class A; color as selected by Architect, equal to PPG-1418 Topgun 400.

2. Type 2: Two-component polyurethane, gun-grade, complying with FS TT-S-00227E, Type II, Class A; color as selected by Architect, equal to Sika 2cns.

3. Type 3: One-component acetoxysilicone, complying with FS TT-S-001543A, Type Non-Sag, Class A; white color - mildew resistant, equal to Tremco Proglaze.

4. Type 4: Acrylic latex, gun grade, paintable, complying with ASTM C834-86; white color, equal to PPG-1417 Topgun 240.

5. Type 5: Oleo-resinous compound, gun grade, non-staining, non-shrinking, and non-sagging, complying with FS TT-C-598b, equal to Alumilastic-5911 HZ.

6. Type 6: Elastomeric, ultra-low modulus designed for minimum 100% elongation and minimum 50% compression, meeting ASTM C-920 and ASTM C-1832.

7. Type 7: One-part silicone rubber, non-slump, conforming to ASTM E814-88, UL rated for rating of construction with which used, equal to 3M Fire Barrier 1000 NS.

8. Type 8: Elastomeric, complying with ASTM C920, Grade NS, Class 25 or higher.

B. Joint Filler: Foam rod, approved by sealant manufacturer, sized to require 20% to 50% compression upon insertion.

C. Primer: Only that as recommended by the sealant manufacturer.

D. Application Equipment: Sealant application equipment shall be only such equipment as is specifically recommended by the manufacturer of the sealant being installed.

### PART 3 - EXECUTION

#### 3.1 Installation:

##### A. Preliminary Requirements:

##### 1. Surface Preparation:

a. Surfaces to be sealed shall be sound, clean, dry, frost free and free of contamination by laitance, form release agents, concrete curing compounds or other surface treatments.

b. Masonry and concrete surfaces shall be wire brushed.

c. Metal, glass and wood surfaces shall be cleaned prior to applying sealants.

2. Masking: Surfaces adjacent to joints shall be masked to obtain a neat sealant line.

3. Joint Filler: Joints exceeding the maximum allowable depth as hereinafter described shall be filled to within the allowable depth with the specified joint filler.

4. Primer: Apply primer to surfaces to be caulked as recommended by the manufacturer of the sealant being installed.

B. Locations: As the work progresses caulk and seal all joints subject to movement or subject to passage of air or moisture.

1. Type 1 Sealant: Install wherever sealant is required in conjunction with roofing, metal flashings, sheet metal work, etc., and juncture of those materials with other finishes.

2. Type 2 Sealant: Exterior and interior perimeter of windows and exterior door frames and louvers.
3. Type 3 Sealant: Around plumbing fixtures (at walls and floors) and at ceramic tile.
4. Type 4 Sealant: Around perimeter of interior metal door frames, and at interior of building where caulking is called for (i.e. wood trim at doors and interior windows, where dissimilar materials abut, wherever casing beads occur, etc.).
5. Type 5: Beneath metal thresholds.
6. Type 6 Sealant: Where sealant is required for joints in masonry.
7. Type 7 Sealant: Where sealant or caulk is required in fire rated walls, floors or ceilings to maintain integrity of rated construction.
8. Type 8 Sealant: Where sealant is required for fiber cement siding.

C. Application of Sealant:

1. Install sealant under pressure to fill joint, taking care to produce beads of proper width and depth; tool as recommended by the manufacturer; immediately remove all surplus sealant.
2. Width and depth of sealed joint shall not exceed the proportions of 1/2 inch width x 1/2 inch diameter and 3/4 inch width x 1/4 inch diameter, except that metal thresholds and sills shall be set in full bed of specified sealant.
3. All floor, wall, and joint penetrations shall be fully-sealed.

3.2 Field Quality Control:

- A. Protection: To insure proper curing, sealed joints shall not be touched, washed or otherwise disturbed for 48 hours after installation unless specifically recommended otherwise by the sealant manufacturer.

END OF SECTION

SECTION 08110  
STEEL FRAMES AND DOORS

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this Section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to special conditions where specified hereinafter.

2. Referenced Publications:

- a. American Society for Testing and Materials (ASTM)
- b. National Fire Protection Association (NFPA)
- c. Underwriters Laboratories, Inc. (UL)
- d. Steel Door Institute (SDI)
- e. National Accreditation and Management Institute (NAMI)

1.2 Related Sections:

- A. Section 04200, Unit Masonry
- B. Section 06100, Rough Carpentry
- C. Section 07900, Sealants and Caulking
- D. Section 08211, Solid Core Flush Wood Doors
- E. Section 08710, Finish Hardware
- F. Section 08800, Glass and Glazing
- G. Section 09900, Painting
- H. Section 12510, Blinds

1.3 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Shop Drawings: Fully dimensioned, showing method of installation and relationship to abutting materials and finished.
- C. Hardware Templates: Contractor shall obtain templates from the manufacturers of the finish hardware (Section 08710) and furnish same to manufacturer of the metal frames and doors along with one (1) copy of the approved "Finish Hardware Schedule".

1.4 Product Handling:

- A. Delivery: Deliver products of this section in manufacturer's original packaging with labels intact and legible.

B. Storage and Protection: Store products in a housed, dry and ventilated area and protect from damage as per their manufacturer's instructions.

## PART 2 - PRODUCTS

### 2.1 Materials:

A. Welded Metal Frames: Fabricated from commercial grade cold rolled steel conforming to ASTM A366, not less than 14 gauge, zinc coated.

B. Metal Drywall Frames: Fabricated from commercial grade cold rolled steel conforming to ASTM 366 not less than 16 gauge.

C. Metal Doors: Fabricated from commercial grade cold rolled steel conforming to ASTM A366, free of scale, pitting or other surface defects and shall have face sheets of not less than 16 gauge and shall be zinc-coated.

#### D. Embossed Panel Doors:

1. Basis of Design: Premium insulated steel doors as manufactured by Therma-Tru Doors, Maumee, OH.

a. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

### 2.2 Fabrication:

#### A. Welded Metal Frames:

1. Comply with ANSI/SDI A250.8 and SDI-100, "Recommended Specifications for Standard Steel Doors and Frames".

2. Frames shall be welded units with integral trim, of the size and designs shown on the drawings; knocked-down frames will not be accepted.

3. Finish work shall be strong and rigid, neat in appearance, square, true and free of defects, warp or buckle and moulded members shall be clean cut, straight and of uniform profile throughout their lengths.

4. Jamb depths, trim profile and backbends shall be shown on the drawings.

5. Corner joints shall have all contact edges closed tight, with trim faces mitered, continuously welded and ground smooth; stops may be butted; the use of gussets will not be permitted.

6. Depth of stops shall be 5/8 inch.

7. Hardware Reinforcements:

a. Frames shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accordance with approved hardware schedule and templates provided by the contractor; where surface-mounted hardware is to be applied, frames shall have reinforcing plates only; all drilling and tapping shall be done at the project site under Section 08710.

follows:

- b. Minimum thickness of hardware reinforcing plates shall be as

- (1) Hinge and pivot reinforcements: 7 gauge, 1½" x 10 min. size.
- (2) Strike reinforcements: 12 gauge
- (3) Flush bolt reinforcements: 12 gauge
- (4) Reinforcements for surface mounted hardware: 12 gauge

8. Floor Anchors:

- a. Floor anchors shall be adjustable 0 to 1-3/8" with two holes provided at each jamb for floor anchorage.

- b. Minimum thickness of floor anchors shall be 14 gauge.

9. Jamb Anchors: Frames shall be provided with anchors, standard with the frame manufacturer, for the type wall construction in which they are to be installed, not less than 16 gauge steel, and in the numbers as follows:

- a. Frames under 7'-6" height - 3 anchors per jamb plus 1 base anchor per jamb.

- b. Frames 7'-6" to 8'-6" height - 4 anchors per jamb plus 1 base anchor jamb.

- c. Frames over 8'-0" height - 1 anchor per jamb for each 2' or fraction thereof plus 1 base anchor per jamb.

10. Dust cover boxes (or mortar guards) of not thinner than 26 gauge steel shall be provided at all hardware mortises on frames to be set in masonry or plaster partitions.

11. All frames shall be provided with a steel spreader temporarily attached to the feet of both jambs to serve as a brace during shipping and handling.

12. Door frame stops shall be punched on the strike side to receive rubber silencers (3 per frame for single doors and 4 per frame for double doors).

13. Label Frames: Comply with NFPA 80 and bear visible UL label called for on the drawings.

14. Factory Priming: After manufacture, all tool marks and surface imperfections shall be dressed, filled and sanded to make all surfaces smooth, level and free of all irregularities and then chemically treated, to insure maximum paint adhesion, and coated with a rust inhibitive primer, standard with the manufacturer of the welded metal frames.

B. Metal Drywall Frames:

- 1. Comply with ANSI/SDI A250.8 and SDI-100, Recommended Specifications for Standard Steel Doors and Frames".

- 2. Frames shall be knock-down type, of sizes and designs shown on the drawings.

3. All frames shall be formed with 5/8" depth integral stops, unless detailed otherwise on drawings, and rabbets and shall have a double return on the back bend to allow frame to be erected after wall is in place and shall be designed so as to grip wall firmly.

4. Corners shall be mitered and reinforced and locked with sheet metal screws on the headbar return to insure positive locking and rigid corners.

5. Hardware Reinforcements:

a. Frames shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accordance with approved hardware schedule and templates provided by the contractor; where surface-mounted hardware is to be applied, frames shall have reinforcing plates only; all drilling and tapping shall be done at the project site under Section 08710.

b. Minimum thickness of hardware reinforcing plates shall be as follows:

Hinge:	7 gauge
Strike:	10 gauge
Flush Bolt:	12 gauge
Closer:	12 gauge
Surface Mounted Hardware:	12 gauge

6. Jamb shall be further strengthened by two heavy gauge stiffeners to provide proper gripping action and bearing surface against the wall.

7. Anchors (jamb, sill) shall be Manufacturer's Standard; sill anchors shall require no notching of wallboard.

8. There shall be no visible fastening devices along face of rabbets.

9. Each door frame stop shall be punched on the strike side to receive rubber silencers (3 per frame for single doors and 4 per frame for double doors).

10. Dust Cover: Shall be provided for strike and hinge reinforcing.

11. Label Frames: Comply with NFPA 80 and bear visible UL label called for on the drawings.

12. Factory Priming: After manufactured all tool marks and surface imperfections shall be dressed, filled and sanded to make all surfaces smooth, level and free of all irregularities and then chemically treated, to insure maximum paint adhesion, and coated with a rust-inhibitive primer, standard with the manufacturer of the drywall metal frames.

C. Metal Doors:

1. Comply with ANSI/SDI A250.8 and SDI-100, Recommended Specifications for Standard Steel Doors and Frames".

2. Doors shall be strong and rigid, neat in appearance, free from warpage or buckle and corner bends shall be true and straight and of minimum radius for the gauge of metal used.

3. Face sheets shall be reinforced, sound deadened and insulated with impregnated kraft honeycomb core completely filling the inside of the doors and laminated to both panels.

4. Door faces shall be joined at their vertical edges by mechanical interlock and a continuous weld extending the full height of the door; all such welds shall be ground, filled and dressed smooth to make them invisible.

5. Top and bottom edges shall be closed with a continuous recessed steel channel of not less than 14 gauge extending the full width of the door and spot welded to both faces; exterior doors shall have an additional flush closing channel at their edges and for the attachment of weather-stripping, a flush closure also at their bottom edges; opening shall be provided in the bottom closure of exterior doors to permit the escape of entrapped moisture.

6. Beveled edge profiles shall be provided on both vertical edges of doors as follows:

a. Single and double-acting swing doors: bevel 1/8" in 2".

7. Hardware Reinforcements:

a. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accordance with approved hardware schedule and templates provided by the contractor. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only; all drilling and tapping shall be done at the project site under Section 08710.

b. Minimum thickness of hardware reinforcing plates shall be as follows:

(1) Hinge and pivot reinforcements - 7 gauge (3/16" at all doors)

(2) Reinforcement for lock face, flush bolts, concealed holders, concealed or surface-mounted closers - 12 gauge.

(3) Reinforcements for all other surface-mounted hardware - 16 gauge.

8. Loose glazing stops shall be cold rolled steel not less than 20 gauge, butted at corners joints and secured with counter sunk cadmium or zinc plated screws.

9. Factory Priming: After manufactured all tool marks and surface imperfections shall be dressed, filled and sanded to make all surfaces smooth, level and free of all irregularities and then chemically treated, to insure maximum paint adhesion, and coated with a rust-inhibitive primer, standard with door manufacturer.

D. Embossed Panel Doors:

1. Faces: .021" (24 gauge) minimum thickness, tension-leveled cold rolled steel, zinc-coated, minimum coating weight 0.11 ounce/sf, conversion-coated to permit paint bond.

2. Door Edges: Machinable kiln-dried pine, mechanically locked to door faces, four-sided full thermal break provided. Stile edges molded from full 5/4 stock, lock area reinforced with solid blocking in full area of passage and deadbolt locksets.
3. Door Bottom Edge: Moisture-proof and decay-proof composite.
4. Core: Foamed-in-place polyurethane, CFC-free, density 2.0 pcf minimum, K-factor of 0.15 for minimum thermal transmittance.
5. Door surfaces shall be factory primed.
6. Glazing: Doors shall be factory-glazed with 1/8" tempered, Low E, two thicknesses with sealed airspace between; furnish with contoured grille between glass.
7. Doors shall be Energy-Star rated.

### PART 3 - EXECUTION

#### 3.1 Installation:

- A. Frames: Install in prepared openings, in locations shown on the drawings, true to line, level and plumb, and in accordance with their manufacturer's details and instructions.
  1. Label Frames: Comply with NFPA 80.
- B. Doors: Install in metal frames, in the locations shown on the drawings, true to line, level and plumb and with clearances as specified in ANSI/SDI A250.8 and SDI-100, Recommended Specifications for Standard Steel Doors and Frames".
  1. Label Doors: Comply with NFPA 80.
- C. Glazing (except embossed panel doors): As specified in Section 08800.
- D. Embossed Panel Doors: Install in metal frames, in the locations shown on the drawings, true to line, level and plumb and with clearances as specified in ANSI/SDI A250.8 and SDI-100, Recommended Specifications for Standard Steel Doors and Frames".
- E. Finish: As specified in Section 09900.

#### 3.2 Field Quality Control:

- A. Touch-Up Priming: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

END OF SECTION

SECTION 08211  
SOLID CORE FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 Quality Assurance:

A. Qualifications of Manufacturer: All solid core flush wood doors shall be of the same manufacturer.

B. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to special conditions where specified hereinafter.

2. Referenced Publications:

- a. Window and Door Manufacturers Association (WDMA)
- b. American National Standards Institute, Inc. (ANSI)
- c. Architectural Woodwork Quality Standards, as published by Architectural Woodwork Institute (AWI).
- d. National Fire Protection Association (NFPA).
- e. Underwriters Laboratories, Inc. (UL).

1.2 Related Sections:

- A. Section 06200, Finish Carpentry and Millwork
- B. Section 08110, Steel Frames and Doors
- C. Section 08710, Finish Hardware
- D. Section 08800, Glass and Glazing

1.3 Definitions: Definitions and terms shall be as described in the referenced standards.

1.4 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Shop Drawings: Fully dimensioned, showing all cut outs and details.
- C. Futen Sample: Of size necessary to show veneer proposed to be used on door. Once approved all doors will be judged against the approved sample and any veneers showing extremes greater than in the approved flitch will not be acceptable.
- D. Product Data: Manufacturer's detailed material and fabrication specifications and installation recommendations.
- E. Warranty: Manufacturer's Full Lifetime.

## 1.5 Product Handling:

A. Delivery: Deliver the products of this section in manufacturer's original unopened packaging with labels intact and legible.

B. Storage and Protection: Store and protect products of this section in accordance with their manufacturer's instructions.

## 1.6 Job Conditions:

A. Environmental Requirements: For a period of ten days prior to the installation of any interior doors, throughout the installation and until date of substantial completion, provide heat to maintain a temperature of not less than 50 degrees F.

B. Sequencing: All exterior doors shall have been installed and all glazing of exterior openings shall be complete before beginning installation of any interior doors.

## PART 2 - PRODUCTS

### 2.1 Materials:

A. Basis of Design: Architectural "Signature" series wood doors as manufactured by Marshfield Door Systems / Marshfield, WI.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

#### B. Door Construction:

1. Workmanship: Comply with WDMA Premium Grade.

2. Performance Standards: Comply with WDMA I.S. 1A heavy duty performance level.

3. Face Veneers: 5-ply, rift-cut Red Oak.

a. Non-Label Doors: Particle-bonded core, Grade LO-2 (AWI Sect. 1300 PC-5).

b. Label Doors: Mineral core non-combustible, complying with AWI Section 1300 - S - 13, FD - 5, for the rating label called for on the drawings. Label doors shall have solid blocking as necessary.

4. Vertical Edges: AWI Section 1300-S-4, Premium Grade, rift-cut Red Oak.

5. Top and Bottom Edges: Manufacturer's standard mill option hardwood.

6. Cross Bands: Min. 1/16-high density hardboard.

7. Adhesive: Per WDMA TM-6.

## 2.2 Fabrication:

A. Non-Labeled Doors: Manufacture to the designs shown on the drawings, in accordance with AWI Section 1300, Premium Grade, transparent factory finish.

B. Labeled Doors: Manufacture to the designs shown on the drawings, in accordance with AWI Section 1300, meeting test requirements of ASTM E 152, Premium Grade, transparent factory finish and bear UL label for rating called for on the drawings.

C. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, and hardware templates.

## 2.3 Factory-Finish:

A. General: Factory-finish to meet or exceed WDMA I.S. IA TR-6.

1. Transparent Finish:

- a. Staining: As selected from manufacturer's standard colors.
- b. Finish: WDMA TR-6 catalyzed polyurethane.

## PART 3 - EXECUTION

### 3.1 Installation:

A. Finish Hardware: Finish hardware and its installation are described in Section 08710.

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standards.

1. Non-Labeled Doors: Install in frames, in locations shown on the drawings or called for in the schedule, hanging square, plumb and level.

2. Labeled Doors: Install in labeled metal frames, in locations shown on the drawings or called for in the schedule, hanging square, plumb and level and in accordance with requirements of NFPA 80 and NFPA 101.

C. Align all doors for uniform clearance at each edge.

D. Restore finish before installation if fitting or machining is required at project site.

E. Glazing: Glass and glazing is specified under Section 08800.

### 3.2 Adjustment:

A. Adjust all doors to swing and operate freely, and to close and latch properly.

END OF SECTION



SECTION 08360  
SECTIONAL DOORS

PART 1 - GENERAL

1.1 Summary: The work of this Section includes upward-acting sectional doors.

A. References:

1. American National Standard Institute Specifications for Sectional Overhead Type Doors (ANSI/DASMA 102)

2. Underwriters Laboratory (UL)

1.2 Related Sections

A. Section 04200, Unit Masonry

B. Section 07900, Sealants and Caulking

C. Section 08110, Steel Frames and Doors

D. Section 08710, Finish Hardware

E. Section 09900, Painting

F. Division 16, Electrical

1.3 Submittals:

A. Product Data: Submit manufacturer's product data and installation instructions in accordance with Section 01300 for each type of sectional door. Include both published data and any specific data prepared for this project.

B. Shop Drawings: Submit shop drawings for approval prior to fabrication. Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent materials.

1. Provide complete electrical coordination drawings showing all connections to power, etc.

1.4 Quality Assurance:

A. Manufacturer: Sectional doors shall be manufactured by a firm with a minimum of five years experience in the fabrication and installation of sectional doors. Manufacturers proposed for use which are not named in these specifications, shall submit evidence of ability to meet performance and fabrication requirements specified, and include a list of five projects of similar design and complexity completed within the past five years.

B. Installer: Installation of sectional doors shall be performed by the authorized representative of the manufacturer.

C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

#### 1.5 Delivery, Storage, and Handling

A. Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

### PART 2 - PRODUCTS

#### 2.1 Sectional Overhead Door

##### A. Manufacturer:

1. Basis of Design: 521 Series, aluminum sectional doors as manufactured by Overhead Door Corporation, Dallas, TX.

a. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

##### B. Characteristics:

1. Sectional Door Assembly: Stile and rail assembly secured with ¼" diameter through rods. Units shall have the following characteristics.

- a. Panel Thickness: 1-3/4"
- b. Aluminum Panels: 0.050" thick, 6063-T6 aluminum alloy
- c. Standard Springs: 10,000 cycles (high cycles)
- d. Glazing: 1/8" double strength glass (factory-glazed)

##### 2. Finish and Color:

a. Powder Coating Finish: Color as selected by Architect from manufacturer's standard colors.

3.. Windload Design: ANSI/DASMA 102 and ANSI/DASMA 108 standards and as required by code; 20 lb. per s/f minimum.

4. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.

a. Key Cylinders for Locks: Furnish under Section 08710.

5. Weather-stripping: Flexible PVC on bottom section. Furnish with manufacturers standard jamb seals and header seal.

6. Track: Provide track as recommended by manufacturer to suit loading required and clearances available. Slot vertical sections of track 2" o/c for door drop safety device. Provide all track supports with adequate braces. Track and supports galvanized finish.

7. Electric Motor Operation:

a. Provide UL listed heavy-duty electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second; minimum 3/4 horsepower. Motor shall be center mount draw bar type.

(1) Entrapment Protection: Electric sensing edge and bottom to meet UL 325/2010.

(2) Door Control System: Provide momentary-contact, 3-button control station with push button controls labeled "open", "close" and "stop" (recessed mount).

(a) Provide interior units, full-g geared, surface-mounted, heavy-duty, with general purpose NEMA Type 4 enclosure.

(b) Furnish two (2) each, three (3) button remote control operators which open and close front and rear doors.

(3) Automatic Reversing Control: Furnish each door with automatic safety switch, extending full width of door bottom, and located within neoprene or rubber astragal mounted to bottom door rail. Contact with switch will immediately reverse downward door travel. Furnish manufacturers standard take-up reel or self-coiling cable.

8. Accessories:

a. Stop / Go Traffic Lights with auxiliary boards (total of two (2) required).

2.2 Rolling Door:

A. Manufacturer:

1. Basis of Design: 600 Series Rolling Door, as manufactured by Overhead Door Corp., Dallas, TX.

a. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

B. Characteristics:

1. Curtain: Interlocking roll-formed galvanized steel slats, flat crown profile type CAW, 26 gauge. End of each slat shall be locked from lateral movement by a staking lock system.

2. Finish:

a. Curtain slats and hood shall be galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick backed-on polyester top coat.

b. Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.

c. Top Color: Polyester top coat; color as selected by the Architect.

3. Weatherseals: Vinyl bottom seal.
4. Bottom Bar: Extruded aluminum.
5. Guides: Roll-formed galvanized steel shapes attached to continuous galvanized steel wall angle.
6. Brackets: Galvanized steel to support counterbalance and curtain.
7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel and supporting the curtain with deflection limited to 0.03 inch per foot of span. Spring tension shall be adjustable.
8. Hood: 24 gauge galvanized steel with intermediate supports as required.
9. Manual Operation: Manual push-up.
10. Locking: Interior bottom bar slide bolt for manually operated doors.
11. Wall Mounting Condition of Doors: Face-of-wall.

### PART 3 - EXECUTION

#### 3.1 Preparation:

A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

B. Provide and install inserts and anchors as set into masonry as detailed on drawings.

#### 3.2 Installation:

A. Strictly comply with manufacturer's installation instructions and recommendations. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

1. Provide all supports necessary to secure door tracks.

B. Instruct Owner's personnel in proper operating procedures and maintenance schedule.

#### 3.3 Adjusting and Cleaning:

A. Test doors for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Touch-up damaged coatings and finish and repair minor damage. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer of material or product being cleaned.

END OF SECTION

SECTION 08410  
ALUMINUM STOREFRONT SYSTEMS

PART 1 - GENERAL

1.1 Scope:

A. The work under this Section consists of furnishing all labor, materials, equipment and services necessary for the complete and satisfactory installation of aluminum storefront systems as called for herein and/or on the Drawings.

1.2 Related Sections:

- A. Section 04200, Unit Masonry
- B. Section 07900, Sealants and Caulking
- C. Section 08800, Glass and Glazing

1.3 Submittals:

A. Shop Drawings: The Contractor shall submit shop drawings, manufacturer's literature and complete installation instructions to the Architect for review prior to beginning installation operations in accordance with the requirements of Section 01300 of these Specifications.

B. Samples: The Contractor shall submit samples of all available finishes to the Architect for color selection. No materials shall be delivered to the job site prior to finish selection.

1.4 Storage and Protection:

A. Delivery: The Contractor shall deliver the aluminum storefront system and all necessary installation accessories to the job site in the manufacturer's original protective packaging. Each package shall be clearly labeled so as to identify manufacturer, brand name, contents, stock number and order number.

B. Storage: Materials shall be stored in original packaging in areas designated for material storage. Materials shall be carefully handled so as to prevent damage.

1.5 Design Requirements:

A. Storefront System:

1. Wind Loads: Completed storefront system shall withstand wind pressure loads normal to wall plane indicated.

2. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E330 with allowable stress in accordance with AA Specifications for Aluminum Structures L/175.

3. Thermal Movement: provide for thermal movement caused by 180 degrees F. surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.

4. Air Infiltration: When tested in accordance with ASTM E 283 at differential static pressure of 6.24 PSF completed storefront systems shall have maximum allowable infiltration of 0.06 cfm/ft<sup>2</sup>.

5. Water Infiltration: No uncontrolled water when tested in accordance with ASTM E 331 at test pressure differential of 10 psf.

B. Quality Assurance: The manufacturer shall provide written certification to the Architect that all materials furnished comply with the specified design requirements.

## PART 2 – PRODUCTS

### 2.1 Acceptable Manufacturers:

A. Basis of Design: YES45F-1 Aluminum Entrance Systems as manufactured by YKK.

B: Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products. Other acceptable manufacturers include:

1. Kawneer
2. Vistawall

### 2.2 Metal:

A. All aluminum extrusions shall conform to ASTM B 221, Type 6063-T5 aluminum alloy. Aluminum sheet (painted finish) shall conform to ASTM B209, 3003-H14 aluminum alloy, 0.080" minimum thickness.

### 2.3 Accessories:

A. Manufacturer's Standard Accessories:

1. Fasteners: Zinc plated steel concealed fasteners; hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners.

2. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; glazing gaskets in accordance with ASTM C 864. Refer to Section 08800.

### 2.4 Finish:

A. High Performance Organic Coating Finish: Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with AAMA 2605 specifications. Color shall be selected by the Architect from the manufacturer's standard finishes.

## 2.5 Construction:

A. Framing: All vertical and horizontal members shall have a face dimension of 2 inches and depth of 4-1/2 inches. Framing members shall be of two-piece construction, consisting of a basic white member and a snap-on front glazing retainer separated by a rigid PVC thermal break insert designed to prevent heat and air transmission through the member.

B. Glazing Retainers: Glazing retainers shall be snap-on type. Retainers on exterior side shall be tamper-proof. No exposed fasteners shall be utilized to secure retainers.

C. Glazing: Glazing shall be lock-in type vinyl; spandrel glass as specified in Section 08800.

## 2.5 Fabrication:

A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

1. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

## PART 3 – EXECUTION

### 3.1 Preparation:

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

1. Aluminum surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

### 3.2 Installation:

A. General: Install manufacturer's system in accordance with manufacturer's instructions, within specified tolerances.

1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.

2. Shim and brace aluminum system before anchoring to structure.

3. Verify storefront system allows water entering system to be collected in gutters and wept to exterior.

4. Locate expansion mullions where indicated on reviewed shop drawings.

5. Seal metal to metal storefront system joints using sealant recommended by system manufacturer.

3.3 Field Quality Control:

A. Provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.

B. Conduct field test to determine watertightness of storefront system. Conduct test in accordance with AAMA 501.2.

3.4 Cleaning:

A. Clean installed products in accordance with manufacturer's instructions prior to acceptance, and remove construction debris from project site. Legally dispose of debris.

B. Protect the installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 08550  
VINYL SINGLE-HUNG WINDOWS

PART 1 - GENERAL

1.1 Section Includes:

A. Vinyl single-hung windows complete with hardware, glazing, weatherstripping, anchors, attachments, and accessories.

1.2 Related Sections:

- A. Section 04200, Unit Masonry
- B. Section 06100, Rough Carpentry
- C. Section 06200, Finish Carpentry and Millwork
- D. Section 07900, Sealants and Caulking

1.3 Submittals:

- A. Shop Drawings: Submit shop drawings under provisions of Section 01300.
- B. Product Data: Submit catalog data under provision of Section 01300.
- C. Quality Control Submittals: Submit manufacturer's certifications that window units meet specified performance and design requirements.

1.4 References:

- A. American Society of Testing Materials (ASTM):
  - 1. ASTM B 456 – Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium, 2008.
  - 2. ASTM F 588 – Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact, 2007.
  - 3. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel, 2007.
  - 4. ASTM B 766 – Specification for Electrodeposited Coatings of Cadmium, 2003.
  - 5. ASTM D 638 – Test Method for Tensile Properties of Plastics, 2008.
  - 6. ASTM D 4216 – Specification for Rigid Poly (Vinyl Chloride) (PVC) and Related PVC and Chlorinated Poly (Vinyl Chloride) (CPVC) Building Products Compounds, 2006.
  - 7. ASTM D 4726 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Exterior-Profile Extrusions Used for Assembled Windows and Doors, 2002.

8. ASTM E 1300 – Standard Practice for Determining Load Resistance of Glass in Buildings, 2007.

9. ASTM E 2190 – Standard Specification for Insulating Glass Unit Performance and Evaluation, 2008.

B. American Architectural Manufacturers Association (AAMA):

1. AAMA 701/702 – Combined Voluntary Specification for Pile Weatherstrip and Replaceable Fenestration Weatherseals, 2004.

2. AAMA 902 – Voluntary Specification for Sash Balances, 2007.

C. IGCC/IGMA – Insulated Glass Certification Program

D. Window and Door Manufacturers Association (WDMA):

1. AAMA/WDMA/CSA 101/1.S.2/A440-08 – Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors, 2008.

E. National Fenestration Rating Council (NFRC):

1. NFRC 100 – Procedure for Determining Fenestration Product U Factors, 2004.

2. NFRC 200 – Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence, 2004.

3. NFRC 500 – Procedure for Determining Fenestration Product Condensation Resistance Values, 2004.

1.5 System Performance Description:

A. Single Unit Air Infiltration shall not exceed 0.30 CFM/SqFt when tested in accordance with AAMA/WDMA/CSA 101/1.S.2/A440-08.

B. Unit Water Penetration Resistance Pressure vs. size when testing in accordance with AAMA/WDMA/CSA 101/1.S.2/A440-08 – 3.13 PSF.

C. Unit Structural Performance ratings vs. size when tested in accordance with AAMA/WDMA/CSA 101/1.S.2/A440-08 – H-R20.

D. Unit Thermal Performance ratings vs. size when tested in accordance with NFRC 100, 200 and 500 – Window shall achieve NFRC thermal u-value rating of 0.34 BTU/hr/SqFt/F° and a Solar Heat Gain Coefficient of .26 using Low E 366 and no argon gas fill.

E. Window units shall be labeled and certified through the WDMA/Hallmark Program.

1.6 Quality Assurance:

A. Manufacturer Qualifications: Minimum five (5) years of documented experience producing products of the type specified in this section.

B. Certifications:

1. Provide window units rated for air infiltration, water penetration and structural performance per AAMA/WDM/CSA 101/1.S.2/A440-08 and certified by independent third-party agent.

2. Provide window units rated and certified for thermal performance by NFRC, and for seal integrity of insulating glass seal.

3. Provide glass units that comply with IGMA TM4000 Quality Assurance Systems.

1.7 Delivery:

A. Deliver in original packaging and protect from weather.

1.8 Storage and Handling:

A. Store window units in an upright position.

B. Units shall be delivered in manufacturer's cartons/packaging.

1.9 Warranty:

A. The installer shall assume full responsibility that the installation is in accordance with the specifications, contract documents and manufacturer specifications.

B. Manufacturer's Warranty: Furnish manufacturer's Limited Warranty on window products.

## PART 2 - PRODUCTS

2.1 Manufactured Units:

A. Basis of Design: Series 2900 vinyl single-hung windows as manufactured by Silver Line Building Products.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed product.

2.2 Materials:

A. Vinyl Extrusions: Multi-chamber extrusions of impact-resistant exterior-grade rigid polyvinyl chloride (PVC) complying with ASTM D 4726, ASTM D4216 and ASTM D 638 standards.

1. Color shall be as selected by the Architect from manufacturer's standard colors.

B. Components:

1. Frame and Sash: Vinyl extrusions, nominal extrusion wall thickness 0.065 inc. Mitered and fusion-welded corners; integral 2-inch pre-punched nailing fin four sides; all lower sash must tilt-in for cleaning; integral glazing provision; molded-in lift handles.

2. Insulating Glass Unit: Windows shall be factory-glazed; unit thickness 5/8-inch. Insulating glass products shall be permanently marked with warranty certification label of IGCC®/IGMA® Certification Program.

a. Insulating Glass shall comply with the ASTM E 2190 standard.

b. Insulating Glass type selection shall comply with the ASTM E 1300 standard.

c. Air Chamber: Hermetically sealed space between panes.

d. The assembled insulated unit shall be Energy-Star rated for South Central climate zone with U-factor less than or equal to 0.35 and SHGC less than or equal to 0.30.

3. Operating Hardware:

a. Locks: Cam-type sash lock and keeper, capable of meeting ASTM F 588 forced entry resistance, engineered to force meeting stiles/rails with interlock for minimum air infiltration.

b. Balances: Block and tackle balances, meeting requirements of AAMA 902, providing maintenance free operation without post-installation adjustment or lubrication.

4. Weatherstripping: Double-row high-density silicone-treated wool pile, with double mylar fin, meeting requirements of AAMA 701.

5. Screens: Installable from interior side, re-screenable using fiberglass mesh, 16 x 18 gage, secured in channel of aluminum box frame with continuous vinyl spline; frame color matching frame and sash color.

6. Fasteners: All screws and other miscellaneous fastening devices incorporated shall be of aluminum, stainless steel, or other non-corrosive material compatible with vinyl extrusions. Cadmium or zinc plated steel, where used, shall be in accordance with ASTM B 766 or ASTM B 633. Nickel or chrome plated steel, where used, shall be in accordance with ASTM B 456.

7. Muntins: 3/4-inch contoured aluminum pre-finished to match window frame, factory-mounted between panes of insulating glass.

8. Accessories: As necessary for complete unit installation.

a. Mullion Posts: Extruded aluminum, color matching adjacent window frame.

## PART 3 – EXECUTION

### 3.1 Examination:

A. Verification of Conditions: Before installation, verify openings are plumb, square, and of proper dimension. Report frame defects or unsuitable conditions to the General Contractor before proceeding.

B. Acceptance of Conditions: Beginning of installation confirms acceptance of existing conditions.

### 3.2 Installation:

A. Install window unit according to manufacturer's instructions and reviewed shop drawings.

1. All windows are to be installed level and plumb. A permanent weather tight seal must be applied between the window nailing fin and the building exterior sheathing at the time of installation. The windows are to be secured to the opening with 1½" or larger fasteners, applied through the window mainframe members.

B. Interior casing shall be furnished and installed under this contract, as described in Sections 06200.

C. Install sealant and related backing materials at perimeter of unit or assembly in accordance with Section 07900 of these specifications.

D. Install accessory items as required.

### 3.3 Cleaning:

A. Adjust operable sash to work freely with all hardware functioning properly. Re-adjust at completion of the project if directed.

B. Remove visible labels and adhesive residue from glass according to manufacturer's instructions.

C. Leave windows and glass in a clean condition.

### 3.4 Protecting Installed Construction:

A. Protect windows from damage by chemicals, solvents, paint, or other construction operations that may cause damage.

END OF SECTION



SECTION 08710  
FINISH HARDWARE

PART 1 - GENERAL

1.1 Summary:

A. Section Includes:

1. Door Hardware, including electric hardware.
2. Cylinders for doors fabricated with locking hardware.

B. Related Sections:

1. Section 06200, Finish Carpentry and Millwork
2. Section 07900, Sealants and Caulking
3. Section 08110, Steel Frames and Doors
4. Section 08211, Solid Core Flush Wood Doors
5. Section 08360, Sectional Doors

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.

1. Windows.
2. Cabinets, including open wall shelving and locks.
3. Signs, except where scheduled.
4. Toilet accessories, including grab bars.

1.2 References:

- A. Use date of standard in effect as of Bid date.
- B. American National Standards Institute – ANSI 156.18 – Materials and Finishes.
- C. ICC/ANSI A117.1 - 1998 – Specifications for making buildings and facilities usable by physically handicapped people.
- D. ADA – Americans with Disabilities Act of 1990
- E. BHMA – Builders Hardware Manufacturers Association
- F. DHI – Door and Hardware Institute
- G. NFPA – National Fire Protection Association
  1. NFPA 80 – Fire Doors and Windows
  2. NFPA 101 – Life Safety Code
  3. NFPA 105 – Smoke and Draft Control Door Assemblies
  4. NFPA 252 – Fire Tests of Door Assemblies
- H. UL – Underwriters Laboratories
  1. UL10B – Fire Tests of Door Assemblies as amended to incorporate positive pressure testing.
  2. UL 305 – Panic Hardware

- I. WHI – Warnock Hersey Incorporated
- J. Local applicable codes
- K. SDI – Steel Door Institute
- L. AWI – Architectural Woodwork Institute
- M. NAAMM – National Association of Architectural Metal Manufacturers

### 1.3 Submittals and Substitutions:

A. Submittals: Submit six copies of schedule Section 01300. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:

- 1. Type, style, function, size, quantity and finish of hardware items. Use BHMA Finish codes per ANSI A156.18.
- 2. Name, part number and manufacturer of each item.
- 3. Fastenings and other pertinent information.
- 4. Location of hardware set coordinated with floor plans and door schedule.
- 5. Explanation of abbreviations, symbols, and codes contained in schedule.
- 6. Mounting locations for hardware.
- 7. Door and frame sizes, materials and degrees of swing.
- 8. List of manufacturers used and their nearest representative with address and phone number.
- 9. Catalog cuts.
- 10. Manufacturer’s technical data and installation instructions for electronic hardware.
- 11. Date of jobsite visit.

B. Bid and submit manufacturer’s updated/improved item if scheduled item is discontinued.

C. Make substitution requests in accordance with Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.

D. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, wiring/riser diagrams, manufacturers’ installation, adjustment and maintenance information, and supplier’s final inspection report.

### 1.4 Quality Assurance:

#### A. Qualifications:

1. Hardware supplier: Direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course Work for project hardware consultation to Owner, Architect and Contractor.

a. Responsible for detailing, scheduling and ordering of finish hardware.

B. Hardware: New, free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.

C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

D. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C / UBC Standard 7-2 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.

1. Note: Scheduled resilient seals may exceed selected door manufacturer's requirements.

2. See 2.6.E for added information regarding resilient and intumescent seals.

E. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions.

#### 1.5 Delivery, Storage and Handling:

A. Delivery: Coordinate delivery to appropriate locations (shop or field).

B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.

C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

#### 1.6 Sequencing and Coordination:

A. Coordinate with concrete.

B. Reinforce walls for wall-mounted hardware, including wall stops and stainless steel guard rails.

C. Coordinate finish floor materials and floor-mounted hardware.

D. Conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.

E. Furnish manufacturer templates to door and frame fabricators.

F. Use hardware consultant to check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.

1. Confirm that wood door manufacturers furnish necessary UBC Standard 7-2 compliant seal packages.

1.7 Warranty:

A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' warranties:

1. Locksets: Three years.
2. Exit Devices: Three years mechanical, one year electrical.
3. Closers: Ten years mechanical, two years electrical.
4. Hinges: Life of Building.
5. Other Hardware: Two years.

PART 2 – PRODUCTS

2.1 Manufacturers:

A. Listed acceptable alternate manufacturers: Submit for review products with equivalent function and features of scheduled products.

<u>ITEM:</u>	<u>MANUFACTURER:</u>	<u>ACCEPTABLE SUB:</u>
Hinges	(IVE) Ives	Stanley, Bommer, McKinney
Continuous Hinges	(IVE) Ives	Hager, Select, ABH
Locks	(SCH) Schlage	
Exit Devices	(VON) Von Duprin	
Closers	(LCN) LCN	
Silencers	(ROC) Rockwood	Ives, Rockwood
Stops & Holders –	(IVE) IVES	Hager, Rockwood
Thresholds	(NGP) National Guard	Zero, Reese, Pemko
Seals & Bottoms	(NGP) National Guard	Zero, Reese, Pemko

2.2 Hinging Methods:

A. Note: Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise Architect if 8-inch width is insufficient.

B. Conventional Hinges: Steel bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.

1. Three hinges per leaf to 7 foot, 6 inch height. Add one for each additional 30 inches in height, or any fraction thereof.
2. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins.
3. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.
4. Provide shims and shimming instructions for proper door adjustment.

C. Continuous Hinges:

1. Geared-type aluminum at exteriors.

- a. Heavy-duty, extra-bearing units for doors over 3-ft., 5-in. in width.
- b. Heavy-duty, extra-bearing units for doors with panic hardware or fire exit devices.
- c. Use wide-throw units where needed for maximum degree of swing, advise Architect if commonly available hinges are insufficient.

### 2.3 Locksets, Latchsets, Deadbolts:

- A. Mortise Locksets and Latchsets: as scheduled:
  - 1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
  - 2. Latchbolts: 3/4 inch throw stainless steel anti-friction type.
  - 3. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
    - a. Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
  - 4. Thumbturns: accessible design not requiring pinching or twisting motions to operate.
  - 5. Deadbolts: stainless steel 1-inch throw.
  - 6. Electric Operation: Manufacturer-installed continuous duty solenoid.
  - 7. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
  - 8. Scheduled Lock Series and Design: Schlage L series, 03A design.
  - 9. Certifications:
    - a. ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
    - b. ANSI/ASTM F476-84 Grade 31 UL Listed
- B. Standard Duty Cylindrical Locks and Latches: as scheduled.
  - 1. Chassis: cylindrical design, corrosion-resistant plated cold-rolled steel, through-bolted.
  - 2. Locking Spindle: stainless steel, interlocking design.
  - 3. Latch Retractors: forged steel. Balance of inner parts: corrosion-resistant plated steel or stainless steel.
  - 4. Backset: 2-3/4" typically, more or less as needed to accommodate frame, door or other hardware.
  - 5. Lever Trim: accessible design, independent operation, spring-cage supported, minimum 2" clearance from lever mid-point to face of door.
  - 6. Lock Series and Design: Schlage "ND: series, "TUBULAR" design.

7. Certifications:

- a. ANSI A156.2, 1994, Series 4000, Grade 2  
UL listed for A label and lesser class single doors up to 4ft x 8ft.

2.4 Exit Devices / Panic Hardware:

A. General Features:

- 1. Independent lab-tested 1,000,000 cycles.
- 2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
- 3. 0.75-inch throw deadlocking latchbolts.
- 4. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.
- 5. No exposed screws to show through glass doors.
- 6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
- 7. Releasable in normal operation with 15-lb. maximum operating force per UBC Standard 10-4, and with 32 lb. maximum pressure under 250-lb. load to the door.
- 8. Flush end cap design as opposed to typical "bottle-cap" design end cap.
- 9. Comply with CBC Section 1003.3.1.9.

2.5 Closers:

A. Surface Closers: 4011/4111.

- 1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
- 2. ISO 2000 certified. Units stamped with date-of-manufacture code.
- 3. Independent lab-tested 10,000,000 cycles.
- 4. Non-sized and adjustable. Place closers inside building, stairs and rooms.
- 5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
- 6. Advanced Variable Backcheck (AVB): where scheduled, these units commence backcheck at approximately 45 degrees
- 7. Opening pressure: Exterior doors 8.5 lb., interior doors 5 lb., labeled fire doors 15 lb, per CBC 1133B.2.5.

8. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.

9. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units. EDA arms: rigid main and forearm, reinforced elbow.

10. Exterior Door Closers: Tested to 100 hours of ASTM B117 salt spray test, furnish data on request.

## 2.6 Other Hardware:

A. Automatic Flush Bolts: Low operating force design, "LBR" type where scheduled.

B. Overhead Stops: Stainless steel (100 series). Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

C. Kick Plates: .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of stainless steel to match other hardware.

D. Door Stops: Provide stops to protect walls, casework or other hardware.

1. Unless otherwise noted in Hardware Sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.

2. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90 deg stop/95 deg deadstop. Note degree of opening in submittal.

E. Seals: Finished to match adjacent frame color. Resilient seal material: polypropylene, nylon brush, or solid high-grade neoprene. UL label applied to seals on rated doors. Substitute products: certify that the products equal or exceed specified material's thickness and durability. Proposed substitutions: submit for approval.

1. Solid neoprene: MIL Spec. R6855-CL III, Grade 40.

2. Non-corroding fasteners at in-swinging exterior doors.

3. Sound control openings: Use components tested as a system using nationally accepted standards by independent laboratories. Ensure that the door leaves have the necessary sealed-in-place STC ratings. Adhesive mounted components not acceptable. Fasten applied seals over bead of sealant.

4. Fire-rated Doors, Resilient Seals: UL10C / UBC Standard 7-2 compliant. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements. Where rigid housed resilient seals are scheduled in this section and the selected door manufacturer only requires an adhesive-mounted resilient seal, furnish rigid housed seal at minimum, or both the rigid housed seal plus the adhesive applied seal. Adhesive applied seals alone are deemed insufficient for this project where rigid housed seals are scheduled.

5. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C / UBC Standard 7-2. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required. Adhesive-applied intumescent strips are not acceptable, use concealed-in-door-edge type or kerfed-in-frame type.

F. Thresholds: As scheduled and per details. Comply with CBC Section 1133B.2.4.1. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.

1. Exteriors: Seal perimeter to exclude water and vermin. Use butyl-rubber or polyisobutylene sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Non-ferrous 1/4inch fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors (SS/FHSL).

2. Fire-rated openings, 90min or less duration: Use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, request direction from Architect.

2.7 Finish:

A. Generally US-3.

B. Door Closers: Factory powder coated to match other hardware, unless otherwise noted.

2.8 Keying Requirements:

A. Key System masterkey locksets to the existing Schlage system.

B. Key Cylinders: Furnish 6-pin solid brass construction.

C. Cylinders / Cores: Keyed at factory of lock manufacturer where permanent records are maintained.

D. Permanent Keys: Use secured shipment direct from point of origination to Owner.

1. For estimate: 3-keys per change combination.

## PART 3 - EXECUTION

3.1 Acceptable Installers:

A. Experienced craftsperson with a resume of successful projects. Can readily differentiate between number 2 and number 3 phillips-drive screws and screwdrivers. Can readily differentiate between #10-24 machine screws and drywall screws, and can explain correct usages of these items.

3.2 Preparation:

A. Ensure that walls and frames are square and plumb before hardware installation.

B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.

1. Notify Architect of any code conflicts before ordering material.

2. Locate levers, key cylinders, t-turn pieces, touchbars and other operable portions of latching hardware between 30 inches to 44 inches above the finished floor, per CBC Section 1133B.2.5.1.

3. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.

C. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.

### 3.3 Installation:

A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.

1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.

2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.

3. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.

4. Replace fasteners damaged by power-driven tools.

B. Locate floor stops no more that 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.

C. Locate overhead stops for minimum 90 degrees and maximum allowable degree of swing.

D. Drill pilot holes for fasteners in wood doors and/or frames.

E. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.

### 3.3 Adjusting:

A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.

1. Hardware damaged by improper installation or adjustment methods to be repaired or replaced to Owner's satisfaction.

2. Adjust doors to fully latch with no more than 1 pound of pressure.

3. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.

B. Inspection: Use hardware supplier. Include supplier's report with closeout documents.

### 3.3 Protection / Cleaning:

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.

B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

### 3.4 Schedule of Finish Hardware:

HW SET: 01 **NOT USED**

HW SET: 02

DOOR NUMBER:

1-101	1-124	2-105	2-106	3A-114	3B-114
3C-114	3D-114				

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	600	IVE
1	EA	ENTRANCE LOCK	L9453P 03A	626	SCH
1	EA	SURFACE CLOSER	4111 SHCUSH	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW	630	IVE
1	SET	SEALS	160V	AL	NGP
1	EA	DRIP CAP	16A	CL	NGP
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	425	AL	NGP

HW SET: 03

DOOR NUMBER:

3-107	3-125	3-126
-------	-------	-------

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	600	IVE
1	EA	STOREROOM LOCK	L9480P 03A	626	SCH
1	EA	OVERHEAD HOLDER	814H	630	GLY
1	SET	SEALS	160V	AL	NGP
1	EA	DRIP CAP	16A	CL	NGP
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	425	AL	NGP

HW SET: 04

DOOR NUMBER:

6-113

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	600	IVE
1	EA	CORRIDOR LOCK	L9456P 03A	626	SCH
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW	630	IVE
1	SET	SEALS	160V	AL	NGP
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	425	AL	NGP
3	EA	SILENCER, METAL DOOR	608	GRY	ROC



HW SET: 10  
DOOR NUMBER:  
5-122

EACH TO HAVE:

3	EA	HINGE	5PB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 03A	626	SCH
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER, METAL DOOR	608	GRY	ROC

HW SET: 11  
DOOR NUMBER:  
6-110            6-115

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	98L-F 996L	626	VON
1	EA	RIM CYLINDER	20-022	626	SCH
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW	630	IVE
1	SET	SEALS	160V	AL	NGP
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	425	AL	NGP
3	EA	SILENCER, METAL DOOR	608	GRY	ROC

HW SET: 12  
DOOR NUMBER:  
5A-120            5A-121            5B-121            5B-124

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 03A	626	SCH
1	EA	SURFACE CLOSER	1261 RW/PA	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW	630	IVE
1	EA	DOME STOP	FS438	626	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
3	EA	SILENCER, METAL DOOR	608	GRY	ROC

NOTE: PROVIDE FLOOR OR WALL STOP AS REQUIRED

HW SET: 13  
DOOR NUMBER:  
7-108            7-127

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	600	IVE
1	EA	ENTRANCE LOCK	L9453P 03A	626	SCH
1	EA	SURFACE CLOSER	1261 CUSH	689	LCN
1	SET	SEALS	160V	AL	NGP
1	EA	DOOR SWEEP	200NA	CL	NGP
1	EA	THRESHOLD	425	AL	NGP

HW SET: 14  
DOOR NUMBER:  
15-105

EACH TO HAVE:

1	EA	CONNECTOR	PDF 250-05		STA
2	EA	POCKET FRAME SET	PDFC 250N		STA
4	EA	FLUSH PULL	221B	626	IVE
2	EA	EDGE PULL	230B	626	IVE

END OF SECTION



SECTION 08800  
GLASS AND GLAZING

PART 1 - GENERAL

1.1 Quality Assurance:

A. Referenced Publications:

1. American Society for Testing and Materials (ASTM)
2. Glazing Manual; Flat Glass Marketing Association, 1990 Edition (FGMA)
3. Federal Specifications (FS)

1.2 Related Sections:

- A. Section 08110, Steel Frames and Doors
- B. Section 08211, Solid Core Flush Wood Doors
- C. Section 08360, Sectional Doors
- D. Section 08550, Vinyl Single-Hung Windows
- E. Section 09311, Ceramic Tile and Marble

1.3 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Product Data: Manufacturer's data describing product characteristics, installation instructions and recommendations, and maintenance procedures.

1.4 Product Handling:

- A. Delivery, Storage and Handling: Protect products in accordance with their manufacturer's recommendations, avoid damage to glass edges; prevent damage due to temperature changes, sunlight and moisture.

1.5 Job Conditions:

- A. Temperature: Do no glazing when the ambient temperature is below 40 deg. F.

PART 2 - PRODUCTS

2.1 Materials:

A. Glass:

1. Glass for embossed panel doors is specified in Section 08110.
2. Glass for sectional doors is specified in Section 08360.
3. Glass for vinyl windows is specified in Section 08550.

4. Fire Glass:

a. Basis of Design: "Firelite Plus" as manufactured by Technical Glass Products.

(1) Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

b. Characteristics: UL-listed 90-minute-rated, 5/16" thick, clear, standard-grade, impact safety rated meeting ANSI Z97.1, hose-stream tested; 5-year limited warranty.

5. 1/4-inch thick, tempered, clear float glass, glazing quality, meeting requirements of ASTM C1036.

6. Spandrel Glass: Tempered 1/4-inch thick minimum with outbound face to match window glass in color. Back side shall be manufacturer's standard spandrel glass finish.

B. Glazing Materials: Adequate provision shall be made for use of glazing compound if applicable. The glazing material shall be particularly adapted for use with the frame material and shall not require painting. Any material to which the glazing compound will not readily adhere shall be removed from the glazing surfaces by the glazing contractor. Windows may be either factory or field glazed by one of the following methods:

1. Glazing Beads: Glazing beads or retainers of any material compatible with the frame material may be used and, if required to retain the glass, shall be of sufficient strength and fixation to serve this purpose. Thickness of glazing beads is optional except as otherwise specified in a particular product specification. Rigid vinyl glazing beads, where used, shall conform to AAMA Specification PS 26-70. Neoprene glazing beads are also acceptable.

2. Channel-Type Gaskets: Gaskets shall be of material compatible with aluminum, be resistant to weathering and maintain a watertight seal between the glass and its surrounding frame. Flexible vinyl, where used, shall be equal to Commercial Standard CS 230-60. Neoprene gaskets are acceptable.

3. Glazing Compound: Glass may be back bedded and face puttied with a glazing compound meeting Federal Specification TT-G-401E. There shall be sufficient bedding compound to prevent glass-to-frame contact. Glazing clips shall be used to secure the glass in the frame before face puttying. Compound used for glazing in aluminum or stainless steel frames shall be nonhardening and noncorrosive, colored to harmonize with the frames. It shall be of type and composition that will not require any paint or other coating to protect it.

2.2 Fabrication:

A. General: Fabrication glass to sizes required on the drawings with bite edge clearance dimensions, including tolerances, as recommended by glass manufacturer and FGMA.

## PART 3 - EXECUTION

### 3.1 Installation:

#### A. Glazing:

1. Permanently adhere setting and edge blocks to frame.
2. Back putty all glass.
3. Tool glazing compound, eliminate air pockets, producing a positive slope away from glass.

B. Glazing Schedule: Refer to drawings for locations of openings and glazing required.

### 3.2 Field Quality Control:

A. Protection: Protect glass from damage during subsequent construction operations.

B. Replacement: Replace damaged glass at no additional cost to Owner.

#### C. Cleaning:

1. Remove dirt, contaminants, staining agents and other deposits promptly, using manufacturer's recommended procedures.
2. Remove excess sealant as work progresses, using methods that will not damage glass.
3. Wash both sides of glass, using manufacturer's recommended procedures, prior to final inspection.

END OF SECTION



SECTION 09260  
GYPSUM BOARD SYSTEMS

PART 1 - GENERAL

1.1 Quality Assurance:

A. Reference Publications:

1. American Society for Testing and Materials (ASTM)
2. Federal Specifications (FS)
3. Underwriter's Laboratories, Inc., (UL)

1.2 Related Sections:

- A. Section 06100, Rough Carpentry
- B. Section 06200, Finish Carpentry and Millwork
- C. Section 07900, Sealants and Caulking
- D. Section 09311, Ceramic Tile and Marble
- E. Section 09512, Suspended Acoustical Tile Ceilings
- F. Section 09900, Painting

1.3 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Product Data: Manufacturer's detailed descriptive and specification data, and installation instructions for the products described hereinafter.
- C. Material List: Furnish a complete list of materials to be used in this work.

1.4 Product Handling:

- A. Delivery: Deliver materials in original and unopened packages, containers or bundles with brand names and manufacturer's labels intact and legible.
- B. Storage and Protection:
  1. Store materials in dry location, fully protected from weather and direct exposure to sunlight.
  2. Stack gypsum board products flat and level, properly supported to prevent sagging or damage to ends and edges.
  3. Store corner bead and other metal and plastic accessories to prevent, sagging, discoloration, or other mechanical damage.

1.5 Job Conditions:

A. Temperature: Maintain temperature in areas of installation between 50 and 70 degrees F for at least 24 hours before installation begins and for not less than 48 hours after joint finishing has been completed.

B. Ventilation: Provide controlled ventilation during joint finishing operations, to eliminate excessive moisture. Avoid drafts during hot, dry weather to prevent excessively fast drying of joint compound.

PART 2 - PRODUCTS

2.1 Materials:

A. Wood: Wood items, including but not limited to framing, blocking, and furring are furnished under Section 06100.

B. Metal Furring Channels: 16 gauge cold rolled steel, "C" shape, of sizes required by the drawings or described hereinafter

C. Metal Screw Furring Channels: 2¾" x 7/8" x 1-3/8" face width, galvanized steel, weighing not less than 292 lbs/mlf.

D. Furring Channel Clips: Galvanized wire, manufacturer's standard, especially designed for attaching screw furring channels to 1½-inch furring channels.

E. Hanger Wire: 9 gauge, galvanized.

F. Gypsum Wallboard:

1. Fire Rated: Fire-rated 5/8 inch thick, tapered edge, meeting requirements of ASTM C 1396 for Type "X" panels; GREENGUARD Certified.

2. Moisture Resistant: Fire-rated 5/8 inch thick, tapered edge, mould-resistant gypsum core and coated fiberglass mat facers meeting requirements of ASTM C 1396, ASTM C 1658, and ASTM C 3273 (Panel Score = 10); GREENGUARD Certified.

G. Fasteners:

1. For attaching gypsum wallboard to wood framing, fasteners shall be 1¼-inches Type W coarse thread wallboard nail, cement coated.

2. For attaching gypsum wallboard to metal framing, fasteners shall be 1-7/8 inches, Type S, Bugle Head screws, cadmium plated.

3. For attaching screw furring channels to concrete or masonry shall be power actuated type capable of withstanding 192 pounds of single shear and 200 pounds bearing force without exceeding allowable stress design of fastener or member being fastened.

4. For attaching framing members together shall be Type S, pan-head screws in sizes recommended by the metal stud manufacturer for applications required.

5. For attaching perimeter wall insulation to masonry, fasteners shall be pneumatically driven or power actuated fasteners, capable of penetrating substrate, providing positive anchorage.

H. Accessories:

1. Outside Corner Bead: All metal, hot-dipped galvanized, 1" x 1" and weighing not less than 114 pounds per MLF.

2. Casing Bead: All metal, hot-dipped galvanized, 7/8 inch flange, "C" shaped, capable of being taped and finished and weighing not less than 165 pounds per MLF.

3. Inside Corner Reinforcement: Perforated fiber tape with chamfered wafer-thin edges, 2-1/16 inches wide and meeting ASTM C 475.

I. Tape: Perforated fiber tape with chamfered wafer-thin edges, 2-1/16 inches wide and meeting ASTM C475.

J. Joint Compound: Ready-mixed compound, meeting ASTM C 475.

K. Sealant: As specified in Section 07900.

L. Sound Attenuation Blankets:

1. Walls: Equal to Owen Corning sound attenuation batts, meeting ASTM C 665, Type I and ASTM E 136, unfaced, flame spread 10, smoke developed 10, 3½" thick.

## PART 3 - EXECUTION

### 3.1 Installation:

A. Wood Framing: Wood framing, including but not limited to blocking, and furring shall be installed under Section 06100.

B. Installation of Metal Furring:

1. Attach metal channels with specified fasteners spaced not less than 24 in. o.c.

C. Installation of Sound Attenuation Blankets: Install in all interior stud walls, full height of wall framing.

D. Installation of Gypsum Wallboard:

1. Install wallboard in accordance with manufacturers printed installation instructions, except where more stringent requirements are specified.

2. Use wallboard of maximum lengths to minimize end joints.

3. Stagger end joints when they occur.

4. Abutt wallboards without forcing. Fit ends and edges of wallboard. Do not place butt ends against tapered edges.

5. Support end and edges of wallboard panels on framing or furring members.

6. At walls and columns, apply wallboard horizontally, attaching upper board first; stagger end joints on opposite sides of partitions.

7. Fasten wallboard to framing members, using the specified fasteners spaced as recommended by the manufacturer of the wallboard being installed for the specific installation.

8. All gypsum board shall be 5/8" Type "X" fire-rated gypsum board, except:

a. Install tile backer board (Section 09311) at all walls to receive ceramic tile.

b. Install fire-rated moisture-resistant gypsum board at all bath/toilet walls (other than where ceramic tile is scheduled) and other locations as noted on the drawings.

E. Installation of Accessories:

1. Install corner beads at all outside corners.

2. Install metal casing beads at exposed edges of wallboard at door and window openings, at intersections with other materials and at other location shown on the drawings.

F. Installation of Sealant: Caulk all perimeter joints, electrical boxes and penetrations with specified sealant.

### 3.2 Joint Treatment:

A. Taping or Embedding Joints:

1. Apply compound to this uniform layer to all joints and angles. Center tape over joint and set tape into compound; leave approximately 1/16 inch to 1/32 inch compound under tape to provide bond.

2. Apply skim coat following tape embeddment, but not to function as fill or second coat; fold tape and embed in angles to provide true angle. Dry embedding coat prior to application of fill coat.

B. Filling:

1. Apply joint compound over embedding coat to cover tape. Feather out fill coat beyond tape and previous joint compound line.

2. Do not apply fill coat on interior angles.

3. Allow fill coat to dry prior to application of finish coat.

C. Finishing:

1. Smooth Finish: Typical wall finish except where specifically noted otherwise on the drawings.

a. Spread joint compound over and beyond fill coat on all joints. Feather to smooth uniform finish.

b. Apply finish coat to taped angles to cover tape and taping compound.

c. Sand final application of compound to provide smooth surface ready.

D. Finishing Beads and Trim:

1. First Fill Coat: Apply joint compound to beads and trim. Feather out from ground to plane of the surface; dry compound prior to application of second fill coats.

2. Second Fill Coat: Apply joint compound in same manner as first fill coat. Extend beyond first coat onto face of wallboard; dry compound prior to application of finish coat.

3. Finish Coat: Apply joint compound to bead and trim; extend beyond second fill coat; feather finish coat from ground to plane of surface; sand finish coat to provide flat surface ready for decoration.

E. Filling and Finishing Depressions:

1. Apply joint compound as first coat to fastener depressions; apply at least two (2) additional coats of compound after first coat is dry.

2. Leave filling and finished depressions level with plane of wallboard.

F. Fire Rated Construction: Where the drawings call for fire rating of walls, columns, beams or ceilings, the entire assembly shall be constructed and installed to comply with the UL rating called for thereon.

1. All new fire-rated walls shall be clearly labeled (in 2" HT painted, stenciled letters) indicating the hourly rating and including the words "PROTECT ALL OPENINGS"; lettering shall be above ceilings and located at every 12-feet and at least 1-location per wall.

G. Refer to Section 09900 for painting gypsum board.

END OF SECTION



SECTION 09311  
CERAMIC TILE AND MARBLE

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to special conditions where specified hereinafter.

2. Referenced Publications:

- a. American Society for Testing and Materials (ASTM)
- b. American National Standards Institute (ANSI)
- c. Tile Council of America (TCA)
- d. Marble Institute of America, Inc., American Standard

Specifications for Interior Marble (MIA)

1.2 Related Sections:

- A. Section 07900, Sealants and Caulking
- B. Section 09260, Gypsum Board Systems
- C. Section 09512, Suspended Acoustical Tile Ceilings

1.3 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Shop Drawings: Submit to Architect for review, shop drawings, fully dimensioned and showing method of installation for all marble items described hereinafter.
- C. Product Data: Manufacturer's detailed descriptive and specification data and installation instructions for product described hereinafter.
- D. Samples: Complete color line available for ceramic floor, wall and base tile and grout.
- E. Extra Materials: Deliver supply of maintenance materials to the Owner. Furnish maintenance materials from same lot as materials installed, and enclosed in protective packaging with appropriate identifying labels.
  - 1. Furnish not less than 2% of total product installed maintenance stock for each type, color, pattern, and size of tile product installed. A single color for each pattern will be selected for the entire project.

#### 1.4 Product Handling:

A. Delivery: Deliver products of this section in manufacturer's original packaging with labels intact and legible.

B. Storage and Protection: Store products in a housed, dry and ventilated area and protect from damage from any cause.

#### 1.5 Job Conditions:

A. Temperature: Maintain at not less than 50 degrees F throughout installation operations and for at least seven (7) days after completion of the tile and marble work.

B. Ventilation: Use sparkproof fans for ventilation.

C. Lighting: Maintain lighting of not less than three (3) watts per square foot of floor area in all areas where setting and grouting operations are in progress.

### PART 2 - PRODUCTS

#### 2.1 Products:

##### A. Ceramic Tile:

1. Floor Tile: Unglazed mosaic colorbody porcelain, integral color, all purpose edges, on back mounted sheets; face size of tile 2" x 2"; manufactured to meet ANSI A137.1; coefficient of friction  $\geq$  0.68 wet per ASTM C1028.

2. Wall Tile: Semi-gloss / matt glazed ceramic wall tile; cushioned edges on back mounted sheets 4-1/4" x 4-1/4" square-in corners, round out-corners, manufactured to meet ANSI A137.1.

3. Base Tile: Semi-gloss / matt glazed ceramic base tile, set-on type with coved bottom, 4-1/4" x 6", square in-corners, round out-corners, manufactured to meet ANSI A137.1.

B. Ceramic Tile Colors: As selected by the Architect from manufacturer's standard colors.

1. Floor Tile: Price Groups 1 and 2.

2. Wall and Base Tiles: Price Groups 2 and 3.

C. Marble Thresholds: 1-15/16" wide x 5/8" thick x length required to allow fitting at door jambs with beveled edges and honed finish; color white.

##### D. Wall Backer Material:

##### 1. Backer Board:

a. Basis of Design: 5/8" DensShield by Georgia Pacific Corp. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

(1) Composition: Water-resistant treated core with glass mat moisture resistant coating and embedded glass mats, both sides. The face side is surfaced with heat-cured water and vapor retardant coating meeting ASTM C 1178.

2. Accessories:

a. Trim: Sheet steel zinc-coated by hot-dip process.

b. Metal Framing Fasteners: Screws shall be light-gauge metal framing; Type S, bugle or wafer head, self-tapping, rust resistant. Heavy-gauge metal framing; Type S-12, bugle or wafer head, rust resistant.

c. Joint Tape:

(1) 2" wide 10 x 10 glass mesh tape.

(2) Reinforcing Fabric: Balanced, alkali-resistant, open-weave, glass fiber fabric, made from continuous multi-end strands with tensile strength of not less than 120 lbs. and 140 lbs. in warp and fill directions, respectively, per ASTM D 1682 and complying with ASTM D 578, and of 4.30 oz./sq. yd. minimum weight.

E. Anti-Fracture Membrane: 40-mil "Peel & Stick" with fabric top surface.

F. Setting Materials:

1. Ceramic Tile Floor / Marble Thresholds:

a. Mortar Bed: ANSI A 108. 1A.

b. Mortar Bed Bond Coat: Portland cement surry.

c. Latex Portland Cement Mortar: ANSI A118.4.

d. Waterproofing Membrane: Elastomeric waterproofing and crack prevention membrane, equal to "RedGard" as manufactured by Custom Building Products and conforming to ASTM A118.10

e. Grout: ANSI A118.7.

2. Ceramic Tile Walls:

a. Latex-Portland Cement Mortar: ANSI A118.4

b. Grout: ANSI A118.6

G. Sealant: As specified in Section 07900.

## PART 3 - EXECUTION

### 3.1 Installation:

#### A. Preliminary Requirements:

1. Substrate Surface Variations:
  - a. Concrete Slabs: Not exceeding 1/8" in 10'.
  - b. Framing:
    - 1) Stud spacing not to exceed 16-inches o.c.
    - 2) Studs square and plumb.
  - c. Wall Backing Surface: Not exceeding 1/4" in 10'.
  - d. Substrates shall be sound, dimensionally stable, free of cracks, waxy or oily films and have not protruding appendages.
2. Layout of Tile Work:
  - a. Determine location of all movement joints.
  - b. Layout all tile work so as to minimize cuts less the one half (1/2) tile in size. Tile shall be centered in each space, both directions, unless shown otherwise.
  - c. Locate both cuts in walls and floors so as to be least conspicuous.
  - d. Align all floor joints to give uniform grout lines parallel to walls, unless otherwise shown on the Drawings.
  - e. Align all wall and base joints and all trim joints to give uniform grout lines that are plumb and level.
  - f. Over all control joints in substrate, install a strip of anti-fracture material, in width as recommended by its manufacturer and secure in place as per its manufacturer's instructions.

B. Setting Tile and Marble:

1. Ceramic Floor Tile / Marble Thresholds: Bonded cement mortar as per TCA F112.
  - a. Install waterproofing membrane over floor concrete slab floor.
  - b. Install mortar bed to thickness shown on plans in accordance with manufacturer's written instructions, using roller, trowel, or sprayer.
  - c. Mortar bed bond coat shall be Portland cement surry.
  - d. Install latex Portland cement mortar on cured mortar bed.
  - e. Install tile per ANSI A108.5.
  - f. Install grout per ANSI A108.10.

2. Ceramic Tile Wall and Base:

a. Backer Board: Install backer board panels in accordance with manufacturer's recommendations, and TCA 245.

(1) Apply glass mesh joint tape and reinforcing fabric over joints. Embed tape in setting material indicated for specified tile finishes. Allow joints to dry prior to installing tile system.

b. Ceramic Tile:

(1) Install tile per ANSI A108.5.

(2) Install grout per ANSI A108.10.

3.2 Field Quality Control:

A. Cleaning: After grout has stiffened, sponge and wash ceramic tile with clear water, then rub with damp cloth or sponge and then polish with dry cloth.

B. Protection:

1. Foot Traffic: After completion of the installation, prohibit all foot traffic for a period of not less than seven days.

2. Protective Covering: Cover all ceramic tile floors with a non-staining construction paper, masked in place; remove prior to final inspection, rinse floor and base tile with clear water and polish with clean dry cloth.

END OF SECTION



SECTION 09512  
SUSPENDED ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications or standard (with respective abbreviations used); these referenced publications may be subject to special conditions where specified hereinafter.

2. Referenced Publications:

- a. American Society for Testing and Material (ASTM)
- b. Federal Specifications (FS)

1.2 Related Sections:

- A. Section 09260, Gypsum Board Systems
- B. Section 09311, Ceramic Tile and Marble

1.3 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Shop Drawings: Fully dimensioned, showing actual field measurements, superimposed over duct work; show locations of all mechanical and electrical items located in or above the ceiling tile.

C. Color Card: Full range of colors available for tile and suspensions systems.

D. Samples:

1. Suspension System: Full size components not less than as inches long for each type and color suspension system described hereinafter.

2. Ceiling Tile: Not less than 12" x 12" full thickness for each type and color of ceiling tile described hereinafter.

E. Product Data: Manufacturer's detailed material and fabrication specification and installation instructions for each suspension system and ceiling tile type described hereinafter.

F. Extra Stock: After completion of this work, deliver to Owner not less than 2 percent replacement material for each 2,000 square feet (or fraction thereof) for each type, finish, color and pattern of tile installed; extra stock shall be from same manufactured lot as material installed, boxed and labeled.

1.4 Product Handling:

A. Delivery: Deliver product in original packaging with labels intact and legible.

B. Storage and Protection: Store products in a housed dry area and protect from damage as per their manufacturer's instructions.

1.5 Job Conditions:

A. Environmental Requirements: For a period of ten days prior to and throughout the installation of acoustical tile and until date of Architect's Certificate of Substantial Completion, maintain a temperature of not less than 50 degrees F and a relative humidity of not more than 60 percent.

B. Glazing: All glazing of exterior openings shall be complete and exterior doors shall be on place before beginning installation of any work under this section.

C. Wet Work: All concrete and other wet work shall be complete before installation is begun.

PART 2 - PRODUCTS

2.1 Manufacturers:

A. Basis of Design: Products described hereinafter are those of Armstrong World Industries, Lancaster, PA.

B. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products. Other acceptable manufacturers include:

1. BPB America, Inc., Tampa, FL.
2. USG Interiors, Inc., Chicago, IL.

2.2 Materials:

A. Acoustical Tile Type 1:

1. Design: "Cortega" 2' x 2' x 5/8" square lay-in tile, non-directional fissured, medium texture, tegular edge white. Minimum weight shall be 1.00 lbs. per square foot.

B. Acoustical Tile Type 2:

1. Design: 2" x 2" x 5/8" square lay-in tile, with scrubbable factory-applied vinyl plastic paint; ceramic and mineral fiber composite substrate material; plain surface. Ceiling tile shall be rated NFPA non-combustible in accordance with ASTM E 136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degree C.

C. Suspension System Type 1:

1. Design: 15/16" exposed tee.
2. Color: White

D. Suspension System Type 2:

1. Design: 15/16" exposed tee grid with all aluminum capping for environmentally severe conditions, white.

2. Color: White.

E. Sound Attenuation Blankets: Equal to Owens Corning "Sono Batts", unfaced glass fiber insulation, meeting ASTM C665, Type 1 and ASTM E136, flame spread 10, smoke developed 10, 3½" thick.

F. Hanger Wire: 12 gauge, galvanized.

G. Direct Load Ceiling Clip: Manufacturer's standard.

H. Tile Markers/Adhesive:

1. Rosettes: 2" diameter x 1/16" thick aluminum with white baked enamel finish.

2. Adhesive: Epoxy compatible with ceiling tile with which used.

I. Hold-Down Clips: Manufacturer's standard.

### PART 3 - EXECUTION

#### 3.1 Preliminary Requirements:

A. Layout: Ceilings shall be centered within areas, producing no tile less than 1/2 size, unless specifically shown otherwise on the drawings.

B. Lines: Contractor shall establish lines and maintain same throughout the work and all trades shall work to these lines.

#### 3.2 Installation:

A. Suspension System Type 1:

1. Erect in accordance with the manufacturer's published literature, producing an exposed grid pattern 24" x 24", except as otherwise shown on the drawings, attaching hanger wires to Type 3 suspension system with direct load ceiling clips.

2. Provide and install an additional 4 hanger wires adjacent to each light fixture at intersections of framing members.

3. The suspension system, once installed and fully loaded shall have a deflection of no more than 1/360 of the span and shall be level to within 1/8" in 12' with levels taken at random.

B. Suspension System Type 2: As described hereinbefore for Suspension System Type 1.

C. Type 1 Ceiling Tiles: Install in Type 1 suspension system in accordance with the tile manufacturer's installation specifications contained in the product packaging.

D. Type 2 Ceiling Tiles: Install in Type 2 suspension system in accordance with the tile manufacturer's installation specifications contained in the product packaging.

E. Sound Attenuation Blankets: Install above acoustical tile ceilings where called for on the drawings.

F. Tile Markers: Install tile markers on ceiling tiles wherever access to mechanical and electrical items, concealed above ceiling, is required for service and maintenance.

G. Hold-Down Clips: Install at all ceiling tiles in restrooms, bathrooms, toilets, and locker rooms.

### 3.3 Field Quality Control:

A. Cleaning: Upon completion of the work, clean all exposed to view surfaces and leave tile and trim in a clean and spotless condition.

END OF SECTION

SECTION 09650  
RESILIENT BASE

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by referenced to published specifications or standards (with respective abbreviations used); these referenced publications may be subject to special conditions where specified hereinafter.

2. Referenced Publications: Federal Specifications (FS).

1.2 Related Sections:

A. Section 09260, Gypsum Board System

B. Section 09656, Flexible Terrazzo Tile

1.3 Submittals:

A. General: Make Submittals in accordance with Section 01300.

B. Product Data: Manufacturer's detailed descriptive and specification data and installation instructions for each product described hereinafter.

C. Samples: Complete color line available for resilient base.

D. Maintenance Guides: Furnish manufacturer's printed maintenance instructions for each product described hereinafter.

E. Certification: Furnish written certification that the products installed comply with the requirements of this section.

F. Extra Stock: After work is complete, deliver to Owner extra stock as follows:

1. Resilient Base: Not less than 15 linear feet of base, plus two (2) outside corners for each color and type installed. Extra stock shall be from same manufactured lot as material installed, boxed and labeled.

1.4 Product Handling:

A. Delivery: Deliver products of this section in manufacturer's original packaging with labels intact and legible.

B. Storage and Protection: Store in a housed, dry and ventilated area and protect from damage from any cause.

1.5 Job Conditions:

A. Temperatures: For a period of at least 24 hours before commencing installation, during installation for at least 48 hours after installation is complete, maintain a temperature of at least 70 degrees F.

B. Sequencing: Do not begin installation of the products of this section until painting has been completed in each area.

PART 2 - PRODUCTS

2.1 Material:

A. Resilient Base: Set-on cove type, 4" high x 1/8" thick, of homogeneous resilient and conforming to FF SS-W-40a, Type II with outside corners.

B. Adhesive: Only that recommended by the manufacturer of the resilient material being installed.

C. Colors: As selected by Architect from manufacturer's standards.

PART 3 - EXECUTION

3.1 Preliminary Requirements:

A. Surface Preparation:

1. Surfaces scheduled to receive resilient materials shall be level and straight with the allowance variations of 1/8 inch in 10 feet and 5/64 inch in 1 foot.

3.2 Installation:

A. Application of Adhesives: Apply in accordance with their manufacturer's instructions.

B. Resilient Base: Install where called for on the drawings in lengths as recommended by the base manufacturer, with preformed outside corners and mitered or coped inside corners and with tight and even joints, adhering to substrate as recommended by the manufacturer of the treads.

3.3 Field Quality Control:

A. Cleaning: Upon completion of the installation, remove excessive adhesives from all surfaces, using a neutral type cleaner.

END OF SECTION

SECTION 09656  
FLEXIBLE TERRAZZO TILE

PART 1 - GENERAL

1.1 Quality Assurance:

A. Industry Standards:

1. Some products and execution are specified in this section by referenced to published specifications or standards (with respective abbreviations used); these referenced publications may be subject to special conditions where specified hereinafter.

2. Referenced Publications: American Society for Testing and Materials (ASTM)

1.2 Related Sections:

A. Section 03300, Cast-in-Place Concrete

B. Section 09650, Resilient Base

1.3 Submittals:

A. General: Make Submittals in accordance with Section 01300.

B. Product Data: Manufacturer's detailed descriptive and specification data and installation instructions for each product described hereinafter.

C. Samples: Complete color line.

D. Maintenance Guides: Furnish manufacturer's printed maintenance instructions for each product described hereinafter.

E. Certification: Furnish written certification that the products installed comply with the requirements of this section.

F. Extra Stock: After work is complete, deliver to Owner extra stock as follows:

1. Flexible Terrazzo Tile: Not less than 2 percent replacement material for each 2,000 sq. ft. (or fraction thereof) of each color, type and pattern installed. Extra stock shall be from same manufactured lot as material installed, boxed and labeled.

1.4 Product Handling:

A. Delivery: Deliver products of this section in manufacturer's original packaging with labels intact and legible.

B. Storage and Protection: Store in a housed, dry and ventilated area and protect from damage from any cause.

1.5 Job Conditions:

A. Temperatures: For a period of at least 24 hours before commencing installation, during installation for at least 48 hours after installation is complete, maintain a temperature of at least 70 degrees F.

B. Sequencing: Do not begin installation of the products of this section until painting has been completed in each area.

PART 2 - PRODUCTS

2.1 Manufacturers:

A. Basis of Design: "Fritztile" as manufactured by Fritz Industries / Mesquite, TX.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

2.2 Material:

A. Flexible Terrazzo tile, having the following characteristics:

Wear Warranty	20 years
Thickness	3/16"
Size	12" x 12"
Abrasive Wear	ASTM F510-93, resistance to abrasion (1000 gram load at 500 cycles). Volume loss/cm <sup>3</sup> : 0.0196
Hardness	ASTM-D 1706-61: Fritztile binder resin casting "D" hardness, 78. Marble barcol hardness, 55-100, depending on pattern type
Coefficient of Friction	Slip resistance, ASTM-D-2047: 0.70 – 0.74 average
Therman Expansion	ASTM D696-91, Coefficient of linear thermal expansion between – 30C and 30C, 1.3x10 <sup>(-5)</sup>
Compressive Strength	ASTM-C109/D695, approx. 2,900 to 5,000 psi
Electrical Characteristics	non-conductive
Flame-Resistant Properties	ASTM – 648 – Critical Radiant Flux, 0.93 watts/cm – Class 1, ASTM-E-662-97, smoke generated, NBS smoke density (smoldering 231.76, flaming 292.05) average DMC, ASTM-E-84-98
Chemical Resistance	ASTM F925-97, resistance to chemicals, no change on surface attack, color change or swelling.
Oil Resistance	Passes MIL-D-3134F
Corrosion Resistance	Passes MIL-D-3134F
Static Load Limit	ASTM F970-93 load at 125 lbs., indentation, in. .0007"
Squareness	ASTM F540-90, squareness of resilient tile by dial gage method, .003"

B. Leveling Underlayment: Only that as recommended by the manufacturer of the flooring material being installed.

C. Adhesive: Portland-cement based hybrid cementitious powdered adhesive, equal to Type F.88, as manufactured by the tile flooring manufacturer.

D. Sealer and Finish: Water-based sealer and finish product as recommended by the flooring manufacturer; matte finish.

E. Sealant as recommended by the flooring manufacturer.

F. Colors: As selected by Architect from manufacturer's standard "Natural Quarry Selection".

### PART 3 - EXECUTION

#### 3.1 Preliminary Requirements:

##### A. Surface Preparation:

1. Surfaces scheduled to receive flooring materials shall be level and straight with the allowance variations of 1/8 inch in 10 feet and 5/64 inch in 1 foot.

2. High spots shall be ground down and depressions filled with leveling Underlayment as approved by the vinyl material being installed; telegraphing of imperfections onto the material will not be acceptable.

B. Perform calcium chloride test per ASTM F-1869, bond test, and other tests as recommended by the manufacturer to determine moisture vapor transmission rate of the concrete prior to installation of flooring material.

C. Flooring materials shall be acclimatized for a minimum of 24-hours prior to installation. Maximum allowable reading – FA88 = 10 lbs./1000 SF in 24-hours.

D. Perform Relative Humidity (RH) test per ASTM F-2170-11, using SITU probes, max. allowable readings FA88 – 90% RH.

#### 3.2 Installation:

A. Layout Fields, patterns and borders shall be centered on applied areas unless specifically shown otherwise on the drawings.

1. Locate expansion/control joints in floor slab. Work patterns between joints such that tile does not bridge over a joint.

B. Application of Adhesives: Apply in accordance with their manufacturer's instructions.

C. Install leveling underlayment as recommended by the manufacturer.

D. Apply adhesive in strict accordance with the manufacturer's instructions.

E. Lay tile with butt joints per manufacturer's recommendations. Roll the tile per the manufacturer's instructions until adhesive has set and complete bonding of tile and adhesive has occurred. Seal exposed edges.

F. Apply a minimum of two (2) coats of sealer and 2-coats of finish per the manufacturer's instructions.

### 3.3 Field Quality Control:

A. Protection: Provide a non-staining paper pathway taped to the flooring in direction of foot traffic.

B. Clean floor prior to final inspection. Re-apply sealer and finish coat as necessary to restore sheen.

END OF SECTION

SECTION 09900  
PAINTING

PART 1 - GENERAL

1.1 Quality Assurance:

A. Manufacturers: All paints/stains selected for the coating and finishing system for each type of surface shall be the product of a single manufacturer and as described hereinafter.

1.2 Related Sections:

- A. Section 05500, Miscellaneous Metals
- B. Section 06200, Finish Carpentry and Millwork
- C. Section 06410, Cabinetwork
- D. Section 07900, Sealants and Caulking
- E. Section 08110, Steel Frames and Doors
- F. Section 09260, Gypsum Board Systems

1.3 Definitions:

A. Paint: Term used in a general sense and has reference to sealers, primer, stains, oils, alkyd, latex, epoxy and enamel type paints.

B. Painting: Term used in a general sense and has reference to the application of "paint" without regard to the type of material, to an item.

C. Back Prime: Terms used in a general sense and has reference to the application of "paint" (first coat), without regard to the type of material, to the back side (unexposed to view) of an item.

1.4 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Material List: Prior to delivery of any paint materials to the project site, submit a complete list of all paint materials to be used in this project as described hereinafter.

C. Manufacturer's Data: Accompanying the materials list, furnish the paint manufacturers detailed descriptive and specification data and application instructions for each type of paint required including INTERIOR Green Seal Standard GS-11 compliance :

Architectural Paints: Flats:	50 g/L
Non-flats:	150 g/L
Coatings and Primers:	150 g/L

D. Color Cards: Manufacturer's full range of colors available for each finish described hereinafter in the "Painting Systems Schedule".

E. Color Samples:

1. After review of the material list color cards and manufacturer's data, but prior to delivery of any paint to the project site, submit color samples, not less than 12 inches x 12 inches each, for each type and color of finish required.

2. Wherever possible, the material upon which the sample colors are applied shall be the same material as that on which the paint will be applied in the project.

1.5 Product Handling:

A. Delivery: Deliver the products of this section in manufacturer's original unopened packaging with labels intact and legible.

B. Storage and Protection: Store products of this section in a housed, dry and ventilated area, and protect from damage.

1.5 Job Conditions:

A. Temperature: Maintain a constant temperature of not less than 65 degrees F during interior painting and drying operations.

B. Ventilation: Provide ventilation to allow for the proper drying of the paint materials by using either of the following:

1. Temporary air circulators (spark proof)
2. Air conditioning system.

PART 2 - PRODUCTS

2.1 Materials:

A. Manufacturers:

1. The use of manufacturer's names and products are for reference only to indicate characteristics of the material and the finished required.

2. Subsequent to the requirements of these specifications, acceptable manufacturers include:

- a. Glidden Professional GP
- b. Benjamin Moore BM
- c. Devoe D
- d. Pratt & Lambert PL

B. Colors shall be as selected by the Architect.

C. Accessory Equipment: Ladders, scaffolding, drop clothes, scrapers, dusters and similar items are not required to be new, but they shall be safe, adequate and acceptable of producing the results for which they are intended.

D. Application Equipment: Brushes, rollers, spray apparatus and similar application equipment are not required to be new, but they shall be capable of producing the required results specified hereinafter.

E. Thinners: Only those recommended for that purpose by the manufacturer of the material being installed.

## PART 3 - EXECUTION

### 3.1 Installation:

#### A. Surface Preparation:

1. General: Do not begin painting on any surface until it has been inspected and is in condition to receive the paint as specified herein. Should any surface be found unsuitable to produce a proper paint finish, the Architect shall be notified in writing and no material shall be applied until the unsuitable surfaces have been made satisfactory. Absence of such notification shall be construed as acceptance of such surface to receive paint. Later claims of defects in surfaces prior to painting shall not relieve the Contractor from his responsibility for compliance with the requirements of the Specifications.

2. Steel and Iron: Remove grease, dirt, mud, rust and scale. Touch up any chipped or abraded places on items that have been shop coated. Where steel and iron have a heavy coating of scale, it shall be removed by de-scaling or wire brushing to produce a smooth surface for painting.

3. Masonry: Masonry surfaces to be painted shall be prepared by removing all dirt, dust, oil and grease stains, mortar droppings, and efflorescence.

4. Plaster Surfaces: Fill all holes and cracks with spackling compound. Before painting any plaster, the surfaces shall first be tested for dryness with a moisture testing device especially designed for this purpose. No paint or sealer shall be applied on plaster when the moisture content exceeds 12% as determined by the testing device. Test sufficient areas in each space as often as necessary to determine the proper moisture content for painting. When requested, testing shall be done in the presence of the Architect, or his representative. If the moisture content is between 8% and 12% prime, with alkali resistant primer. If 85 or less, prime with the primer specified under "Schedule of Painting". Remove the dry salts deposits from all plaster surfaces by brushing with a stiff brush before painting.

5. Wood Surfaces: Primed and finish-coated as specified in the painting schedule herein. Wood surfaces shall be cleaned of all dirt, oil, or foreign substances with mineral spirits, scraper, sandpaper and/or wire brush. Finished surface exposed to view shall be made smooth by sandpapering. Small, dry, seasoned knots shall be surface scraped and cleaned and shall be given a thin coat of knot sealer before application of the priming coat. Pitch on large, open, unseasoned knots and on all other beads or streaks of pitch shall be scraped off, or if still soft, shall be removed with mineral spirits or turpentine and the resinous area thinly coated with knot sealer. After priming, all holes and imperfections in finish surface shall be filled with putty or plastic wood filler colored to match the finish coat, allowed to dry and sandpapered smooth. Painting shall proceed only when the moisture content of the wood does not exceed 12% as measured by a moisture meter. All wood trim shall be backed primed.

6. Exposed pipes and conduit shall be cleaned using mechanical cleaning and/or solvents, mineral spirits or other paraffin-free solvents having a flash point no higher than 100 degrees F. and shall be painted in accordance with the Painting Systems Schedule.

7. Hardware, hardware accessories, lighting fixtures, switch and outlet plates, in place and not to be painted shall be removed prior to surface preparation and painting operations or protected. Following completion of painting of each space, removed items shall be reinstalled.

B. Application and Instructions:

1. The proportions of all ingredients in all paints and stains mixed on the site shall be in accordance with the recommendations of the paint manufacturer printed on the container applicable to the particular use for which the specific mixture is intended. No thinner or flattening oil will be used in the last coat. Screen out all lumps and impurities during mixing using clean containers, and protect against dirt or trash entering the mix. Stir until uniform consistency is procured.

2. During the actual application and drying of the paint, and until normal occupancy of the building occurs, a minimum temperature of 65 degrees F. shall be maintained. This temperature shall be held as constant as possible to prevent condensation. Ventilation shall be provided at all times so that the humidity cannot rise above the dew point of the coldest wall.

3. Do not apply exterior paint in damp rainy weather or until the surface has dried thoroughly from the effects of such weather.

4. Surface to be stained or painted shall be clean, dry and smooth. Each coat of paint shall be smoothly applied, worked out evenly and allowed to dry before the subsequent coat is applied.

5. Enamel or varnish undercoats on wood surfaces and on steel surfaces shall be sanded smooth prior to recoating. Undercoats on steel and iron shall be dusted prior to recoating.

6. Finished work shall be uniform and of the specified color. It shall completely cover, be smooth and free from runs, sags, clogging or excessive flooding. Make edges of paint adjoining other materials or color, sharp and clean without overlapping. Where high gloss enamel is used, lightly sand undercoats to obtain a smooth finish coat.

7. Each coat of paint shall be slightly different shade than preceding coat. Final coat shall not be applied until the previous coat has been approved by the Contracting Officer.

8. Paste wood filler, applied on open grain wood, when "set" shall be wiped across the grain of the wood, then with the grain to secure a clean surface.

9. Correction of improper or damaged work may be by "spot touching" except that in final coat corrections, a re-coating of the entire surface between corners or "breaks" will be required without additional charge.

10. Access panels, registers, and grilles (except aluminum) shall be painted the same color as adjacent walls or ceilings. Where adjacent surfaces do not require painting, use color as directed by the Architect.

11. Where open cabinets or shelves occur, room finish on wall shall not be omitted. However, painting on walls will not be required behind permanently built-in cabinets with closed back.

12. Prime coated butts shall be painted the same color as door trim to which they are attached.

13. Exposed piping, conduit, duct work and hangers in finished spaces, shall

be painted a color and texture to match walls or ceilings adjacent to them. Where adjacent surfaces are unpainted, use color as directed by the Architect.

14. The top and bottom edges of all wood and metal doors shall be finished with two coats of paint or varnish as used for finish coat. Apply after fitting and before faces are painted.

15. Cleaning: At completion of the work, clean all paint, coatings, oil and stain spots from all surfaces not required to be paint under this section. Remove all surplus materials and debris resulting from the work included herein.

16. Schedule indicates minimum number of coats. Additional coats shall be applied as required for full coverage.

C. Painting Systems Schedule:

1. Exterior Painting:

a. Ferrous Metal:

- 1) Primer – Multi Purpose Alkyd  
One coat (in addition to shop coat):  
GP Devguard 4160 Tank & Structural Primer  
BM IMC Alkyd Metal Primer M06  
D MIRROLAC All Purpose Metal & Galvanized  
Primer - DP13201  
PL Steeltech® Rust Inhibitive Metal Primer
- 2) Finish - Rust Inhibitive Alkyd Gloss Industrial Enamel  
Two coats:  
GP Devguard 4308 Alkyd Industrial Enamel  
BM IMC Alkyd Urethane M22  
D BAR-OX Alkyd Gloss Enamel - DP581XX  
PL S4500 Techgard® Maintenance Gloss Enamel

b. Galvanized Metal:

- 1) Primer – Multi Purpose Alkyd Primer  
One coat:  
GP Devguard 4160 Tank and Structural Primer  
BM IMC Alkyd Metal Primer M06  
D MIRROLAC All Purpose Metal & Galvanized  
Primer - DP13201  
PL S4556 Steeltech® Rust Inhibitive Metal Primer
- 2) Finish - Gloss Acrylic Enamel:  
Two coats:  
GP 4216 Devflex Direct to Metal Gloss Acrylic Enamel  
BM D.T.M. (Direct to Metal) Acrylic Gloss Enamel M28  
D  
PL Z6611 Enducryl® Acrylic Gloss Enamel

2. Interior Painting: Interior Green Seal Standard GS-11  
Architectural Paints:  
Flats: 50 g/L  
Non-flats: 150 g/L  
Coatings and Primers 150 g/L

a. Ferrous Metal:

1) Primer – Waterborne Metal Primer  
One coat (in addition to shop coat):

GP 4020 PF Devlex Direct to Metal Primer Flat Finish  
BM Benjamin Moore® Super Spec HP® D.T.M.  
(Direct to Metal) Acrylic Semi-Gloss P29  
D Mirrolac WB Waterborne DTM Flat Primer & Finish  
DP85XX  
PL Z6650 Steeltech® Acrylic Prime or Finish

2) Finish, Latex Semi-Gloss  
Two Coats:

GP 1416 Glidden Ultra-Hide Latex Semi-Gloss  
BM N333 Regal® Semi-Gloss Finish  
D Wonder-Tones Semi-Gloss Interior Latex Enamel -  
DR39XXN  
PL Z2400 RedSeal® Interior Latex Semi-Gloss

b. Galvanized Metal:

1) Primer – Waterborne Metal Primer  
One coat (in addition to shop coat):

GP 4020 PF Devlex Direct to Metal Primer Flat Finish  
BM Benjamin Moore® Super Spec HP® D.T.M.  
(Direct to Metal) Acrylic Semi-Gloss P29  
D Mirrolac WB Waterborne DTM Flat Primer & Finish  
DP85XX  
PL Z6650 Steeltech® Acrylic Prime or Finish

2) Latex Semi-Gloss  
Two Coats

GP 1416 Ultra-Hide 150 Interior Latex Semi-Gloss  
BM N333 Regal® Semi-Gloss Finish  
D Wonder-Tones Semi-Gloss Interior Latex Enamel –  
DR39XXN  
PL Z2400 RedSeal® Interior Latex Semi-Gloss

c. Wood-Painted:

- 1) Primer, Acrylic bonding stain-killer Primer/Sealer  
One Coat:

GP 3210 Gripper Int/Ext Primer  
BM Fresh Start® All-Purpose 100% Acrylic Primer 023  
D Primz 220 Kilstain WB Interior/Exterior latex  
All Purpose Stain Killer/Primer/Sealer - DR5180X  
PL Z6650 Steeltech® Acrylic Prime or Finish

- 2) Finish - Latex Semi Gloss:  
Two coats:

GP 1416 Ultra-Hide 150 Interior Latex Semi-Gloss  
BM N333 Regal® Semi-Gloss Finish  
D Wonder-Tones Semi-Gloss Interior Latex Enamel  
DR39XXN  
PL Z2400 RedSeal® Interior Latex Semi-Gloss

d. Wood-Stained:

- 1) One or two coats water-based stain as required for an  
even finish:

GP WOOD PRIDE® Professional Wood Finishes  
Water-Based Wood Finishing Semi-Transparent  
Stain – 1700V  
BM Benwood® Interior Wood Finishes Waterborne  
Stain 205  
D N/A  
PL Interior Acrylic Latex Stain Z197  
PL Interior Acrylic Latex Varnish Gloss Finish Z24/Z24C

- 2) Two coats waterborne gloss or satin varnish:

GP WOOD PRIDE® Professional Wood Finishes  
Water-Based Gloss Varnish - 1808  
BM Benwood® Stays Clear® Acrylic Polyurethane Low  
Lustre 423  
BM Benwood® Stays Clear® Acrylic Polyurethane High  
Gloss 422  
D N/A  
PL Interior Acrylic Latex Varnish Satin Z17 / Z17C  
PL Interior Acrylic Latex Varnish Gloss Finish Z24 / Z24C

e. Gypsum Board

- 1) Primer, latex PVA  
One Coat:

GP 1030 PVA Latex Wall Primer Sealer  
BM Moorcraft Super Craft® Interior Latex Primer 250  
D Primz 220 Interior Latex PVA Wall Primer - DR53360  
PL Z8190 Pro-Hide® Silver Interior Latex PVA Wall  
Primer

- 2) Finish, Ceilings, Latex Flat  
Two coats:
- |    |   |
|----|---|
| GP | 1210 Glidden Ultra-Hide 150 Interior Flat Latex                               |
| BM | Moorcraft Super Hide® Latex Flat 282  |
| D  | Wonder-Tones Interior Flat latex Wall Paint - Dr36xxn                         |
| PL | RedSeal® Porcelain™ Interior Flat Acrylic Latex<br>Wall Coating - Z3700/F3700 |
- 3) Finish, Walls, Acrylic Eggshell:  
Two coats:
- |    |   |
|----|---|
| GP | 1410 Glidden Ultra-Hide 150 Low Sheen Eggshell        |
| BM | Moorcraft Super Hide® Latex Eggshell Enamel C286      |
| D  | Wonder-Tones Flat Interior Latex Wall Paint - Dr36xxn |
| PL | Z8290 Pro-Hide® Gold Interior Latex Eggshell          |

3. Concrete Masonry:  
Filler Coat: High performance acrylic block filler  
Two (2) coats waterborne low VOC Polyamide Epoxy

Acceptable Manufacturers:

- Devoe Coatings
- Carboline Coatings
- Tnemec Coatings

a) Devoe:

1) Filler 1-coat:

- High Performance Block Filler
- 4000-1000 Bloxfill HD Acrylic Block Fill Interior / 67 g/L  
Exterior Heavy Duty Acrylic Block Filler

2) Two Finish Coats

Polyamine Waterborne Gloss Epoxy	
4428 TRU-GLAZE-WB 4428 Waterborne	50 g/L

b) Carboline:

1) Filler 1-coat:

- High Performance Block Filler
- Sanitile® 100 Havy Duty Acrylic Block Filler 60 g/L

2) Two Finish Coats

Polyamine Waterborne Gloss Epoxy	
Sanitile 555 High Performance WB Epoxy Finish	79 g/L

c) Tnemec:

1) Filler 1-coat:

- High Performance Block Filler
- F130-0130A – ENVIROFILL 100 g/L

2) Two Finish Coats

Polyamine Waterborne Epoxy	
S287XW227A – ENVIRO-POX	60 g/L

### 3.2 Field Quality Control:

#### A. Painting:

1. During progress of the work, do not allow the accumulation of empty containers or other excess items except in areas specifically set aside for that purpose.

2. Prevent accidental spilling of paint materials and, in event of such spill, immediately remove all spilled material and the waste or other equipment used to clean up the spill, and wash the surfaces to their original undamaged condition.

3. Upon completion of this portion of the work, visually inspect all surfaces and remove all paint and traces of paint from surfaces not scheduled to be painted.

END OF SECTION



SECTION 10155  
TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 Quality Assurance:

A. Qualification of Manufacturer: Manufacturer of the products of this section shall have been successfully engaged in the business of manufacturing and fabricating toilet partitions for a period of not less than five years immediately prior to furnishing the products of this section.

B. Special Warranty:

1. As a condition of acceptance, furnish a written warranty agreeing to replace products found to be defective as a result of inferior grade of materials or inferior workmanship within one year of date of Architect's Final Certificate.

2. Manufacturer's 15-year warranty against rusting of panels from the inside.

3. Manufacturer's lifetime warranty for stainless steel hardware.

C. Referenced Publications: National Electrical Manufacturers Association (NEMA)

1.2 Related Sections:

A. Section 09311, Ceramic Tile and Marble

1.3 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Shop Drawings: Prior to commencing fabrication of the products of this section, submit manufacturer's shop drawings to the Architect for review, fully dimensioned, showing actual field measurements and showing method of installation and anchorage.

C. Manufacturer's Data: Accompanying the shop drawing submittal, furnish the Architect for review, manufacturer's detailed materials and fabrication specifications and installation recommendations; include catalog cuts of all hardware, anchors, and accessories.

D. Samples: After review of the above submittals, but prior to commencing fabrication, submit to the Architect for review, samples, not less than 2 inches x 2 inches for each color required; samples shall be representative of color, texture and surface reflectivity.

E. Templates: Prior to commencing installation, the contractor shall be furnished setting drawings and templates by the manufacturer of the products of this section.

1.4 Job Conditions:

A. Sequencing: Prior to commencing installation of the products of this section, all finish flooring, wall finishes and plumbing fixtures shall be in place.

## PART 2 - PRODUCTS

### 2.1 Design:

- A. Floor-mounted, overhead braced type.

### 2.2 Materials:

- A. Toilet compartments and urinal screens:

1. Doors, panels, and pilasters consist of two sheet metal faces insulated with moisture-resistant honeycomb core adhered to inner surface; all manufactured from Type 304 stainless steel with #4 satin brushed finish.

- a. Pilasters: 1¼" thick, 20 ga. stainless steel.

(1) Floor edge shall have welded 18 ga. reinforcement to accept 3/8" zinc-plated jack bolt for leveling. Furnish hex nuts, washers, etc., as required for installation.

- b. Panels: 1" thick, 22 ga. stainless steel.

(1) Internal 16 and 14 ga. welded reinforcements at top and bottom hinge location.

- (2) Factory-installed concealed true gravity cam.

- c. Doors: 1" thick, 22 ga. stainless steel.

- (1) Same construction as panels.

2. Hardware shall be 18-85, Type 304 heavy gauge stainless steel with satin finish.

- a. Continuous stainless steel self-closing hinge.

- b. Stainless steel surface – mounted slide latch and keeper.

- c. Continuous stainless steel brackets.

d. Etched and anodized aluminum headrails and end caps (satin finish); grip-resistant edge.

e. Provide other accessories, including door stops, coat hooks, etc., necessary for complete installation. Accessories shall be manufactured "institutional" grade.

- i. Theft-resistant, stainless steel pin-head, torx screws.

### 2.3 Fabrication:

A. General: Fabricate toilet compartments, urinal screens, and lavatory screens to the sizes and designs shown on the drawings; colors will be as selected by Architect and may vary from room to room.

B. Detail Requirements:

1. Threaded inserts shall be factory-installed to secure all door hinges, latches, and door stops.
2. Make all cut outs and holes for hardware in shop.
3. Exposed edges shall be beveled back 20 degrees flush with face of adjacent material.
4. Finish edge smooth without marring surface.

PART 3 - EXECUTION

3.1 Installation:

A. Toilet Partitions and Urinal Screens: Install in the locations shown on the drawings, and in accordance with the details shown thereon, straight, plumb and with all horizontal lines level and rigidly secured in place.

1. Secure panels to pilasters using U-channels.
2. Secure panels and pilasters to walls using angle brackets.
3. All door hardware, U-channels, and angle brackets shall be installed with theft-resistant screws.

B. Accessories:

1. Install 1-coat hook and 2-door stops on each inswing door (interior side).
2. Install 1-coat hook on each outswing door (interior side).
3. Install 2-doorstops on each outswing door (exterior side).
4. Install 1-door pull on each outswing door (exterior side).

3.2 Field Quality Control:

A. All stainless steel partitions, etc., shall be covered with self-adhesive coating for protection from scratches during installation.

B. Adjustment: Upon completion of the installation, adjust all components for operation and alignment; adjust door hinges to hold door in 30 degree open position when compartment is not in use.

C. Cleaning: Prior to final inspection, remove maskings and labels and clean all toilet partitions.

END OF SECTION



SECTION 10200  
ARCHITECTURAL LOUVERS

PART 1 - GENERAL

1.1 Quality Assurance:

A. Qualification of Manufacturer: Manufacturer of the products of this section shall have been successfully engaged in the business of manufacturing and fabricating architectural louvers for a period of not less than five years immediately prior to furnishing the products of this section.

B. Special Warranty: As a condition of acceptance, furnish a written warranty agreeing to replace products found to be defective as a result of inferior grade of materials or inferior workmanship within one year of date of Architect's Certificate of Substantial Completion.

C. Referenced Publications:

1. Air Movement and Control Association (AMCA)

1.2 Related Sections:

- A. Section 04200, Unit Masonry
- B. Section 06100, Rough Carpentry
- C. Section 06190, Pre-Fabricated Wood Trusses
- D. Section 07600, Metal Flashing and Sheet Metal Work
- E. Section 07900, Sealants and Caulking

1.3 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Shop Drawings: Prior to commencing fabrication of the products of this section, submit manufacturer's shop drawings to the Architect for review, fully dimensioned, showing actual field measurements and showing method of installation and anchorage.
- C. Manufacturer's Data: Accompanying the shop drawing submittal, furnish the Architect for review, manufacturer's detailed materials and fabrication specifications and installation recommendations.
- D. Manufacturer's color chart.

PART 2 - PRODUCTS

2.1 Materials:

A. Basis of Design: Design is based on RCS stationary louvers, drainable, with Type 245D, extruded aluminum louvers, fixed, as manufactured by Reliable Products, Geneva, AL.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed product(s).

B. Characteristics: 0.060" thick, 6063-T5 alloy, extruded aluminum frame. Furnish complete with drip pan and ½-inch mesh aluminum insect screen unless noted otherwise on the drawings. Minimum thickness on extruded frame and blade shall be 0.060", positioned at 45 degree angle and spaced approximately 3-3/16 inches center-to-center. Louvers shall be finished. Color shall be selected by the Architect from the manufacturer's standard colors.

C. Accessories: Furnish accessories and anchors as required for a complete installation.

## 2.2 Fabrication:

A. General: Fabricate architectural louvers to the design and sizes shown on the drawings from the materials and in compliance with AMCA and the published specifications of the louver manufacturer.

## PART 3 - EXECUTION

### 3.1 Inspection:

A. The Contractor shall examine the areas and conditions under which the products of this section are to be installed; notify the Architect in writing of conditions detrimental to the installation of the products of this section and the completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

### 3.2 Installation:

A. Install all members in accordance with the details shown on the drawings and in strict compliance with the manufacturer's instructions. Louvers shall be level, plumb, square, and securely anchored.

### 3.3 Field Quality Control:

A. Inspection: Materials and workmanship at all times will be subject to inspection by the Architect.

B. Cleaning: Prior to final inspection, remove maskings and labels and clean all exposed to view surfaces as recommended by the manufacturer of the items installed.

END OF SECTION

SECTION 10350  
FLAGPOLES

PART 1 - GENERAL

1.1 Quality Assurance:

A. Qualification of Manufacturer: Engaged in the business of manufacture of aluminum ground-set flagpoles for a period of not less than five years immediately prior to furnishing the products of this section.

1.2 Related Section:

A. Section 03300, Cast-in-Place Concrete

1.3 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Shop Drawings: Fully dimensioned, showing details of installation.

C. Product Data: Manufacturer's detailed material and fabrication specifications; include catalog cuts of all hardware, anchors, and accessories.

1.4 Product Handling:

A. Delivery: Deliver products in manufacturer's original packaging with labels intact and legible.

B. Storage and Protection: Store and protect in accordance with the instructions of the manufacturer of the products furnished.

PART 2 - PRODUCTS

2.1 Materials:

A. Flagpoles:

1. Basis of Design: Commercial cone-tapered aluminum flagpole as manufactured by Baartol Company, Kenton, OH.

a. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed product.

2. Furnish one (1) 30' exposed height, 6" butt.

a. Wall Thickness: 0.188-inch

b. Maximum Wind Speeds: 163 mph unflagged / 106 mph flagged

3. Finish shall be manufacturer's standard.

4. Fittings:
  - a. Finial Ball, 6" diameter in gold anodized finish; 14 ga. aluminum.
  - b. Revolving type truck.
  - c. Two No. 10 polypropylene halyards.
  - d. Two 9" cast aluminum cleats with covers.
  - e. Foundation Tube: 16 ga. galvanized corrugated steel tube.
  - f. Flash Collar: Manufacturer's standard.
  - g. Lightning Ground and Support Plate: Manufacturer's standard.
- B. Concrete: 3000 psi, Class A as described in Section 03300.

### PART 3 - EXECUTION

#### 3.1 Installation:

A. Foundation: Construction foundation as shown on the drawings, placing concrete in accordance with Section 03300, with foundation tube properly positioned, utilizing steel wedges, base plate and ground rod and support plate. Allow concrete to cure at least 14 days before erecting flagpole.

B. Flagpole: Erect plumb and true to line, in accordance with details shown on the drawings and the manufacturer's instructions.

#### 3.2 Field Quality Control:

A. Adjustment: After installation put components through full operating cycle and adjust as necessary to insure continued proper operation.

B. Cleaning: Prior to final inspection, clean all exposed to view surfaces as recommended by their manufacturer.

END OF SECTION

SECTION 10420  
LETTERS AND SIGNAGE

PART 1 - GENERAL

1.1 Scope:

A. Furnish and install letters and signage and related items as shown on the drawings and related items as shown on the drawings and/or described hereinafter. This work does not include any signage described within other sections of these specifications.

1.2 Related Sections:

- A. Section 04200, Unit Masonry
- B. Section 06100, Rough Carpentry
- C. Section 09260, Gypsum Board Systems

1.3 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Manufacturer's Data: Material and fabrication specifications and installation recommendations for each product described herein.
- C. Building Identification Letters Template: Manufacturer's full size mounting/layout template.
- D. Samples:
  - 1. Letters: Full size for each type and size required in actual finish proposed.
  - 2. Signage: Full size plaque showing color and letter style.
- E. Color Card: Manufacturer's full range of colors and finishes available for each product described hereinafter.

PART 2 - PRODUCTS

2.1 Manufacturers:

- A. Basis of Design: As listed herein and for each type of signage.
- B. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

2.2 Materials:

- A. Interior Signage:

1. Restroom Signage: Design is based on Scott Sign Systems / Tallevast, FL, or equal; ADA approved, 8" x 6" x 1/8" thick, injected acrylic molded plaques, with integral frame. Sign to contain the word "Men" or "Women", or "Unisex", male or female or unisex pictogram (as applicable) and Grade 2 Braille. Letters shall be a minimum 5/8" high integral copy, raised 1/32". Color will be as selected by Architect. Letters and pictograms shall be of same color on contrasting background. Signs shall be mounted with (VHB) Very High Bond tape fastened to back of plaque.

B. Building Identification Letters: Design is based on cast aluminum letters as manufactured by Matthews International Corp., Bronze Division / Pittsburgh, PA, or equal; letters to be Prismatic style, all upper case, height as shown on plans; mounting to be projected with studs and one inch (1") spacers; finish to be baked enamel. Color to be selected by the Architect from manufacturer's standard colors. Furnish with template.

C. Building Plaque and Dedication Plaque: Design is based on cast bronze plaque as manufactured by Matthews International Corp., Bronze Division / Pittsburgh, PA, or equal; 24" x 30", with egg and dart border, leatherette background texture. Letters to be upper and lower case, Caslon 540; mounting to be toggle-bolted and covered with rosettes. Owner will furnish wording for plaque(s). A total of two (2) plaques will be required.

D. Anchors: Manufacturer's standard anchors for each product and installation condition, unless otherwise noted.

## 2.2 Fabrication:

A. Products shall be fabricated from materials described in manufacturer's published specification, to the sizes described hereinbefore, or shown on the drawings.

## PART 3 - EXECUTION

### 3.1 Installation:

A. Locations: Verify with Architect exact locations prior to commencing installations; in the case of items to be built-in to construction or requiring back-up framing, verify locations early in progress of work in order to provide proper framing, blocking and like items at proper stage in work.

B. Install items in accordance with manufacturer's instructions.

### 3.2 Schedule of Letters, Signage and Directories:

#### A. Interior Signs:

1. Restroom Signs: Install on wall adjacent to lock side of door at required height and proper distance from door jamb at doors entering every restroom, bath, toilet, etc.

#### B. Building Identification Letters:

1. Mount letters on 2-sides of brick sign wall as directed by the Architect, using manufacturer's layout template; 2-sets required.

C. Building Plaque(s): Mount on building wall in location as directed by the Architect.

D. Verify application of signage based on substrate, as recommended by the manufacturer.

### 3.3 Field Quality Control:

A. Cleaning: Just prior to final inspection, clean all items as recommended by their manufacturer.

END OF SECTION



SECTION 10505  
METAL LOCKERS

PART 1 - GENERAL

1.1 Quality Assurance:

A. Manufacturer: Qualification of Manufacturer: Manufacturer of the products of this section shall have been successfully engaged in the business of manufacturing and fabricating metal lockers for a period of not less than five years immediately prior to furnishing the products of this section.

1.2 Submittals:

A. General: Make all submittals in accordance with Section 01300.

B. Product Data: Manufacturer's detailed descriptive and specification data, and installation instructions for each item described hereinafter.

1.3 Product Handling:

A. Delivery: Deliver products in original and unopened packaging, with brand names and manufacturer's labels intact and legible.

B. Storage and Protection: Store and protect the products of this section as per their manufacturer's instructions.

1.4 Job Conditions:

A. Sequencing: Prior to installation of the products of this section, all wall finishes and all flooring shall be in place.

PART 2 - PRODUCTS

2.1 Type 1 Metal Lockers:

A. Basis of Design: Single tier "Quiet" lockers as manufactured by Republic Storage Systems / Canton, OH.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

B. Construction:

1. Material: All major steel parts shall be made of mild cold rolled steel, free from imperfections and capable of taking a high-grade enamel finish.

2. Finish: All parts shall then be finished with a heavy coat of enamel baked.

3. Door Frames: Shall be 16 gauge formed into deep, 1" face channel shapes with a continuous vertical door strike integral with the frame on both sides of the door opening.

4. Doors: Doors shall be 16 gauge, formed with a full channel shape on lock side to fully conceal the lock bar, channel formation on the hinge side and right angle formation across the top and bottom. Doors shall have a diagonal reinforcing angle welded to the inner surface.

5. Latching: Latching shall be one-piece, pre-lubricated, spring steel latch completely contained within the lock bar under tension to provide rattle-free operation. The lock bar shall be securely contained in the door channel by self-lubricating polyethylene guides that isolate the lock bar from metal-to-metal contact with the door. There shall be three latching points.

6. Handles: Non-protruding 14 gauge, lifting trigger and slide plate shall transfer the lifting force for actuating the lock bar when opening the door. The exposed portion of the lifting trigger shall be encased in a molded ABS thermoplastic cover that provides isolation from metal-to-metal contact and be contained in a formed 20 gauge stainless steel recessed pocket. This stainless steel pocket shall contain a recessed area for locking.

7. Hinges: Hinges shall be 2" high, 5-knuckle, full loop, tight pin style, securely welded to frame and double riveted to the inside of the door flange. Doors shall have three hinges.

8. Body: The body of the locker shall consist of 24 gauge upright sheets, backs, tops, bottoms and shelves.

9. Interior Equipment: One hat/book shelf, one double prong rear hook, and two single prong side hooks in each compartment. All hooks shall be made of steel, formed with ball points, zinc-plated and attached with two bolts or rivets.

10. Number Plates: Each locker shall have a polished aluminum number plate with black numerals not less than 1/2" high. Plates shall be attached with rivets.

11. Color: As selected by the Architect from manufacturer's standard colors.

12. Assembly: Assembly of all locker components shall be accomplished by the use of zinc plated, low round head, slotless, fin neck machine screws with hex nuts, producing a strong mechanical connection.

13. Size: 18" wide x 24" deep x 72" high.

14. Quantity: 22-total (Space Nos. 117, 119, 120)

## 2.2 Type 2 Equipment Lockers:

A. Basis of Design: All-welded ventilated lockers as manufactured by Republic Storage Systems / Canton, OH.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

B. Construction:

1. Material: All major steel parts shall be made of mild cold rolled steel, free from imperfections and capable of taking a high grade enamel finish.
2. Finish: All parts shall then be finished with a heavy coat of enamel baked.
3. Door Frames: Door frames shall be 16 gauge formed into 1" wide face channel shapes with a continuous vertical door strike, integral with the frame on both sides of the door opening. Cross frame members of 16 gauge channel shapes, including intermediate cross frame on double tier lockers shall be securely welded to vertical framing members to ensure a square and rigid assembly.
4. Doors: Formed from one piece 14 gauge cold rolled sheet steel. Formations shall consist of a full channel shape on the lock side of adequate depth to fully conceal the lock bar, channel formation on the hinge side and right angle formations across the top and bottom. Doors shall have diamond shaped perforations 3/4" wide by 1-1/2" high to provide free airflow while leaving sufficient metal for rigidity and strength. Doors shall be reinforced with a 16 gauge channel welded to the inside side of the door. Channel shall be 7/8" wide and shall be placed vertically in the center of the door.
5. Latching: Latching shall be a one-piece, pre-lubricated spring steel latch, completely contained within the lock bar under tension to provide rattle-free operation. The lock bar shall be of pre-coated, double-channel steel construction. The lock bar shall be securely contained in the door channel by self-lubricating polyethylene guides that isolate the lock bar from metal-to-metal contact with the door. There shall be two latching points.
6. Handles: Non-protruding 14 gauge lifting trigger and slide plate shall transfer the lifting force for actuating the lock bar when opening the door. The exposed portion of the lifting trigger shall be encased in a molded ABS thermoplastic cover that provides isolation from metal-to-metal contact and be contained in a formed 20 gauge stainless steel pocket. This stainless steel pocket shall contain a recessed area for locking.
7. Hinges: Hinges to be 2" high, 5-knuckle, full loop, tight pin style, securely welded to frame and double riveted to the inside of the door flange. Hinges are attached with two rivets. Doors shall have three hinges.
8. Body: Locker body components shall be made of cold rolled steel. 16 gauge side uprights are perforated with diamond-shaped openings 3/4" wide by 1-1/2" high. Locker backs shall be fabricated from 16 gauge upright to provide a one piece uniform structure.
9. Interior Equipment: All lockers shall have one double prong rear hook and two single prong side hooks in each compartment. All hooks shall be made of steel, formed with ball points, zinc-plated and attached with two bolts or rivets.
10. Number Plates: Each locker shall have a polished aluminum number plate with black numerals not less than 1/2" high. Plates shall be attached with rivets.
11. Color: As selected by the Architect from manufacturer's standard colors.

12. Assembly: Assembly of all locker components shall be accomplished by the use of zinc plated, low round head, slotless, fin neck machine screws with hex nuts, producing a strong mechanical connection.

13. Size: 24" wide x 24" deep x 42" high.

14. Quantity: 12-total (Space No. 108)

### 2.3 Bench:

A. Fixed-in-place, 1-1/4" thick x 9-1/2" wide, 4'-0" long, laminated maple, factory finished clear. Pedestals shall be 1-1/4" diameter tubing with welded 10 gauge steel flanges and be permanently anchored to the floor. Bench shall be of same manufacturer as lockers.

## PART 3 - EXECUTION

### 3.1 Installation:

A. General: Install lockers in the locations shown on the drawings, level, plumb and true to line, at the heights shown thereon and in accordance with their manufacturer's instructions contained within the product packaging.

#### 1. Anchoring:

a. Lockers are to be anchored to the floor and wall to prevent tipping, in accordance with the manufacturer's recommendations.

b. Bench shall be securely anchored to the floor in accordance with the manufacturer's recommendations.

### 3.2 Field Quality Control:

A. Adjustment: After installation is complete check items for proper operation and make any necessary adjustments.

B. Cleaning: Just prior to final inspection, remove all masking and temporary labels and clean all accessories as recommended by their manufacturer.

C. Key Delivery: Deliver keys for key accessories to Owner.

END OF SECTION

SECTION 10522  
FIRE EXTINGUISHERS AND ACCESSORIES

PART 1 - GENERAL

1.1 Quality Assurance:

- A. Manufacturer: The products of this section shall be by a single manufacturer.
- B. Industry Standards:

1. Some products and execution are specified in this section by reference to published specifications or standards (with respective abbreviations used). These referenced publications may be subject to special conditions or limitations where specified hereinafter.

2. Referenced Publications:

- a. National Fire Protection Association (NFPA)
- b. Underwriter's Laboratories, Inc. (UL)

1.2 Related Sections:

- A. Section 06100, Rough Carpentry
- B. Section 09260, Gypsum Board Systems

1.3 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Product Data: Manufacturer's detailed descriptive and specification data, and installation instructions for each product described hereinafter.
- C. Certification: Furnish written certification that the fire extinguishers installed comply with the requirements of this section are fully and correctly charged. (see Article 3.1, D).

1.4 Job Conditions

- A. Sequencing:
  - 1. Cabinets shall be installed in prepared openings at proper time in wall construction.
  - 2. Deliver and install Fire Extinguishers not more than (5) days prior to final inspection (see Par. .3.1.E).

PART 2 - PRODUCTS

2.1 Materials:

- A. Fire Extinguishers:

1. General: Fire Extinguishers shall bear UL "Listing Mark" for type, rating and classification of extinguisher.

2. Type 1 Extinguisher:

- a. Rating: 4A-80 BC
- b. Type: Multipurpose dry chemical (Ammonium Phosphate)
- c. Manufacturers and models: One of the following:

(1) Cosmic, Model 10E as manufactured by J.L. Industries,  
Bloomington, MN.

(2) MP10 as manufactured by Larsen's Manufacturing  
Company, Minneapolis, MN.

(3) Figure No. 3010 as manufactured by Potter-Roemer,  
Cerritos, CA.

3. Type 2 Extinguisher:

- a. Rating: 6A-120BC
- b. Type: Multipurpose dry chemical (Ammonium Phosphate)
- c. Manufacturers and models: One of the following:

(1) Cosmic, Model 20E as manufactured by J.L. Industries,  
Bloomington, MN.

(2) MP20 as manufactured by Larsen's Manufacturing  
Company, Minneapolis, MN.

4. Type 3 Extinguisher:

- a. Type: Class K Wet Chemical; stainless-steel cylinder; 2½ gallon
- b. Manufacturers and models: One of the following:

(1) Saturn 25 Extinguishers as manufactured by J.L.  
Industries, Bloomington, MN.

(2) WC 2½ Extinguisher as manufactured by Larsen's  
Manufacturing Company, Minneapolis, MN.

B. Fire Extinguisher Cabinets:

1. Recessed Cabinets: One of the following:

a. Clear Vu Series No. 1525 with F25 door as manufactured by J.L.  
Industries, Bloomington, MN; US3 with white baked enamel tub.

b. Vista Series Model AL-V-2709 as manufactured by Larsen's  
Manufacturing Company, Minneapolis, MN; US3 with white baked enamel tub.

c. Figure No. 7130-A-6 as manufactured by Potter-Roemer, Cerritos,  
CA; US3 with white baked enamel tub.

C. Wall Mounting Brackets: Standard with manufacturer of Fire Extinguishers for the specified type of extinguisher, black enamel factory finish.

## PART 3 - EXECUTION

### 3.1 Installation:

A. General: Installation shall be in compliance with NFPA 10-1985, Standard for Portable Fire Extinguishers.

B. Fire Extinguisher Cabinets: Install in locations shown on the drawings, level and plumb and permanently anchored to wall construction.

C. Wall Mounting Brackets: Install in the locations shown on the drawings for Type 2 and Type 3 extinguishers, securing to masonry walls with expansion bolts.

D. Fire Extinguishers:

1. Install Type 1 Extinguisher in each recessed cabinet where noted on drawings.

2. Install Type 2 Extinguisher in wall bracket where noted on drawings.

3. Install Type 3 Extinguisher in wall bracket where shown on drawings.

E. Filling and Service:

1. Filling: Prior to, but not more than (5) five days before final inspection, employ a licensed person to fill and tag each fire extinguisher.

2. Tagging: After filling, tag each fire extinguisher with tag approximately 2-1/2 inches x 5-1/4 inches, showing the following information:

- a. Notice not to remove.
- b. Serial number of extinguisher and type of extinguisher.
- c. Name of person servicing the extinguisher.
- d. Permit number of person servicing extinguisher.
- e. Type of service performed.
- f. Date of service performed.

F. Cleaning: Prior to final inspection, clean all surfaces as recommended by manufacturer.

END OF SECTION



SECTION 10800  
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 Quality Assurance:

A. Manufacturer: Unless specifically noted otherwise all toilet accessories shall be the products of a single manufacturer.

1.2 Related Sections:

- A. Section 06100, Rough Carpentry
- B. Section 09260, Gypsum Board Systems
- C. Section 09311, Ceramic Tile and Marble

1.3 Submittals:

- A. General: Make all submittals in accordance with Section 01300.
- B. Product Data: Manufacturer's detailed descriptive and specification data, and installation instructions for each item described hereinafter.

1.4 Product Handling:

- A. Delivery: Deliver products in original and unopened packaging, with brand names and manufacturer's labels intact and legible.
- B. Storage and Protection: Store and protect the products of this section as per their manufacturer's instructions.

1.5 Job Conditions:

A. Sequencing: Prior to installation of the products of this section, all wall finishes and all plumbing fixtures shall be in place, as shall toilet compartments.

PART 2 - PRODUCTS

2.1 Toilet Accessories:

A. Basis of Design: Products as manufactured by American Specialties, Inc. / Yonkers, NY.

1. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed products.

B. Schedule of Toilet Accessories:

ACCESSORY MARK	DESCRIPTION	CATALOG NO.
1.	42" grab bar	3800 Series – 42"L
2.	36" grab bar	3800 Series - 36"L
3.	36" x 54" corner grab bar	3800 Series - 36" x 54"
4.	Tilt Mirror 18 x 36	0535
5.	Mirror 18" x 36"	0620
6.	Roll Paper Holder	0263-1
7.	Towel Dispenser	0210
8.	Soap Dish	07320
9.	Robe Hook	7345
10.	Shower Curtain	1200-V (widths as required)
11.	Towel Bar	7360 - 24"L.
12.	Napkin Disposal	0852 (surface-mounted)
13.	Janitor Shelf	8215-5
14.	Trash Receptacle	0828

C. Locks: Accessories marked 7 and 12 shall have manufacturer's standard tumbler locks; key alike.

D. Fasteners: Anchors and fasteners shall be manufacturer's standard unless otherwise shown on the drawings.

E. Mirrors: ¼" plate glass mirror, electrolytically copper-plated.

1. Mirrors shall be guaranteed against silver spoilage for 15-years.

PART 3 - EXECUTION

3.1 Installation:

A. General: Install accessories in the locations shown on the drawings, level, plumb and true to line, at the heights shown thereon and in accordance with their manufacturer's instructions contained within the product packaging.

3.2 Field Quality Control:

A. Adjustment: After installation is complete check items for proper operation and make any necessary adjustments.

B. Cleaning: Just prior to final inspection, remove all masking and temporary label and clean all accessories as recommended by their manufacturer.

C. Key Delivery: Deliver keys for key accessories to Owner.

END OF SECTION



SECTION 11450  
EQUIPMENT

PART 1 - GENERAL

1.1 Submittals:

- A. General: Make submittals in accordance with Section 01300.
- B. Product Data: Manufacturer's material and fabrication specifications and installation instructions.
- C. Shop Drawings: Fully dimensioned, showing installation details and connection to other parts of the work.

1.2 Referenced Sections:

- A. Section 06410, Cabinetwork
- B. Section 15870, Commercial Kitchen Hoods

1.3 Product Handling:

- A. Delivery: Deliver products of this section manufacturer's original packaging with labels intact and legible.
- B. Storage: Store products as recommended by their manufacturer in a housed dry area.
- D. Manufacturers:

1. The manufacturers listed hereinafter and the use of manufacturer's names and catalog plate numbers is for reference only to indicate characteristics and functions and to give a descriptive of the type, size and manufactured finish and required in the work.

PART 2 - PRODUCTS

2.1 Equipment:

- A. Refrigerator: Equal to Whirlpool, No. WRT541SZDM, 21.3 cu.ft. top-freezer refrigerator with automatic ice-maker, Energy-Star rated; stainless steel finish.
- B. Microwave: Counter-top, Whirlpool, No. WMC30516AS, 1.6 cu. ft., 1200 watts, stainless steel finish.
- C. Commercial Range: Equal to Garland SunFire X Series 36" gas restaurant range, manufactured by Mantiwoc; six (6) open burners 30,000 BTU, stainless steel front, sides, backguard, and plate rail; 213,000 BTU oven with ribbed porcelain bottom and door interior, aluminized top, sides, and back; 6" (152mm) front locking swivel casters (4).

D. Wall Cabinets:

1. 18 gauge stainless steel wall cabinets fabricated from Type 304 #4 stainless steel with double pan hinged doors. Interior shall have two (2) stainless steel shelves. Provide stainless steel door pulls to match typical cabinet pulls.

E. Stainless Steel Counter Tops / Backsplashes, etc.: 16 gauge, 304 #4 stainless steel.

F. Stainless Steel Wall Flashing: 20 gauge, 304 #4 stainless steel.

G. Commercial Kitchen Hoods: Refer to Section 15870.

H. Gas Exterior Grille:

1. Cash Allowance: The contractor shall allow the net release sum of **Nine Hundred Dollars (\$900.00)** for the purchase and delivery of the gas grille to the project site.

2. Overhead, profit and cost of installation of the gas grille shall be included in the contract sum and not as a part of the cash allowance.

3. The contract sum will be adjusted by Change Order, based upon actual cost of the gas grille purchased.

4. The Owner shall select the grille.

### PART 3 - EXECUTION

#### 3.1 Installation:

A. General: Comply with manufacturer's instructions and recommendations.

B. Built-In Equipment: Securely anchor units to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

C. Wall Cabinets: Install at each side of range as shown on drawings.

D. Countertops and Backsplashes: Furnish and install seamless counter tops with a 4" backsplash on rear and ends as applicable. Splash to be turned up 4" at 90 degrees and back 1" and down 1/2" at 90 degrees. Front edge to be turned down 1 1/2" at 90 degrees and return back 1/2". Vertical and horizontal radiuses to be a min. of 1/8". All seams to be welded, polished, and blended so that grain direction matches. Size and configuration to match plan and is to be mounted on the millwork counter base as shown on the drawings and specified in Section 06410.

E. Wall Flashing:

1. Wall Flashing Above Counter Tops: Install continuous wall flashing from bottom of overhead cabinets to 2" below top edge of counter backsplash where shown on plan. Flashing to be attached to wall with approved adhesive and stainless steel screws as needed. Where seams are needed they are to be covered with stainless steel feature strips and mounted with stainless steel screws. Feature strips to be of same material as flashing, all pieces of flashing and trim to have grain running vertically. Seams / feature strips shall be symmetrically and equally spaced.

2. Wall Flashing at Range: Install continuous wall flashing from underside of range hood fully to the floor behind the range. Flashing to be attached to wall with approved adhesive and stainless steel screws as needed. Where seams are needed they are to be covered with stainless steel feature strips and mounted with stainless steel screws. Feature strips to be of same materials as flashing, all pieces of flashing and trim to have grain running vertically. Seams / feature strips shall be symmetrically and equally spaced.

3.2 Adjust and Clean:

- A. Testing: Test equipment to verify proper operation. Make necessary adjustments.
- B. Accessories: Verify that accessory items required have been furnished and installed.
- C. Cleaning: Remove packing material from equipment items and leave units in clean condition, ready for operation.

END OF SECTION



SECTION 12510  
BLINDS

PART 1 - GENERAL

1.1 Quality Assurance:

A. Qualifications of Manufacturer: The Manufacturer of the products of this section shall have been successfully engaged in the business of the manufacturing and fabricating blinds for a period of not less than five years immediately prior to furnishing the products of this section.

B. Qualifications of Installer: The installer of the products of this section shall have been successfully engaged in the business of installation of blinds for a period of not less than five years immediately prior to furnishing the products of this section.

C. Guarantee: Manufacturer's lifetime warranty.

1.2 Related Sections:

A. Section 08110, Steel Frames and Doors

B. Section 08211, Solid Core Flush Wood Doors

C. Section 08550, Vinyl Single-Hung Windows

1.3 Submittals:

A. General: Make submittals in accordance with Section 01300.

B. Shop Drawings: Fully dimensioned, showing actual field measurements, method of installation and anchorage, and relationship with abutting materials and finishes.

C. Product Data: Manufacturers detailed material and fabrication specifications, and installation recommendations; include catalog cuts of all hardware, anchors, and accessories.

D. Color Card: Full range of colors available.

E. Specimen Guarantee: As described hereinbefore.

1.4 Product Handling:

A. Delivery: Deliver the products of this section in manufacturer's original packaging with labels intact and legible.

B. Storage and Protection: Store products in a housed, dry, and ventilated area and protect from damage from any cause.

1.5 Job Conditions:

A. Sequencing: Prior to commencing installation of the products of this section, all wall finishes, ceilings, painting, and glazing shall be complete.

## PART 2 - PRODUCTS

### 2.1 Materials:

#### A. Blinds:

1. Manufacturer: "Traditions™" composite 2-inch blinds as manufactured by Bali-Graber, Springs Window Fashions Division, Inc.

a. Product information is listed for reference purposes to establish material characteristics, quality, and finish. Alternate manufacturer's products shall meet or exceed the listed product.

2. Color: As selected by the Architect from manufacturer's standard colors.

3. Components:

a. Headrail: "U"-shaped 1½" high by 2¼" deep channel with a 1/8" light blocking lip on the bottom center line fabricated from 0.022" thick phosphate treated steel with rolled edges at top with a prime coat of polyester primer and finished coat of polyester baked enamel to match bottomrail and end support brackets and to coordinate with slats. Headrail shall be roll-formed.

b. Head Channel Hardware: Metal hardware shall be electroplated with lift cords and ladders guided by acetal low friction thermoplastic grommets in the head channel that prevents wear and discoloration. Operating hardware shall be mechanically locked into head channel, by means of snap-in fittings with no mechanical cleats visible from underside of headrail.

c. Bottomrail: Bottomrail is made of a blend of PVC polymers that will coordinate with slat color, measuring 2" wide by 7/8" high in a trapezoid shape for improved slat closure.

d. Slats: Slats are made from a blend of PVC polymers measuring 2" wide by 1/8" thick that meet the requirement of NFPA 701 Test Method 1. Slat edges are straight cut.

e. Tilt Rod Support: Tilt rod support shall be low friction thermoplastic and shall support tilt rod. It shall provide a smooth bearing and center the ladder drum over ladder hole. Incorporated with tilt rod support shall be metal lift cord rollers to guide lift cords when entering and exiting headrail for smoother lifting and lowering operation. Grommet shall prevent cord and braided ladder wear and discoloration.

d. Ladder Drum: Ladder drums are made of high strength thermoplastic which securely attaches braided ladder or cloth tapes.

e. Cord Lock: Metal cord lock shall be of a snap-in design and incorporate a floating shaft-type locking pin. Cord lock shall incorporate a crash-proof safety feature that shall lock blind automatically upon release of cord.

f. Cord Tilter: Cord tilter is standard. It incorporates a worm and pulley of low friction thermoplastic and a gear of nylon.

(1) Wand Tilter: Furnish with worm and gear design wand tilter in a totally enclosed gear case. The worm and gear is zinc die castings and the gear vase of low friction thermoplastic. Wands are made of wood finished to coordinate with slat color.

g. Square Tilt Rod: Tilt rod shall be electro-zinc coated solid steel. Tilt rod shall be hexagonal in cross-section measuring 1/4" at its widest points.

h. Braided Ladders (Slat Supports): Braided ladder shall assure proper control with adequate overlap of slats in the closed position. Distance between end ladder and end of slats will not exceed 6"; distance between braided ladders shall not exceed 14".

(1) Braided Ladder Materials: Material shall be 100% high tenacity polyester yarn. Vertical component shall be not less than 0.060" diameter nor greater than 0.080" diameter. Horizontal component, or rungs shall be not less than two threads and shall be approximately 53.0mm long. Ladder will provide 44mm of distance between slats. Ladders shall be of a sufficient length for bottom of blind to hang with a tolerance of plus one-half/minus zero inches of the specified length.

(2) Braided Ladder Clip: Plated metal clip shall be mechanically clinched to the end of each braided ladder to lock in holes of ladder drum.

i. Lift Cord: Lift cord shall be braided with polyester jacket and center core or an approved equal construction. Size of cord shall be 1.8mm. Cords shall be detachable and shall be of sufficient length to properly control the raising or lowering of the blind. Cord ends shall be securely anchored to the bottomrail and it shall be possible to detach and attach cords.

j. End Support Brackets: Universal hinged cover end support brackets of phosphate treated steel with a prime coat of polyester primer and a finish coat of baked on polyester enamel in color to match headrail. Brackets shall facilitate easy removal of head channel and will include an adjustable tab to eliminate lateral headrail movement.

k. Hold-Down Brackets: Universal hold-down brackets for sill or jamb installations are available.

l. End Stiffeners: Thermoplastic end stiffener caps shall be inserted at each end of the headrail.

## 2.2 Fabrication:

A. General: Fabricate to the sizes required for specified openings, from the materials and components described hereinbefore and in accordance with the blind manufacturer's published specifications.

1. Prior to fabrication, installer shall field measure all openings.

2. Blinds shall fill openings from head to sill and from jamb to jamb. Locate blind divisions at mullions of grouped openings.

## PART 3 - EXECUTION

### 3.1 Installation:

- A. Location, as follows:
  - 1. All exterior windows.
  - 2. Exterior doors with glass lites, except sectional doors.
  - 3. All interior doors with view windows (except narrow vision panels).
  - 4. All interior view windows.

B. Installation Brackets: Install in accordance with the blind manufacturer's instructions contained in the packaging materials, level and true to line.

- 1. Install intermediate support brackets as necessary to prevent depletion in headrail.
- 2. Provide bottom hold-down brackets/clips for blinds installed on doors.

C. Blinds: After installation brackets are accurately and securely positioned, install blinds, securely seating headrails in installation brackets.

- 1. Install blinds with adequate clearance to allow for smooth operations.

### 3.2 Field Quality Control:

A. Adjustment: After installation is complete, check and adjust all components for proper operation.

B. Cleaning: Just prior to final inspection, clean all exposed to view surfaces as recommended by the blind manufacturer.

END OF SECTION

SECTION 15000  
GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes general provisions covering the contract documents for HVAC, Plumbing, and Fire Protection Systems.

1.3 DEFINITIONS

A. Provide shall mean "Furnish, install and connect."

B. Piping shall mean "pipe installed with all specified fittings, valves and accessories, and forming a complete system."

C. HVAC shall mean "Heating, Ventilation and Air Conditioning."

1.4 INFORMATIONAL SUBMITTALS

A. Electrical Coordination Drawings: In addition to submittal requirements of other Division 15 Sections, submit a document approved by the project Electrical Contractor certifying that all mechanical equipment being furnished under Division 15 complies with the electrical characteristics of the source power which will be furnished under Division 16.

B. Model numbers listed on the Mechanical Contract Documents shall not be construed to indicate electrical characteristics. Electrical characteristics of mechanical equipment shall be as indicated on the Electrical Contract Documents.

C. Review of Submittals does not relieve the Contractor of any of the requirements of the Contract Documents. Failure by the Engineer to document errors and omissions in the Contractor's submittals during the Engineer's submittal review does not constitute a waiver of any of the requirements of the original Contract Documents.

1.5 CLOSEOUT SUBMITTALS

A. Installation Instructions: Two binders containing manufacturer's installation instructions for all equipment furnished under Division 15 shall be furnished by the Contractor. One binder shall be kept in the General Contractor's office at the job site. The other binder shall be delivered to the Engineer upon acceptance by the Architect of the Submittals.

B. Operation and Maintenance Instructions: Three copies of equipment O&M manuals contained in rigid 3-ring binders shall be submitted to the Owner a minimum of 15 days prior to equipment/systems training. Binders shall have permanent labels on the spine and front cover indicating project name, project number, building name and contents. Model and serial numbers of equipment shall be shown on the cover of their respective O&M manual(s).

## 1.6 QUALITY ASSURANCE

### A. Plumbing Installer Qualifications:

1. Plumbing Subcontractor shall have demonstrated proficiency in the installation of plumbing systems by the successful installation of systems similar to those included in the Construction Documents for this project. Such systems shall have been installed in commercial or institutional buildings having a minimum of 150 plumbing fixtures (in a single building). The Subcontractor shall have been in business as described above for a minimum period of five years.

2. A master or journeyman plumber shall be present at the site during the installation of all plumbing related work. The master or journeyman plumber shall be certified in the state in which the construction is being performed and shall have his license present at site or on file during construction.

### B. HVAC Installer Qualifications:

1. HVAC Subcontractor shall have a current Class II Conditioned Air Contractors License for the state in which the project is being constructed. The Subcontractor shall have as part of the Firm a Service Department qualified to service all systems installed in the project, or have a written agreement with a Service Agency qualified to provide such service. The Service Department or Agency shall be on call at all hours.

C. Fire Protection System installer qualifications shall be specified in other Division 15 where applicable.

## 1.7 DELIVERY, STORAGE, AND HANDLING

### A. Material storage

1. All materials and equipment stored on the jobsite shall be elevated above the ground and stored under suitable weather cover. Materials and equipment shall not be stored in areas subjected to localized flooding.

2. Manufacturer's original shipping packaging and protective coverings shall be left in place until the equipment is prepared for installation.

### B. Electrical enclosure protection

1. During construction, all protective covers and other devices shall be left in place that protect against inadvertent contact with live electrical circuits.

2. All warning labels related to electrical and rotating equipment hazards shall be in place prior to energizing mechanical equipment circuits.

### C. Protection of ductwork and piping

1. Maintain temporary closures on the ends of all ductwork and piping as the installation work progresses. Temporary closures include plastic sheeting, tape and appropriate caps and covers.

2. Where debris enters piping during installation, steps shall be taken to clean the interior of the pipe prior to placing in service.

3. Where debris enters ductwork during installation the duct interior shall be cleaned prior to placing in service.

4. All lined ductwork shall be kept clean and dry. Any lined duct must be removed from the job site if moisture is discovered in installed or stored ductwork.

D. Roof protection: All penetrations through roofs, including roof curbs, piping curbs and roof drainage system elements shall be properly protected during construction to prevent water intrusion into the building. Protective measures could include temporary covers and plugs, as well as other appropriate temporary elements.

### 1.8 PRIOR APPROVALS

A. Manufacturers References: When reference is made in the Contract Documents to trade names or specific manufacturers and/or models, such reference, unless noted otherwise, is made to designate and identify the quality of materials or equipment to be furnished and is not intended to restrict competitive bidding. If it is desired to use materials or equipment different from those indicated on the Contract Documents, written request for approval must be received by the Architect at least TEN DAYS prior to the date set for the opening of bids. A copy of the request should also be sent directly to the Engineer. Requests for prior approval of a proposed substitute shall be accompanied by complete technical data supporting the request.

B. Request for Prior Approval by facsimile transmission (fax) will not be considered. Prior approval requests shall be submitted in hard copy or email format only.

### 1.9 PERMITS AND FEES

A. Obtain all necessary Permits and Inspections required for the installation of this work and pay all charges incident thereto. Deliver to the Architect all certificates of inspection issued by authorities having jurisdiction.

B. Sewer tap fees, water tap fees, meter fees, Dept. of Labor Fees for Boilers and Pressure Vessels and all other charges for work under Division 15, including charges for meter installation and excess service by the Gas Company or any other utilities shall be paid by the Contractor.

### 1.10 SAFETY

A. OSHA Requirements applicable to the project shall be complied with at all times.

B. Manufacturer's Safety Instructions shall be followed in all instances.

C. Asbestos Containing Materials (ACM) shall not be used on this project.

D. Refrigerants containing CFC's or HCFS's shall not be used on this project, nor shall any equipment using such refrigerants be incorporated into this project.

E. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof or grade below. The guard shall extend not less than 30 inches beyond each end of such appliances, equipment, fans, components and roof hatch openings and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21 inch diameter sphere and shall comply with the loading requirements for guards specified in the International Building Code.

#### 1.11 ENVIRONMENT

A. Refrigerants containing CFC's or HCFS's shall not be used on this project, nor shall any equipment using such refrigerants be incorporated into this project.

#### 1.12 FIELD CONDITIONS

A. Electrical Equipment Clearances: Piping, equipment and other mechanical installations shall not be located within 42" of the front or 36" of the side of any electrical switchboards, panelboards, power panels, motor control centers, electrical transformers or similar electrical equipment. Piping and ductwork shall not pass through or above electrical equipment rooms except as required to serve those rooms.

##### B. Layout:

1. The equipment listed on the Drawings is considered basis of design equipment and has been used for the physical arrangement of the mechanical systems. When other equipment listed in the specifications as acceptable, equal or equipment which has received "prior approval" is used, it shall be the Contractor's responsibility to provide structural, ductwork, electrical, service clearances, or other changes required to accommodate the substituted equipment. Changes to use non basis of design equipment shall be made at no additional cost to the Owner. Submit a list of required changes along with all prior approval requests and shop drawing submittals.

2. The Contract Drawings are intended to show the general arrangement of all mechanical work. They do not show in detail all offsets, fittings and transitions. Examine Drawings, investigate site conditions to be encountered and arrange work accordingly. Furnish all offsets and transitions required for a complete and functional installation.

3. Drawings do not indicate in detail exact configuration of connections for fixtures, equipment and accessories. Final connection shall be as shown on approved Manufacturer's Submittal Drawings. Where Manufacturer's Submittal Drawings conflict with the Contract Documents, consult with the Architect for resolution.

C. Measurement of Drawings by scale shall not be used as dimensions for fabrication. Measurements for locating fixtures, equipment, ductwork, piping and other mechanical items shall be made on the site and shall be based on actual job site conditions.

D. Check spatial limitations and verify electrical requirements before ordering any mechanical equipment or materials. Before ordering materials or fabricating ductwork and piping, notify Architect if conflicts are detected with other building components. Place large equipment inside the building prior to the erection of exterior walls where equipment cannot enter finished building openings.

E. Coordination: Mechanical work shall be coordinated with that of other trades to avoid conflict. The Contractor shall study all plans and specifications for this project and shall notify the Architect of any conflict between work under Division 15 and work under other divisions of the Project. Particular attention shall be given to interference between piping, electrical installations, structural systems, building openings and ductwork.

F. Failure to accurately and timely coordinate with other trades for installation of mechanical systems shall not result in additional charges to the owner, architect or engineer.

### 1.13 CODES AND STANDARDS

A. Mechanical installations shall conform to the latest edition or the addition approved by the authority having jurisdiction of the following, in addition to any other mentioned Codes and Standards.

1. The International Building Code.
2. The International Mechanical Code.
3. The International Plumbing Code
4. The State Energy Code
5. The International Fire Protection Code
6. NFPA Standard 13, Installation of Sprinkler Systems.
7. NFPA Standard 70, National Electric Code.
8. NFPA Standard 90A, Installation of Air Conditioning and Ventilation Systems
9. NFPA Standard 101, Code for Safety to Life for Fire in Buildings and Structures

### 1.14 USE OF MEHCANICAL SYSTEMS DURING CONSTRUCTION

A. The operation of the permanent HVAC systems during the construction process is strongly discouraged. However, the Contractor may take measures to protect the systems from contamination if they are operated.

B. Under no circumstances shall the HVAC system be operated while sanding of any kind is taking place on the jobsite.

C. When placed in operation during the construction period, all HVAC systems shall have MERV 8 filtration in all standard filter racks throughout the systems. Final filter banks if specified, do not have to be in place.

D. All return openings and outdoor air intake openings shall be protected with MERV 8 filter material at all points of entry into the duct system. These protections shall be maintained and remain in place until the building is prepared for final inspection. Failure to comply will result in contractor being required to clean ductwork prior to final acceptance.

E. The interior of all HVAC units shall be thoroughly cleaned to "like-new" condition prior to final acceptance of the building HVAC systems. New, clean filters shall be furnished in all new equipment.

## 1.15 INTERRUPTION OF EXISTING SERVICES

A. Exercise care so as not to cut any existing utilities or services. Where an existing utility line or service line is cut it shall be repaired to "like-new" condition. Interruption of service shall not be made without prior written permission of the Owner.

PART 2 - PRODUCTS (Not applicable for this section.)

PART 3 - EXECUTION (Not applicable for this section.)

END OF SECTION

SECTION 15050  
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes the following basic mechanical materials and methods to complement other mechanical sections.

1. Non-shrink grout for equipment installations.
2. Fire stopping.
3. Installation requirements common to equipment specification sections.
4. Touchup painting and finishing.
5. Concrete equipment base construction requirements.
6. Cutting and Patching.

B. See individual piping sections for pipe and pipe fitting materials.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract.

B. Prepare coordination drawings of Mechanical Rooms to a 1/4 inch equals 1 foot scale or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:

1. Proposed locations of piping, ductwork, equipment, and materials. Include the following:
  - a. Planned piping layout, including valve and specialty locations and valve stem movement.
  - b. Planned duct systems layout, including elbow radii and duct accessories.
  - c. Clearances for installing and maintaining insulation.
  - d. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
  - e. Equipment service connections and support details.
  - f. Exterior wall and foundation penetrations.
  - g. Fire-rated wall and floor penetrations.
  - h. Sizes and location of required concrete pads and bases.
2. Scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

## 1.5 QUALITY ASSURANCE

A. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

B. Coordinate all electrical service requirements for mechanical equipment prior to the submittal of shop drawings. Confirm the compatibility of all power services with the equipment being furnished. Confirm compatibility of electrical lugs being provided by the equipment manufacturer with the power wiring being furnished under Division 16. Furnish written documentation that all characteristics have been coordinated with and confirmed by the electrical subcontractor.

## 1.6 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory-packaged.

### 2.2 FIRE STOPPING

A. Fire-Resistant Sealant: Provide UL Listed firestopping system for filling openings around penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Products: Subject to compliance with requirements, provide products by one of the following:

1. Dow Corning Corp.
2. 3M Corporation
3. General Electric Co.
4. Standard Oil Engineered Materials Co.
5. Hilti, Inc.
6. Tremco Corp.

## PART 3 - EXECUTION

### 3.1 GROUTING

- A. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms for placement of grout, as required.
- D. Avoid air entrapment when placing grout.
- E. Place grout to completely fill equipment bases.
- F. Place grout on concrete bases to provide a smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout according to manufacturer's printed instructions.

### 3.2 FIRESTOPPING

- A. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials

### 3.3 COMMON INSTALLATION REQUIREMENTS

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of mechanical systems. Indicated locations and arrangements were used to size ductwork and pipe; and calculate friction loss, expansion, pump sizing, and other design considerations. Install ductwork and piping as indicated, except where deviations to layout are approved on coordination drawings.
- B. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.
- C. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.
- D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
- E. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- F. Install equipment giving right-of-way to piping systems installed at a required slope.

### 3.4 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

B. Paint all exposed steel surfaces of piping and supports with one coat of primer and two coats of enamel.

### 3.5 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive strength concrete with 6 x 6 x #10 reinforcing wire mesh.

B. Outdoor concrete bases shall extend a minimum of 4" above grade and be a minimum thickness of 6".

END OF SECTION



SECTION 15055  
MOTOR CONTROLLERS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes ac motor control devices for mechanical equipment that are supplied as enclosed units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include material descriptions, dimensions of individual components and profiles.

2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Maintain, within 150 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Comply with NFPA 70.

C. Listing and Labeling: Provide motor controllers specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

1.7 COORDINATION

A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.

B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Manual and Magnetic Motor Controllers:

- a. ABB
- b. Allen-Bradley Co.; Industrial Control Group.
- c. Cerus Industrial
- d. Cutler-Hammer Products.
- e. Danfoss Graham
- f. General Electric
- g. Siemens Energy & Automation, Inc.
- h. Square D.

### 2.2 MANUAL MOTOR CONTROLLERS

A. Description: NEMA ICS 2, general purpose, Class A with toggle action and overload element.

### 2.3 MAGNETIC MOTOR CONTROLLERS

A. Combination starters shall be furnished for all three phase motors, (unless specifically noted otherwise) and single phase motors which are automatically started.

B. Starters shall be NEMA type and shall provide protection on all three phases.

C. Starters shall be magnetic across the line FVNR with "H-O-A" selector switch, red run pilot and fused disconnect.

D. Each starter shall have an individual control circuit transformer, line voltage primary, 120 volt secondary, with one fuse in the ungrounded side of the secondary. The transformer shall have 100% space capacity. Where electrical interlocking is involved, a separate contact on the circuit breaker disconnect shall open the interlock circuit. All sources of power to each combination starter shall be deenergized when the lockable circuit breaker disconnect is opened.

E. Starters for single phase motors not automatically started shall be manual type with thermal protection.

### 2.4 ENCLOSURES

A. Description: Flush or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to meet environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

## 2.5 ACCESSORIES

- A. Devices are factory installed in controller enclosure, unless otherwise indicated.
- B. Pilot Lights and "Hand-Off-Auto" Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Stop and Lockout Push-Button Station: Momentary-break push-button station with a factory-applied hasp arranged so a padlock can be used to lock push button in depressed position with control circuit open.
- D. Factory mounted with Nationally Recognized Testing Laboratory listed and labeled mounting device.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. Push-Button Stations: In covers of magnetic controllers for manually started motors where indicated, start contact connected in parallel with sealing auxiliary contact for low-voltage protection.
- D. Hand-Off-Automatic Selector Switches: In covers of controllers of motors started and stopped by automatic controls or interlocked with other equipment. Also, furnish "run" light in cover.

### 3.2 GENERAL INSTALLATION

- A. Install independently mounted motor-control devices according to manufacturer's written instructions.
- B. Location: Locate controllers within sight of motors controlled, unless otherwise indicated.
- C. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks conforming to Division 16 Sections.
- D. Motor-Controller Fuses: Install indicated fuses in each fusible switch.

### 3.3 CONTROL WIRING INSTALLATION

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

D. Connect hand-off-automatic switch and other automatic control devices where available.

1. Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.

2. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, fire-related cutouts and motor overload protectors.

### 3.4 IDENTIFICATION

A. Identify motor-control components and control wiring according to other Division 15 Sections.

### 3.5 STARTUP SERVICE

A. Testing: After installing motor controllers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Sections 7.5, 7.6, and 7.16. Certify compliance with test parameters.

2. Remove and replace malfunctioning units with new units, and retest.

### 3.6 ADJUSTING

A. Tighten connectors, terminals, bus joints, and mountings. Tighten field-connected connectors and terminals, including screws and bolts, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.7 CLEANING

A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

### 3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 15058  
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 104 deg F and at altitude of 3300 feet above sea level.

- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.

- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

#### 2.4 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 15061  
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.
10. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

## 1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

- B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.

2. Hanger Rods: Continuous-thread rod, washer, and nuts made of fiberglass Carbon steel.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.

2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Allied Tube & Conduit.
- b. Cooper B-Line, Inc.
- c. Flex-Strut Inc.
- d. GS Metals Corp.
- e. Thomas & Betts Corporation.
- f. Unistrut Corporation; Tyco International, Ltd.
- g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

3. Standard: MFMA-4.

4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dipped galvanized.
8. Plastic Coating: PVC

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with minimum compressive strength and vapor barrier.

D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with minimum compressive strength.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

2. Base: Stainless steel.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

2. Bases: One or more; plastic.

3. Vertical Members: Two or more protective-coated-steel channels.

4. Horizontal Member: Protective-coated-steel channel.

5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## 2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## 2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

I. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

O. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

P. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

Q. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - b. NPS 4: 12 inches long and 0.06 inch thick.
  - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
  - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
  - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches

### 3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

- a. Horizontal (MSS Type 54): Mounted horizontally.
- b. Vertical (MSS Type 55): Mounted vertically.
- c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION



SECTION 15062  
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Sections:

1. Section 15069, Vibration Controls for HVAC, Section "Vibration Controls for HVAC" for vibration isolation devices.
2. Section 15815, Metal Ducts

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Equipment supports.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

## 1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

### 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

### 2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Allied Tube & Conduit.
- b. Cooper B-Line, Inc.
- c. Flex-Strut Inc.
- d. GS Metals Corp.
- e. Thomas & Betts Corporation.
- f. Unistrut Corporation; Tyco International, Ltd.
- g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.

3. Standard: MFMA-4.

4. Channels: Continuous slotted steel channel with inturned lips.

5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

7. Metallic Coating: galvanized or alternate rust preventing shop coating.

8. Paint Coating: two coats primer and one coat enamel.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Anvil International; a subsidiary of Mueller Water Products Inc.
- b. Empire Industries, Inc.
- c. ERICO International Corporation.
- d. Haydon Corporation; H-Strut Division.
- e. NIBCO INC.
- f. PHD Manufacturing, Inc.
- g. PHS Industries, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.

3. Standard: Comply with MFMA-4.

4. Channels: Continuous slotted steel channel with inturned lips.

5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

7. Coating: galvanized or alternate rust preventing shop coating.

## 2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches minimum or 2 ½ times the pipe diameter beyond sheet metal shield for piping operating below ambient air temperature.

## 2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

b. NPS 4: 12 inches long and 0.06 inch thick.

c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1½ inches.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.

11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.

12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
  - a. Light (MSS Type 31): 750 lb.
  - b. Medium (MSS Type 32): 1500 lb.
  - c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

- a. Horizontal (MSS Type 54): Mounted horizontally.
- b. Vertical (MSS Type 55): Mounted vertically.
- c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 15069  
VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, apply to this Section.

1.2 SUMMARY

A. Section Includes elastomeric isolation pads.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Ace Mountings Co., Inc.
- b. California Dynamics Corporation.
- c. Isolation Technology, Inc.
- d. Kinetics Noise Control, Inc.
- e. Mason Industries, Inc.
- f. Vibration Eliminator Co., Inc.
- g. Vibration Isolation.
- h. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.

3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Smooth pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

### 3.2 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points.

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

### 3.3 VIBRATION ISOLATOR AND SEISMIC-RESTRAINT SCHEDULE

A. Supported or Suspended Equipment: Gas Furnace's

1. Equipment Location: On Grade.
2. Isolator Type: Elastomeric Isolation Pads.
3. Base Type: None.
4. Minimum Deflection: 0.25"

- B. Supported or Suspended Equipment: Condensing Units
  - 1. Equipment Location: On Grade.
  - 2. Isolator Type: Elastomeric Isolation Pads.
  - 3. Base Type: None.
  - 4. Minimum Deflection: 0.25"
- C. Supported or Suspended Equipment: Inline Fans
- D. Spring Hangers – refer to Section 15838, Power Ventilators.

END OF SECTION



SECTION 15076  
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: White

3. Background Color: Black Maximum Temperature: Able to withstand temperatures up to 160 deg F.

4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

6. Fasteners: Stainless-steel rivets or self-tapping screws

7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

## 2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal

2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

## 2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link or beaded chain; or S-hook

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Section 09900.
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels complying with ASME A13.1 on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
  - 1. Domestic Water Piping:
    - a. Background Color: Green.
    - b. Letter Color: White.
  - 2. Domestic Water Piping:
    - a. Background Color: Yellow.
    - b. Letter Color: White.

### 3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
  - a. Cold Water: 1-1/2 inches round
  - b. Hot Water: 1-1/2 inches
2. Valve-Tag Color:
  - a. Cold Water: Natural
  - b. Hot Water: Natural
3. Letter Color:
  - a. Cold Water: Black
  - b. Hot Water: Black

END OF SECTION



SECTION 15077  
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes equipment labels.

1.3 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content.

6. Minimum Letter Size: 1/4 inch

7. Fasteners: Stainless-steel rivets.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

END OF SECTION

SECTION 15085  
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Domestic chilled-water piping for drinking fountains.
5. Sanitary waste piping exposed to freezing conditions.
6. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

3. Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

- C. Coordinate installation and testing of heat tracing.

## 1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following
  - a. Pittsburgh Corning Corporation; Foamglas.
2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ. Comply with ASTM C 552, Type II, Class 2.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide the following
  - a. Aeroflex USA, Inc.; Aerocel.
  - b. Armacell LLC; AP Armaflex.
  - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following
  - a. CertainTeed Corp.; SoftTouch Duct Wrap.
  - b. Johns Manville; Microlite.
  - c. Owens Corning; SOFTR All-Service Duct Wrap.

I. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide the following
  - a. Fibrex Insulations Inc.; Coreplus 1200.
  - b. Johns Manville; Micro-Lok.
  - c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850°F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

## 2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200°F.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide the following:
  - a. Aeroflex USA, Inc.; Aeroseal.
  - b. Armacell LLC; Armaflex 520 Adhesive.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
  - d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
  - b. Eagle Bridges - Marathon Industries; 225.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
  - d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
  - b. Eagle Bridges - Marathon Industries; 225.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
  - d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide the following

- a. Dow Corning Corporation; 739, Dow Silicone.
- b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
- c. P.I.C. Plastics, Inc.; Welding Adhesive.
- d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide the following

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.

b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180°F.

4. Solids Content: ASTM D 1644, 58% by volume and 70% by weight.

5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide the following

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.

b. Eagle Bridges - Marathon Industries; 501.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.

d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.

3. Service Temperature Range: 0 to 180°F.

4. Solids Content: ASTM D 1644, 44% by volume and 62% by weight.

5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.

b. Eagle Bridges - Marathon Industries; 570.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.

3. Service Temperature Range: Minus 50 to plus 220°F.

4. Solids Content: ASTM D 1644, 33% by volume and 46% by weight.

5. Color: White.

## 2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Products: Subject to compliance with requirements, provide the following

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.

b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.

c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.

4. Service Temperature Range: 0 to plus 180°F.

5. Color: White.

## 2.6 SEALANTS

### A. Joint Sealants:

1. Joint Sealants for Cellular-Glass and Phenolic Products: Subject to compliance with requirements, provide the following

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

b. Eagle Bridges - Marathon Industries; 405.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.

d. Mon-Eco Industries, Inc.; 44-05.

e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Permanently flexible, elastomeric sealant.

4. Service Temperature Range: Minus 100 to plus 300°F.

5. Color: White or gray.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

b. Eagle Bridges - Marathon Industries; 405.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.

d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250°F.

5. Color: Aluminum.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250°F.

5. Color: White.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide the following
  - a. Johns Manville; Zeston.
  - b. P.I.C. Plastics, Inc.; FG Series.
  - c. Proto Corporation; LoSmoke.
  - d. Speedline Corporation; SmokeSafe.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
  - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

## 2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following
  - a. ABI, Ideal Tape Division; 428 AWF ASJ.
  - b. Avery Dennison Corporation, Specialty Tapes Div.; Fasson 0836.
  - c. Compac Corporation; 104 and 105.
  - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2%.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements provide the following:
  - a. ABI, Ideal Tape Division; 491 AWF FSK.
  - b. Avery Dennison Corporation, Specialty Tapes Div.; Fasson 0827.
  - c. Compac Corporation; 110 and 111.
  - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2%.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide the following
  - a. ABI, Ideal Tape Division; 370 White PVC tape.
  - b. Compac Corporation; 130.
  - c. Venture Tape; 1506 CW NS.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500%.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide the following
  - a. ABI, Ideal Tape Division; 488 AWF.
  - b. Avery Dennison Corporation, Specialty Tapes Div.; Fasson 0800.
  - c. Compac Corporation; 120.
  - d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.

4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5%.
6. Tensile Strength: 34 lbf/inch in width.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75% of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

### 3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies.

### 3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.

2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

### 3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

F. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

G. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

- B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.10 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

### 3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:
  - a. Cellular Glass: 1-1/2 inches thick.
  - b. Flexible Elastomeric 3/4 inch thick.
  - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2-inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Flexible Elastomeric: 1 inch thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2-inch thick.
- B. Domestic Hot and Recirculated Hot Water:
1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Flexible Elastomeric: 3/4 inch thick.
  2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Flexible Elastomeric: 1 inch thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 1/2 inch thick.
- D. Domestic Hot and Recirculated Hot Water:
1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 2 inches thick.
    - b. Flexible Elastomeric: 2 inches thick.

END OF SECTION

SECTION 15086  
DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply, return and outdoor air.
2. Indoor, exposed in mechanical room supply, return and outdoor air.
3. Indoor, Type I, commercial, kitchen hood exhaust.
4. Outdoor supply and return.

B. Related Sections:

1. Section 15088, HVAC Piping Insulation
2. Section 15815, Metal Ducts for duct liners

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 15062, Hangers and Supports for HVAC Piping and Equipment.

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type II with factory-applied vinyl jacket or Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; SoftTouch Duct Wrap.
- b. Johns Manville; Microlite.
- c. Knauf Insulation; Friendly Feel Duct Wrap.
- d. Manson Insulation Inc.; Alley Wrap.
- e. Owens Corning; SOFTR All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; Commercial Board.
- b. Fibrex Insulations Inc.; FBX.
- c. Johns Manville; 800 Series Spin-Glas.
- d. Knauf Insulation; Insulation Board.
- e. Manson Insulation Inc.; AK Board.
- f. Owens Corning; Fiberglas 700 Series.

## 2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

## 2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: 60 percent by volume and 66 percent by weight.

## 2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.

3. Service Temperature Range: 0 to plus 180 deg F.

## 2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.

2. Fire- and water-resistant, flexible, elastomeric sealant.

3. Service Temperature Range: Minus 40 to plus 250 deg F.

4. Color: Aluminum.

5. Materials shall be compatible with insulation materials, jackets, and substrates.

6. Fire- and water-resistant, flexible, elastomeric sealant.

7. Service Temperature Range: Minus 40 to plus 250 deg F.

8. Color: White.

## 2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in.) for covering ducts.

## 2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and prescribed a minimum of 8 oz./sq. yd..

## 2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White

C. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

- a. Sheet and roll stock ready for shop or field sizing
- b. Finish and thickness are indicated in field-applied jacket schedules.
- c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

## 2.11 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

## 2.12 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

b. Spindle: Copper- or zinc-coated, low-carbon steel, Aluminum, Stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.

b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.

c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel, aluminum, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

## 2.13 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

B. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

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

### 3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in other Sections specifying firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in other Sections specifying penetration firestopping materials.

### 3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not over compress insulation during installation.

e. Impale insulation over pins and attach speed washers.

f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18" and smaller, place pins along longitudinal centerline of duct. Space 3" maximum from insulation end joints, and 16" o.c.

b. On duct sides with dimensions larger than 18", space pins 16" o.c. each way, and 3" maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2" overlap at seams and joints.
2. Embed glass cloth between two 0.062" thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in other Sections.

### 3.8 FINISHES

A. Insulation with Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

- a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

### 3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed: supply, return and outdoor air.
2. Indoor, exposed in mechanical rooms: supply, return and outdoor air.
3. Type I, commercial, kitchen hood exhaust.
4. Above ceiling surfaces of all air devices.

B. Items Not Insulated:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.
6. Transfer ducts.
7. Exhaust duct serving toilets, janitor's closets, and electrical rooms.
8. Exposed in occupied spaces: lined duct.

### 3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round, supply-air duct, outdoor air duct and return air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
2. Seal all joints and penetrations in jacket with glasfab and mastic.

B. Concealed, rectangular, supply-air duct, outdoor air duct and return air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density for unlined duct.
2. Mineral-Fiber Blanket: 1 ½ or 2 inches thick and 0.75-lb/cu. ft. nominal density for lined duct.
3. Seal all joints and penetrations in jacket with glasfab and mastic.

C. Concealed, supply-air plenum, return air plenum, and outdoor air plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density for unlined duct.
2. Mineral-Fiber Blanket: 1 ½ or 2 inches thick and 0.75-lb/cu. ft. nominal density for lined duct.
3. Seal all joints and penetrations in jacket with glasfab and mastic.

D. Exposed in mechanical rooms, round, supply-air duct, return air duct, and outdoor air duct and insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
2. Seal all joints and penetrations in jacket with glasfab and mastic.

E. Exposed in mechanical rooms, rectangular, supply-air duct, return air duct, and outdoor air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density for lined and unlined ductwork.

F. Exposed in mechanical rooms, supply-air plenum, return air plenum, and outdoor air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. density for lined and unlined ductwork.

G. Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve 2-hour fire rating.

### 3.11 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Round and rectangular, supply-air duct, return air duct, and outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Board: 3 inches thick and 3-lb/cu. ft. nominal density.

### 3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Ducts and Plenums, Concealed: None.

C. Ducts and Plenums, Exposed in mechanical rooms:

1. Finish ductwork insulation exposed in each mechanical room with a field applied 8 ounce per square yard canvas jacket cemented in place with white lagging adhesive.

2. Apply PVC pipe fitting covers over canvas.

3. Paint canvas with two coats of enamel paint. Colors shall be approved by the Architect.

END OF SECTION

SECTION 15088  
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors and outdoors.
2. Refrigerant suction and hot-gas piping, indoors and outdoors.

B. Related Section:

1. Section 15086, Duct Insulation

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Aeroflex USA, Inc.; Aerocel.
- b. Armacell LLC; AP Armaflex.
- c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

### 2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

### 2.3 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel, or 0.062-inch soft-annealed, galvanized steel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.
  - 7. Flexible Connectors

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 16175, Firestopping for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 16175, Firestopping.

### 3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.7 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

### 3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Condensate Drainage piping located in crawl spaces or outdoors.
2. Underground piping.

### 3.9 INDOOR PIPING INSULATION SCHEDULE

A. Condensate Drain Piping:

1. All Pipe Sizes: Insulation shall be the following:
  - a. Flexible Elastomeric: 3/8 inch thick.

B. Refrigerant Suction and Hot-Gas Piping and Tubing:

1. All Pipe Sizes: Insulation shall be the following:
  - a. Flexible Elastomeric: 3/4 inch thick.

### 3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping and Tubing:

1. All Pipe Sizes: Insulation shall be the following:
  - a. Flexible Elastomeric: 1 inch thick.

END OF SECTION

SECTION 15093  
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Grout.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

C. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.

2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07900.

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in other Sections.

### 3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete and Masonry Walls above Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

2. Interior Concrete or Masonry Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION

SECTION 15097  
ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes: Escutcheons.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated Retain one or both hinge options in paragraph below that match escutcheon types retained in Part 3.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Chrome-Plated Piping: One-piece, split-casting brass type with polished, chrome-plated finish.

c. Insulated Piping: One-piece, stamped-steel type split-plate, stamped-steel type with exposed-rivet hinge. Retain one of first two subparagraphs below.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type split-plate, stamped-steel type with exposed-rivet hinge.

f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plate finish.

h. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with exposed-rivet hinge.

2. Escutcheons for Existing Piping:

a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.

b. Insulated Piping: Split-plate, stamped-steel type with exposed-rivet hinge.

c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with exposed-rivet hinge.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.

f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with exposed-rivet hinge.

g. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.

h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with exposed-rivet hinge.

i. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.

j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with exposed-rivet hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

### 3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION



SECTION 15098  
ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes: Escutcheons.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.

b. Insulated Piping: One-piece, stamped-steel type.

c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

e. Bare Piping in Unfinished Service and Equipment room Spaces: One-piece, cast-brass finish.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION



SECTION 15113  
BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Steel ball valves.
4. Iron ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded end valves.
  - 2. ASME B16.1 for flanges on iron valves.
  - 3. ASME B16.5 for flanges on steel valves.
  - 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 5. ASME B16.18 for solder-joint connections.
  - 6. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
  - 2. Hand lever: For quarter-turn valves smaller than NPS 4
- H. Valves in Insulated Piping:
  - 1. Include 2-inch stem extensions
  - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
  - 3. Memory stops that are fully adjustable after insulation is applied.

## 2.2 BRASS BALL VALVES

- A. One-Piece, Brass Ball Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. CWP Rating: 400 psig.
    - c. Body Design: One piece.
    - d. Body Material: Forged brass or bronze.
    - e. Ends: Threaded and soldered.
    - f. Seats: PTFE.
    - g. Stem: Brass or stainless steel.

- h. Ball: Chrome-plated brass or stainless steel.
- i. Port: Reduced.

B. Two-Piece, Brass Ball Valves with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. American Valve, Inc.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Stockham Valves.
- d. Hammond Valve.
- e. Kitz Corporation.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig.
- c. Body Design: Two piece.
- d. Body Material: Forged brass.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Brass.
- h. Ball: Chrome-plated brass.
- i. Port: Full.

C. Two-Piece, Brass Ball Valves with Full Port and Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Kitz Corporation.
- b. Milwaukee Valve Company.

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig.
- c. Body Design: Two piece.
- d. Body Material: Forged brass.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel, vented.
- i. Port: Full.

D. Two-Piece, Brass Ball Valves with Regular Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Hammond Valve.
- b. Milwaukee Valve Company.
- c. NIBCO INC.
- d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig.
- c. Body Design: Two piece.
- d. Body Material: Forged brass.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Brass.
- h. Ball: Chrome-plated brass.
- i. Port: Regular.

E. Two-Piece, Brass Ball Valves with Regular Port and Stainless-Steel Trim:

1. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig.
- c. Body Design: Two piece.
- d. Body Material: Brass or bronze.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel, vented.
- i. Port: Regular.

## 2.3 BRONZE BALL VALVES

A. One-Piece, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. NIBCO INC.
- b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- c. Jenkins

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 400 psig.
- c. Body Design: One piece.

- d. Body Material: Bronze.
- e. Ends: Threaded.
- f. Seats: PTFE.
- g. Stem: Bronze.
- h. Ball: Chrome-plated brass.
- i. Port: Reduced.

B. One-Piece, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. NIBCO INC.
- b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- c. Jenkins

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig.
- c. Body Design: One piece.
- d. Body Material: Bronze.
- e. Ends: Threaded.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel, vented.
- i. Port: Reduced.

C. Two-Piece, Bronze Ball Valves with Full Port, and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Hammond Valve.
- c. Milwaukee Valve Company.
- d. NIBCO INC.
- e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig.
- c. Body Design: Two piece.
- d. Body Material: Bronze.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Bronze or brass.
- h. Ball: Chrome-plated brass.
- i. Port: Full.

D. Two-Piece, Bronze Ball Valves with Full Port and Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Hammond Valve.
- c. Milwaukee Valve Company.
- d. NIBCO INC.
- e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig.
- c. Body Design: Two piece.
- d. Body Material: Bronze.
- e. Ends: Threaded or soldered.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel, vented.
- i. Port: Full.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

### 3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

4. For Steel Piping, NPS 2 and Smaller: Threaded ends.

5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

6. For Steel Piping, NPS 5 and Larger: Flanged ends.

C. Pipe NPS 2-1/2 and Larger:

1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

2. Class 150, steel ball valves with full port.

3. Class 150, iron ball valves.

### 3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.

2. One piece, brass ball valve.

3. One piece, bronze ball valve with bronze trim.

4. Two-piece, brass ball valves with full port and brass trim.

5. Two-piece, bronze ball valves with full port and bronze trim.

B. Pipe NPS 2-1/2 and Larger:

1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

2. Class 150, steel ball valves with full port.

3. Class 150, iron ball valves.

END OF SECTION



SECTION 15115  
CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze lift check valves.
2. Bronze swing check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 for valve materials for potable-water service.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Bypass and Drain Connections: MSS SP-45.

### 2.2 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Valves.

2. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B 61 or ASTM B 62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Hammond Valve.
- b. Kitz Corporation.
- c. Milwaukee Valve Company.
- d. Mueller Steam Specialty; a division of SPX Corporation.
- e. NIBCO INC.
- f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B 61 or ASTM B 62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: NBR, PTFE.

## 2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze, Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Valve, Inc.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Valves.
- e. Hammond Valve.
- f. Kitz Corporation.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell Valves.
- j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Valves.
- d. Hammond Valve.
- e. Kitz Corporation.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 4.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: PTFE.

C. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. American Valve, Inc.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Valves.
- e. Kitz Corporation.
- f. The Macomb Groups.
- g. Milwaukee Valve Company.
- h. NIBCO INC.

2. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 300 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: Bronze.

D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Hammond Valve.
- d. Milwaukee Valve Company.
- e. NIBCO INC.
- f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 4.
- b. CWP Rating: 300 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: PTFE.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

- 1. Swing Check Valves: In horizontal position with hinge pin level.
- 2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
- 3. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements in Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

### 3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze

b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, metal-seat check valves.

c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.

3. For Copper Tubing, NPS 5 and Larger: Flanged.

4. For Steel Piping, NPS 2 and Smaller: Threaded.

5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.

6. For Steel Piping, NPS 5 and Larger: Flanged.

### 3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze swing check valves, Class 150, with soldered or threaded end connections.

B. Pipe NPS 2-1/2 and Larger:

1. Iron swing check valves, Class 250, metal end connections.

END OF SECTION

SECTION 15116  
GATE VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bronze gate valves.
2. Iron gate valves.
3. Chainwheels.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. NRS: Nonrising stem.
- C. OS&Y: Outside screw and yoke.
- D. RS: Rising stem.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
1. Certification that products comply with NSF 61

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
  2. Protect threads, flange faces, grooves, and weld ends.
  3. Set gate valves closed to prevent rattling.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. RS Valves in Insulated Piping: With 2-inch stem extensions.

H. Valve Bypass and Drain Connections: MSS SP-45.

### 2.2 BRONZE GATE VALVES

A. Class 125, NRS, Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide
  - a. American Valve, Inc.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Crane Co.; Crane Valve Group; Jenkins Valves.
  - d. Crane Co.; Crane Valve Group; Stockham Valves.
  - e. Hammond Valve.
  - f. Kitz Corporation.
  - g. The Macomb Groups.
  - h. Milwaukee Valve Company.
  - i. NIBCO INC.
  - j. Powell Valves.
  - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 200 psig.
  - c. Body Material: Bronze with integral seat and screw-in bonnet.
  - d. Ends: Threaded or solder joint.
  - e. Stem: Bronze.
  - f. Disc: Solid wedge; bronze.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, RS, Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. American Valve, Inc.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Valves.
- e. Hammond Valve.
- f. Kitz Corporation.
- g. The Macomb Groups.
- h. Milwaukee Valve Company.
- i. NIBCO INC.
- j. Powell Valves.
- k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Material: Bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

C. Class 150, NRS, Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Hammond Valve.
- b. Kitz Corporation.
- c. Milwaukee Valve Company.
- d. NIBCO INC.
- e. Powell Valves.
- f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 300 psig.
  - c. Body Material: Bronze with integral seat and union-ring bonnet.
  - d. Ends: Threaded.
  - e. Stem: Bronze.
  - f. Disc: Solid wedge; bronze.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable iron, bronze, or aluminum.

D. Class 150, RS, Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Stockham Valves.
- c. Hammond Valve.
- d. Kitz Corporation.
- e. The Macomb Groups.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Powell Valves.
- i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
  - a. Standard: MSS SP-80, Type 2.
  - b. CWP Rating: 300 psig.
  - c. Body Material: Bronze with integral seat and union-ring bonnet.
  - d. Ends: Threaded.
  - e. Stem: Bronze.
  - f. Disc: Solid wedge; bronze.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable iron, bronze, or aluminum.
  - i. Packing and Gasket: Asbestos free.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for gate valves NPS and larger above floor. Extend chains to 60 inches above finished floor.

F. Install valve tags. Comply with requirements in Section 15076 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

### 3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. Use gate valves for shutoff service only.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. For Grooved-End Copper Tubing Valve ends may be grooved.

END OF SECTION



SECTION 15126  
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Light-activated thermometers.
5. Thermowells.
6. Dial-type pressure gages.
7. Gage attachments.
8. Test plugs.
9. Test-plug kits.
10. Sight flow indicators.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following;

1. Ashcroft Inc.
2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
3. Weiss Instruments, Inc.
4. WIKA Instrument Corporation - USA.

B. Standard: ASME B40.200.

C. Case: Liquid-filled type(s); stainless steel with 3-inch nominal diameter.

- D. Dial: Non-reflective aluminum with permanently etched scale markings and scales in deg F
- E. Connector Type(s): Union joint, with unified-inch screw threads.
- F. Connector Size: 1/2 inch with ASME B1.1 screw threads.
- G. Window: Plain glass
- H. Ring: Stainless steel.
- I. Element: Bimetal coil.
- J. Pointer: Dark-colored metal.
- K. Accuracy: Plus or minus 1.5percent of scale range.

## 2.2 FILLED-SYSTEM THERMOMETERS

- A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
    - a. Ashcroft Inc.
    - b. Weiss Instruments, Inc.
    - c. Ametek
  - 2. Standard: ASME B40.200.
  - 3. Case: Sealed type, cast aluminum 4-1/2-inch nominal diameter.
  - 4. Element: Bourdon tube or other type of pressure element.
  - 5. Dial: Non-reflective aluminum with permanently etched scale markings graduated in deg F
  - 6. Pointer: Dark-colored metal.
  - 7. Window: Glass
  - 8. Ring: Metal
  - 9. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, with ASME B1.1 screw threads.
  - 10. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  - 11. Accuracy: Plus or minus 1percent of scale range.

B. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR
4. Type: Stepped shank unless straight or tapered shank is indicated.
5. External Threads: ASME B1.20.1 pipe threads.
6. Internal Threads: ASME B1.1 screw threads.
7. Bore: Diameter required to match thermometer bulb or stem.
8. Insertion Length: Length required to match thermometer bulb or stem.
9. Lagging Extension: Include on thermowells for insulated piping and tubing.
10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

C. Heat-Transfer Medium: Mixture of graphite and glycerin

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AMETEK, Inc.; U.S. Gauge.
  - b. Ashcroft Inc.
  - c. Weiss Instruments, Inc.
  - d. WIKA Instrument Corporation - USA.
  - e. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Liquid-filled material; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.

7. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi
8. Pointer: Dark-colored metal.
9. Window: Glass
10. Ring: Metal
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. AMETEK, Inc.; U.S. Gauge.
- b. Ashcroft Inc.
- c. Weiss Instruments, Inc.

2. Standard: ASME B40.100.

3. Case: Seale 4-1/2-inch nominal diameter.

4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

5. Pressure Connection: Brass, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

6. Movement: Mechanical, with link to pressure element and connection to pointer.

7. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi

8. Pointer: Dark-colored metal.

9. Window: Glass

10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

## 2.4 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following

1. Flow Design, Inc.
2. Miljoco Corporation.
3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
4. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F

F. Core Inserts: EPDM self-sealing rubber.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlet and outlet of each domestic hot-water storage tank.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.

### 3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### 3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

### 3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be liquid-filled bimetallic-actuated type.

B. Thermometers at inlets and outlets of each domestic water shall be liquid-filled bimetallic-actuated type.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be liquid-filled bimetallic-actuated type.

D. Thermometers at inlet and outlet of each remote domestic water chiller shall be liquid-filled, bimetallic-actuated type.

- E. Thermometer stems shall be of length to match thermowell insertion length.

### 3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 120°F.

### 3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be the following:

1. Liquid-filled direct-mounted, metal case.
2. Test plug with EPDM self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:

1. Liquid-filled direct mounted, metal case.
2. Sealed mounted, plastic case.
3. Test plug with EPDM self-sealing rubber inserts.

### 3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping: 0 to 150 psi.

END OF SECTION

SECTION 15140  
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

## 2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal seating surfaces.
  - 4. Solder-joint or threaded ends.
- G. Copper Pressure-Seal-Joint Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
    - a. Elkhart Products Corporation.
    - b. NIBCO Inc.
    - c. Viega.
  - 3. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
  - 4. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
- H. Copper Push-on-Joint Fittings:
  - 1. Description:
    - a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
    - b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.
- I. Copper-Tube, Extruded-Tee Connections:
  - 1. Description: Tee formed in copper tube according to ASTM F 2014.

J. Push-on-Joint, Ductile-Iron Pipe:  
1. AWWA C151/A21.51.  
2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

K. Standard-Pattern, Push-on-Joint Fittings:  
1. AWWA C110/A21.10, ductile or gray iron.  
2. Gaskets: AWWA C111/A21.11, rubber.

L. Compact-Pattern, Push-on-Joint Fittings:  
1. AWWA C153/A21.53, ductile iron.  
2. Gaskets: AWWA C111/A21.11, rubber.

## 2.3 CPVC PIPING

A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40  
1. CPVC Socket Fittings: ASTM F 438 for Schedule 40  
2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.  
B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.  
C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

## 2.4 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, Schedule 40  
B. PVC Socket Fittings: ASTM D 2466 for Schedule 40  
C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.  
D. Solder Filler Metals: ASTM B 32, lead-free alloys.  
E. Flux: ASTM B 813, water flushable.  
F. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.  
G. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.  
1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).  
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

H. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

I. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

## 2.5 TRANSITION FITTINGS

### A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

### C. Plastic-to-Metal Transition Fittings:

#### 1. Description:

a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.

b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

### D. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Colonial Engineering, Inc.
- b. NIBCO Inc.
- c. Spears Manufacturing Company.

2. Description:
  - a. CPVC four-part union.
  - b. Brass threaded end.
  - c. Solvent-cement-jointplastic end.
  - d. Rubber O-ring.
  - e. Union nut.

## 2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

### B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Capitol Manufacturing Co.; member of the Phoenix Forge Group.
- b. Central Plastics Company.
- c. Hart Industries International, Inc.
- d. Jomar International.
- e. Matco-Norca.
- f. McDonald, A. Y. Mfg. Co.
- g. Watts; a division of Watts Water Technologies, Inc.
- h. Wilkins; a Zurn company.

2. Standard: ASSE 1079.

3. Pressure Rating: 150 psig

4. End Connections: Solder-joint copper alloy and threaded ferrous.

### C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by the following;

- a. Capitol Manufacturing Co.; member of the Phoenix Forge Group.
- b. Central Plastics Company.
- c. Matco-Norca.
- d. Watts; a division of Watts Water Technologies, Inc.
- e. Wilkins; a Zurn company.

2. Standard: ASSE 1079.

3. Factory-fabricated, bolted, companion-flange assembly.

4. Pressure Rating: 150 psig

5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Advance Products & Systems, Inc.
- b. Calpico, Inc.
- c. Central Plastics Company.
- d. Pipeline Seal and Insulator, Inc.

2. Nonconducting materials for field assembly of companion flanges.

3. Pressure Rating: 150 psig

4. Gasket: Neoprene or phenolic.

5. Bolt Sleeves: Phenolic or polyethylene.

6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Elster Perfection Corporation.
- b. Grinnell Mechanical Products; Tyco Fire Products LP.
- c. Matco-Norca.
- d. Precision Plumbing Products, Inc.
- e. Victaulic Company.

2. Standard: IAPMO PS 66.

3. Electroplated steel nipple complying with ASTM F 1545.

4. Pressure Rating and Temperature: 300 psig at 225 deg F

5. End Connections: Male threaded or grooved.

6. Lining: Inert and noncorrosive, propylene.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

A. Comply with requirements Earth Moving for excavating, trenching, and backfilling.

### 3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section "Domestic Water Piping Specialties."

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section "Domestic Water Piping Specialties."

F. Install domestic water piping level with 0.25 (1) percent slope downward toward drain and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install PEX piping with loop at each change of direction of more than 90 degrees.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section "Meters and Gages for Plumbing Piping."

R. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section "Meters and Gages for Plumbing Piping."

S. Install sleeves for piping penetrations of walls, ceilings, and floors.

- T. Install sleeve seals for piping penetrations of concrete walls and slabs.
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- J. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
  - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 3. PVC Piping: Join according to ASTM D 2855.

K. Joints for PEX Piping: Join according to ASTM F 1807.

L. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### 3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 Use dielectric flange kits

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

### 3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.

2. Individual, Straight, Horizontal Piping Runs:

- a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
- c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

C. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

D. Install supports for vertical copper tubing every 10 feet.

E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

F. Install supports for vertical steel piping every 15 feet.

G. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

H. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

I. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8: 48 inches with 7/8-inch rod.

J. Install supports for vertical PVC piping every 48 inches.

### 3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.

2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

### 3.9 FIELD QUALITY CONTROL

PART 4 - Retain "Perform the following tests and inspections" Paragraph below to require Contractor to perform tests and inspections.

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.

d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

## 2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

## 4.2 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.

3. Open throttling valves to proper setting.

4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.

b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

#### 4.3 CLEANING

##### A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Fill and isolate system according to either of the following:
    - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
    - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
  - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  - d. Repeat procedures if biological examination shows contamination.
  - e. Submit water samples in sterile bottles to authorities having jurisdiction.

##### B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

#### 4.4 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller , shall be one of the following:

1. Soft copper tube, ASTM B 88, Type L; no joints.
2. PVC, Schedule 40 socket fittings; and solvent-cemented joints.
3. PP, SDR 11 socket fittings; and fusion-welded joints.

E. Aboveground domestic water piping, NPS 2 and smaller shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L copper, solder-joint fittings; and soldered joints.

2. Hard copper tube, ASTM B 88, Type L copper pressure-seal-joint fittings; and pressure-sealed joints.

3. Hard copper tube, ASTM B 88, Type L copper push-on-joint fittings; and push-on joints.

4. CPVC, Schedule 40 socket fittings; and solvent-cemented joints.

5. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints. NPS 1-1/2 and NPS 2 CPVC pipe with CPVC socket fittings may be used instead of tubing.

6. PVC, Schedule 40 socket fittings; and solvent-cemented joints.

F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 , shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L copper, solder-joint fittings; soldered joints.

2. Hard copper tube, ASTM B 88, Type L copper pressure-seal-joint fittings; and pressure-sealed joints.

3. Hard copper tube, ASTM B 88, Type L grooved-joint, copper-tube appurtenances; and grooved joints.
4. CPVC, Schedule 40 socket fittings; and solvent-cemented joints.
5. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
6. PVC, Schedule 40 socket fittings; and solvent-cemented joints.

#### 4.5 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION



SECTION 15145  
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Strainers.
5. Outlet boxes.
6. Hose bibbs.
7. Wall hydrants.
8. Ground hydrants.
9. Post hydrants.
10. Drain valves.
11. Water-hammer arresters.
12. Air vents.
13. Trap-seal primer valves.
14. Trap-seal primer systems.
15. Specialty valves.
16. Flexible connectors.
17. Water meters.

B. Related Requirements:

1. Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section "Domestic Water Piping" for water meters.
3. Section "Pressure Water Coolers" for water filters for water coolers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

## 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14

### 2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

### 2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
- b. Cash Acme; a division of Reliance Worldwide Corporation.
- c. FEBCO; a division of Watts Water Technologies, Inc.
- d. Rain Bird Corporation.
- e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
- f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze

B. Hose-Connection Vacuum Breakers :

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Arrowhead Brass Products.

- b. Cash Acme; a division of Reliance Worldwide Corporation.
  - c. Conbraco Industries, Inc.
  - d. Watts; a division of Watts Water Technologies, Inc.; Watts  
Regulator Company.
  - e. Woodford Manufacturing Co.; a division of WCM Industries, Inc.
  - f. Zurn Industries, LLC; Plumbing Products Group; Light Commercial  
Products.
  - g. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water  
Control Products.
2. Standard: ASSE 1011.
  3. Body: Bronze, non-removable, with manual drain.
  4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
  5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    - b. FEBCO; a division of Watts Water Technologies, Inc.
    - c. Flomatic Corporation.
    - d. Toro Company (The); Irrigation Div.
    - e. Watts; a division of Watts Water Technologies, Inc.; Watts  
Regulator Company.
    - f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water  
Control Products.
2. Standard: ASSE 1020.
  3. Operation: Continuous-pressure applications.
  4. Pressure Loss: 5 psig maximum, through middle third of flow range.
  5. Size: Match that as piping size shown on contract documents.
  6. Design Flow Rate: 5 gpm.
  7. Accessories:
    - a. Valves: Ball type, on inlet and outlet.

## 2.4 BACKFLOW PREVENTERS

### A. Intermediate Atmospheric-Vent Backflow Preventers

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Cash Acme; a division of Reliance Worldwide Corporation.
- b. FEBCO; a division of Watts Water Technologies, Inc.
- c. Honeywell International Inc.
- d. Legend Valve.
- e. Watts; a division of Watts Water Technologies, Inc.; Watts  
Regulator Company.
- f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water  
Control Products.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size NPS 3.
5. Body: Bronze.
6. End Connections: Union, solderjoint.
7. Finish: Chrome plated

### B. Reduced-Pressure-Principle Backflow Preventers

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
- b. FEBCO; a division of Watts Water Technologies, Inc.
- c. Flomatic Corporation.
- d. Watts; a division of Watts Water Technologies, Inc.; Watts  
Regulator Company.
- e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water  
Control Products.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.

4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Pressure Loss at Design Flow Rate: 5 psig for sizes NPS 2 and smaller; 10 psi for NPS 2-1/2 and larger.
6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved
7. for NPS 2-1/2 and larger.
8. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
9. Configuration: Designed for horizontal, straight-through flow.
10. Accessories:
  - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
  - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
  - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double-Check, Backflow-Prevention Assemblies

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
  - b. FEBCO; a division of Watts Water Technologies, Inc.
  - c. Flomatic Corporation.
  - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Pressure Loss at Design Flow Rate: 5psig for sizes NPS 2 and smaller; 10 psi for NPS 2-1/2 and larger.

6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.

7. End Connections: Threaded for NPS 2 and smaller; flanged Insert type for NPS 2-1/2 and larger.

8. Configuration: Designed for horizontal, straight-through flow.

9. Accessories:

a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.

b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

#### D. Dual-Check-Valve Backflow Preventers

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Cash Acme; a division of Reliance Worldwide Corporation.

b. FEBCO; a division of Watts Water Technologies, Inc.

c. Flomatic Corporation.

d. Honeywell International Inc.

e. Mueller Co. Ltd.; a subsidiary of Mueller Water Products Inc.

f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

g. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1024.

3. Operation: Continuous-pressure applications.

4. Body: Bronze with union inlet.

## 2.5 WATER PRESSURE-REDUCING VALVES

### A. Water Regulators

1. Manufacturers: Subject to compliance with requirements, provide products by the following

a. Cash Acme; a division of Reliance Worldwide Corporation.

b. Honeywell International Inc.

Regulator Company. c. Watts; a division of Watts Water Technologies, Inc.; Watts

Control Products. d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Primary, Thermostatic, Water Mixing Valves

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Armstrong International, Inc.
  - b. Lawler Manufacturing Company, Inc.
  - c. Leonard Valve Company.
  - d. Powers; a division of Watts Water Technologies, Inc.
  - e. Symmons Industries, Inc.
2. Standard: ASSE 1017.
  3. Pressure Rating: 125 psig minimum unless otherwise indicated.
  4. Type: Exposed-mounted thermostatically controlled, water mixing valve.
  5. Material: Bronze body with corrosion-resistant interior components.
  6. Connections: Threaded inlets and outlet.
  7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
  8. Tempered-Water Setting: 110 deg F.
  9. Tempered-Water Design Flow Rate: 30 gpm.
  10. Selected Valve Flow Rate at 45-psig Pressure Drop: 5 gpm.
  11. Pressure Drop at Design Flow Rate: 7 psig.
  12. Valve Finish: Rough bronze.
  13. Piping Finish Copper.

C. Individual-Fixture, Water Tempering Valves

1. Manufacturers: Subject to compliance with requirements, provide products by the following :

- a. Cash Acme; a division of Reliance Worldwide Corporation.
- b. Honeywell International Inc.
- c. Lawler Manufacturing Company, Inc.
- d. Leonard Valve Company.
- e. Powers; a division of Watts Water Technologies, Inc.
- f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
- g. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 110 deg F.
9. Tempered-Water Design Flow Rate: 5 gpm.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.020 inch
  - b. Strainers NPS 2-1/2 to NPS 4:0.045 inch
6. Drain: Factory-installed, hose-end drain valve.

## 2.7 OUTLET BOXES

### A. Clothes Washer Outlet Boxes

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Acorn Engineering Company.
  - b. Guy Gray Manufacturing Co., Inc.
  - c. IPS Corporation.
  - d. LSP Products Group, Inc.
  - e. Oatey.
  - f. Plastic Oddities.
  - g. Symmons Industries, Inc.
  - h. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - i. Whitehall Manufacturing; a div. of Acorn Engineering Company.
  - j. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
4. Faucet: Combination separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: ball valves and NPS 1/2 copper, water tubing.
6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
7. Inlet Hoses: Two 60-inch- long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
8. Drain Hose: One 48-inch- long, rubber household clothes washer drain hose with hooked end.

### B. Icemaker Outlet Boxes

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Acorn Engineering Company.
  - b. IPS Corporation.
  - c. LSP Products Group, Inc.
  - d. Oatey.
  - e. Plastic Oddities.
- 2. Mounting: Recessed.
  - 3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
  - 4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
  - 5. Supply Shutoff Fitting: NPS 1/2, globe, or ball valve and NPS 1/2 copper, water tubing.

## 2.8 HOSE BIBBS

- A. Hose Bibbs
  - 1. Standard: ASME A112.18.1 for sediment faucets.
  - 2. Body Material: Bronze.
  - 3. Seat: Bronze, replaceable.
  - 4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
  - 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
  - 6. Pressure Rating: 125 psig.
  - 7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
  - 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
  - 9. Finish for Service Areas: Chrome or nickel plated.
  - 10. Finish for Finished Rooms: Chrome or nickel plated.
  - 11. Operation for Equipment Rooms: Wheel handle or operating key.
  - 12. Operation for Service Areas: Operating key.
  - 13. Operation for Finished Rooms: Operating key.
  - 14. Include operating key with each operating-key hose bibb.
  - 15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.9 WALL HYDRANTS

### A. Nonfreeze Wall Hydrants

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Josam Company.
- b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- c. Watts Drainage Products.
- d. Woodford Manufacturing Company; a division of WCM Industries, Inc.
- e. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
- f. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASME A112.21.3M for concealed outlet, self-draining wall hydrants.

3. Pressure Rating: 125 psig.

4. Operation: Loose key.

5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.

6. Inlet: NPS 3/4 or NPS 1.

7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

8. Box: Deep, flush mounted with cover.

9. Box and Cover Finish: Polished nickel bronze

10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

11. Nozzle and Wall-Plate Finish: Polished nickel bronze

12. Operating Keys(s): Two with each wall hydrant.

### B. Nonfreeze, Hot- and Cold-Water Wall Hydrants

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Josam Company.

- b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- c. Tyler Pipe; Wade Div.
- d. Watts Drainage Products.
- e. Woodford Manufacturing Co.; a division of WCM Industries, Inc.
- f. Zurn Industries, LLC; Plumbing Products Group; Specification

Drainage Products.

2. Standard: ASME A112.21.3M for concealed outlet, self-draining wall hydrants.

3. Pressure Rating: 125 psig.

4. Operation: Loose key.

5. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.

6. Inlet: NPS 3/4 or NPS 1.

7. Outlet: Concealed.

8. Box: Deep, flush mounted with cover.

9. Box and Cover Finish: Polished nickel bronze

10. Vacuum Breaker:

a. Non-removable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.

b. Garden-hose thread complying with ASME B1.20.7 on outlet.

11. Operating Keys(s): Two with each wall hydrant.

a. Josam Company.

b. MIFAB, Inc.

c. Prier Products, Inc.

d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

e. Tyler Pipe; Wade Div.

f. Watts Drainage Products.

g. Woodford Manufacturing Company; a division of WCM Industries, Inc.

h. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.

## 2.10 DRAIN VALVES

### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

## 2.11 WATER-HAMMER ARRESTERS

### A. Water-Hammer Arresters

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. AMTROL, Inc.
- b. Josam Company.
- c. MIFAB, Inc.
- d. Precision Plumbing Products, Inc.
- e. Sioux Chief Manufacturing Company, Inc.
- f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- g. Tyler Pipe; Wade Div.
- h. Watts Drainage Products.
- i. Zurn Industries, LLC; Plumbing Products Group; Specification

Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.

3. Type: Metal bellows
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

B. Supply-Type, Trap-Seal Primer Device

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Precision Plumbing Products, Inc.
- b. Sioux Chief Manufacturing Company, Inc.
- c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standard: ASSE 1018.

3. Pressure Rating: 125 psig minimum.

4. Body: Bronze.

5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.

6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.

7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

C. Drainage-Type, Trap-Seal Primer Device

1. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.

2. Size: NPS 1-1/4 minimum.

3. Material: Chrome-plated, cast brass.

## 2.12 SPECIALTY VALVES

A. Comply with requirements for general-duty metal valves in Section "Ball Valves for Plumbing Piping, Section "Check Valves for Plumbing Piping," and Section "Gate Valves for Plumbing Piping."

B. CPVC Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. American Valve, Inc.
- b. Asahi/America.

- c. Georg Fischer LLC; GF Piping Systems.
- d. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
- e. NIBCO Inc.
- f. Spears Manufacturing Company.
- g. Thermoplastic Valves Inc.

2. Description:

- a. Standard: MSS SP-122.
- b. Pressure Rating and Temperature: 150 psig< at 120 deg F
- c. Body Material: CPVC.
- d. Body Design: Union type.
- e. End Connections for Valves NPS 2 and Smaller: Detachable, socket
- f. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable,  
socket or threaded
- g. Ball: CPVC; full port.
- h. Seals: PTFE or EPDM-rubber O-rings.
- i. Handle: Tee shaped.

C. PVC Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Valve, Inc.
- b. Asahi/America.
- c. Colonial Engineering, Inc.
- d. Georg Fischer LLC; GF Piping Systems.
- e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
- f. NIBCO Inc.
- g. Spears Manufacturing Company.
- h. Thermoplastic Valves Inc.

2. Description:

- a. Standard: MSS SP-122.
- b. Pressure Rating and Temperature: 150 psig at 110 deg F
- c. Body Material: PVC.
- d. Body Design: Union type.
- e. End Connections for Valves NPS 2 and Smaller: Detachable, socket
- f. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable,  
socket or threaded.
- g. Ball: PVC; full port.
- h. Seals: PTFE or EPDM-rubber O-rings.
- i. Handle: Tee shaped.

D. CPVC Non-Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Valve, Inc.

- b. Asahi/America.
- c. NIBCO Inc.
- d. Spears Manufacturing Company.
- e. Thermoplastic Valves Inc.

2. Description:

- a. Standard: MSS SP-122.
- b. Pressure Rating and Temperature: 150 psig at 110 deg F
- c. Body Material: CPVC.
- d. Body Design: Non-union type.
- e. End Connections: Socket or threaded.
- f. Ball: CPVC; full or reduced port.
- g. Seals: PTFE or EPDM-rubber O-rings.
- h. Handle: Tee shaped.

E. PVC Non-Union Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Valve, Inc.
- b. Asahi/America.
- c. Colonial Engineering, Inc.
- d. Georg Fischer LLC; GF Piping Systems.
- e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
- f. IPEX.
- g. NIBCO Inc.
- h. Spears Manufacturing Company.
- i. Thermoplastic Valves Inc.

2. Description:

- a. Standard: MSS SP-122.
- b. Pressure Rating and Temperature: 150 psig at 110 deg F
- c. Body Material: PVC.
- d. Body Design: Non-union type.
- e. End Connections: Socket or threaded.
- f. Ball: PVC; full or reduced port.
- g. Seals: PTFE or EPDM-rubber O-rings.
- h. Handle: Tee shaped.

F. CPVC Ball Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Valve, Inc.
- b. Asahi/America.
- c. Georg Fischer LLC; GF Piping Systems.
- d. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
- e. IPEX.

- f. NIBCO Inc.
- g. Spears Manufacturing Company.
- h. Thermoplastic Valves Inc.

2. Description:

- a. Pressure Rating and Temperature: 150 psig at 110 deg F
- b. Body Material: CPVC.
- c. Body Design: Union-type ball check.
- d. End Connections for Valves NPS 2 and Smaller: Detachable, socket threaded.
- e. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable socket or threaded
- f. Ball: CPVC.
- g. Seals: EPDM- or FKM-rubber O-rings.

G. PVC Ball Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Valve, Inc.
- b. Asahi/America.
- c. Georg Fischer LLC; GF Piping Systems.
- d. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
- e. NIBCO Inc.
- f. Spears Manufacturing Company.
- g. Thermoplastic Valves Inc.

2. Description:

- a. Pressure Rating and Temperature: 150 psig at 110 deg F
- b. Body Material: PVC.
- c. Body Design: Union-type ball check.
- d. End Connections for Valves NPS 2 and Smaller: Detachable, socket
- e. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket or threaded
- f. Ball: PVC.
- g. Seals: EPDM- or FKM-rubber O-rings.

H. CPVC Gate Valves:

1. Description:

- a. Pressure Rating and Temperature: 150 psig at 110 deg F
- b. Body Material: CPVC.
- c. Body Design: Nonrising stem.
- d. End Connections for Valves NPS 2 and Smaller: Socket
- e. End Connections for Valves NPS 2-1/2 to NPS 4: Socket or threaded
- f. Gate and Stem: Plastic.
- g. Seals: EPDM rubber.

h. Handle: Wheel.

I. PVC Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Asahi/America.
- b. Georg Fischer LLC; GF Piping Systems.
- c. KBI Company.
- d. Spears Manufacturing Company.

2. Description:

- a. Pressure Rating and Temperature: 150 psig at 110 deg F
- b. Body Material: PVC.
- c. Body Design: Nonrising stem.
- d. End Connections for Valves NPS 2 and Smaller: Socket
- e. End Connections for Valves NPS 2-1/2 to NPS 4: Socket or threaded
- f. Gate and Stem: Plastic.
- g. Seals: EPDM rubber.
- h. Handle: Wheel.

## 2.13 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Flex Pression, Ltd.
4. Flex-Weld Incorporated.
5. Hyspan Precision Products, Inc.
6. Mercer Gasket & Shim, Inc.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. TOZEN Corporation.
10. Unaflex.Universal Metal Hose; a Hyspan company.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 250 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 250 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.

3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

C. Install water-control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.

G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06100 "Rough Carpentry."

H. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06100 "Rough Carpentry."

- I. Install water-hammer arresters in water piping according to PDI-WH 201.

J. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

K. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

L. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

### 3.2 CONNECTIONS

A. Comply with requirements for ground equipment as described in electrical specifications.

B. Fire-retardant-treated-wood blocking as noted in electrical specifications.

### 3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Reduced-pressure-principle backflow preventers.
3. Double-check, backflow-prevention assemblies.
4. Dual-check-valve backflow preventers.
5. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.
6. Double-check, detector-assembly backflow preventers.
7. Water pressure-reducing valves.
8. Primary, thermostatic, water mixing valves.
9. Outlet boxes.

B. Supply-type, trap-seal primer valves. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section "Identification for Plumbing Piping and Equipment."

### 3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each double-check, backflow-prevention assembly, according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

### 3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION



SECTION 15150  
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Sections:

1. Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water

1.4 ACTION SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.

2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

### 2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Solvent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

C. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ANACO-Husky.
- b. Dallas Specialty & Mfg. Co.
- c. Fernco Inc.
- d. Matco-Norca, Inc.
- e. MIFAB, Inc.
- f. Mission Rubber Company; a division of MCP Industries, Inc.
- g. Stant.
- h. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.

3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:

1. Standard: ASTM C 1277.

2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

### 2.3 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## 2.4 ABS PIPE AND FITTINGS

A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

B. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

C. Solvent Cement: ASTM D 2235.

1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.5 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.6 SPECIALTY PIPE FITTINGS

### A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

### 3. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following

- 1) Dallas Specialty & Mfg. Co.
- 2) Fernco Inc.
- 3) Mission Rubber Company; a division of MCP Industries, Inc.
- 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

b. Standard: ASTM C 1173.

c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

d. Sleeve Materials:

- 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
- 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
- 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

### B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

### 2. Dielectric Unions:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Capitol Manufacturing Company.
- 2) Central Plastics Company.
- 3) Hart Industries International, Inc.
- 4) Jomar International Ltd.
- 5) Matco-Norca, Inc.
- 6) McDonald, A. Y. Mfg. Co.
- 7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 8) Wilkins; a Zurn Company.

b. Description:

- 1) Standard: ASSE 1079.
- 2) Pressure Rating: 150 psig
- 3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Capitol Manufacturing Company.
- 2) Central Plastics Company.
- 3) Matco-Norca, Inc.
- 4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 5) Wilkins; a Zurn company.

b. Description:

- 1) Standard: ASSE 1079.
- 2) Factory-fabricated, bolted, companion-flange assembly.
- 3) Pressure Rating: 150 psig
- 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Advance Products & Systems, Inc.
- 2) Calpico, Inc.
- 3) Central Plastics Company.
- 4) Pipeline Seal and Insulator, Inc.

b. Description:

- 1) Non-conducting materials for field assembly of companion flanges.
- 2) Pressure Rating: 150 psig
- 3) Gasket: Neoprene or phenolic.
- 4) Bolt Sleeves: Phenolic or polyethylene.
- 5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Elster Perfection.
- 2) Grinnell Mechanical Products.
- 3) Matco-Norca, Inc.
- 4) Precision Plumbing Products, Inc.
- 5) Victaulic Company.

b. Description:

- 1) Standard: IAPMO PS 66
- 2) Electroplated steel nipple.
- 3) Pressure Rating: 300 psig at 225 deg F End Connections: Male threaded or grooved.
- 4) Lining: Inert and noncorrosive, propylene.

## PART 3 - EXECUTION

### 3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section "Earthwork."

### 3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1% downward in direction of flow for piping NPS 4 and larger.

2. Horizontal Sanitary Drainage Piping: 1% downward in direction of flow.

3. Vent Piping: 1% down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install steel piping according to applicable plumbing code.

O. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

Q. Install aboveground ABS piping according to ASTM D 2661.

- R. Install aboveground PVC piping according to ASTM D 2665.
- S. Install underground PVC piping according to ASTM D 2321.
- T. Install engineered soil and waste drainage and vent piping systems as follows:
  - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
  - 2. Solvent Drainage System: Comply with ASSE 1043 and solvent fitting manufacturer's written installation instructions.
  - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- U. Plumbing Specialties:
  - 1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Section "Sanitary Waste Piping Specialties."
  - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section "Sanitary Waste Piping Specialties."
  - 3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section "Sanitary Waste Piping Specialties."
- V. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- W. Install sleeves for piping penetrations of walls, ceilings, and floors.
- X. Install sleeve seals for piping penetrations of concrete walls and slabs.
- Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

G. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

I. Plastic, Non-pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.

3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### 3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded non-pressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

- a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
- b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 Use dielectric flanges flange kits

### 3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Section "Ball Valves for Plumbing Piping", Section "Check Valves for Plumbing Piping," and Section "Gate Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

### 3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:
  - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
  - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
  - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

I. Install supports for vertical copper tubing every 10 feet.

J. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

K. Install supports for vertical PVC piping every 48 inches.

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

### 3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section "Identification for Plumbing Piping and Equipment."

### 3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.

### 3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and solvent stack fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Unshielded non-pressure transition couplings.

C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
5. Copper DWV tube, copper drainage fittings, and soldered joints.
  - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
6. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. Dissimilar Pipe-Material Couplings: Unshielded non-pressure transition couplings.

D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed calking materials; and calked joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
4. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION

SECTION 15151  
SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
1. Grease interceptors.
  2. Oil interceptors.
  3. Sand interceptors.

1.3 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.
- B. PP: Polypropylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.

1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:

1. Interceptors.
2. Piping connections. Include size, location, and elevation of each.
3. Interface with underground structures and utility services.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:

1. Notify Architect no fewer than five days in advance of proposed interruption of service.

2. Do not proceed with interruption of sewer services without Architect's written permission.

## PART 2 - PRODUCTS

### 2.1 GREASE INTERCEPTORS

A. Grease Interceptors: Precast concrete complying with ASTM C-94, ASTM C-478-97, AND ASTM-C789-00

1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.

2. Structural Design Loads:

a. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).

b. Walkway Load: Comply with ASTM C 890, A-03.

3. Resilient Pipe Connectors: ASTM C 923, cast or fitted into interceptor walls, for each pipe connection.

4. Steps: Individual FRP steps wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of interceptor to finished grade is less than 60 inches.

5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

6. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover.

a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.

b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.

c. Include indented top design with lettering cast into cover, using wording equivalent to "GREASE INTERCEPTOR".

B. Capacities and Characteristics:

1. Retention Capacity: 1 000 gallon

2. Inlet and Outlet Pipe Size: 4" NPS.

3. Trapped Outlet Required: No

4. Vent Pipe Size: 3" NPS.

5. Installation Position: Top flush with grade

### 2.2 Sand / OIL INTERCEPTORS

A. Precast concrete comply with ASTM C 913

1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.

2. Structural Design Loads:

a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10-44).

b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).

c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).

d. Walkway Load: Comply with ASTM C 890, A-03.

3. Resilient Pipe Connectors: ASTM C 923, cast or fitted into interceptor walls, for each pipe connection.

4. Steps: Individual FRP steps or FRP ladder, Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of interceptor to finished grade is less than 60 inches

5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

6. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover.

a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.

b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.

c. Include indented top design with lettering cast into cover, using wording equivalent to "SAND / OIL INTERCEPTOR".

7. Manufacturers: Subject to compliance with requirements, provide products by one of the following

a. Josam Company.

b. Georgia-lina precast

c. Parkson Corporation.

d. Rockford Sanitary Systems, Inc.

e. Schier Products Company.

f. Smith, Jay R. Mfg. Co.

g. Tyler Pipe, Inc.

h. Watts Water Technologies, Inc.

i. Zurn Plumbing Products Group; Zurn Specification Drainage Products.

8. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.

9. Extension: Cast-iron or steel shroud, full size of interceptor, extending from top of interceptor to grade.

10. Cover: Cast iron or steel, with steel reinforcement to provide ASTM C 890, A-03, walkway load.

B. Capacities and Characteristics:

1. Capacity: 750 gal. .
2. Inlet and Outlet Pipe Size: 4" NPS.
3. Waste-Oil-Outlet Pipe Size: 4" NPS.
4. Trapped Outlet Required No
5. Vent Pipe Size: 3"NPS.
6. Installation Position: Top flush with grade

### 2.3 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 02200.

### 2.4 INSTALLATION

A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.

B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

C. Set tops of manhole frames and covers flush with finished surface in pavements. Set tops 3 inches above finish surface elsewhere, unless otherwise indicated.

D. Set tops of grating frames and grates flush with finished surface.

### 2.5 CONNECTIONS

A. Piping installation requirements are specified in Section "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

### 2.6 IDENTIFICATION

A. Identification materials and installation are specified in Section 02200. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.

1. Use warning tapes or detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION

SECTION 15152  
FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure and pressure couplings.
3. Expansion joints and deflection fittings.
4. Backwater valves.
5. Cleanouts.
6. Encasement for piping.
7. Manholes.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Expansion joints and deflection fittings.
2. Backwater valves.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

C. Field quality-control reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

## PART 2 - PRODUCTS

### 2.1 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI-Trademark, Shielded Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ANACO-Husky.
- b. Dallas Specialty & Mfg. Co.
- c. Fernco Inc.
- d. Mission Rubber Company; a division of MCP Industries, Inc.
- e. Stant; a Tompkins company.
- f. Tyler Pipe.
- g. Charlotte pipe and foundry

2. Description: ASTM C 1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Cast-Iron, Shielded Couplings:

1. Description: ASTM C 1277 with ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

### 2.2 ABS PIPE AND FITTINGS

A. ABS Sewer Pipe and Fittings: ASTM D 2751, with bell-and-spigot ends for gasketed joints.

1. NPS 3 to NPS 6: SDR 35.
2. NPS 8 to NPS 12: SDR 42.

B. Gaskets: ASTM F 477, elastomeric seals.

### 2.3 PVC PIPE AND FITTINGS

A. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

B. PVC Pressure Piping:

1. Pipe: AWWA C900, Class 150 PVC pipe with bell-and-spigot ends for gasketed joints.

2. Fittings: AWWA C900, Class 150 PVC pipe with bell ends.

3. Gaskets: ASTM F 477, elastomeric seals.

C. PVC Water-Service Piping:

1. Pipe: ASTM D 1785, Schedule 40 and Schedule 80 PVC, with plain ends for solvent-cemented joints.

2. Fittings: ASTM D 2466, Schedule 40 and ASTM D 2467, Schedule 80 PVC, socket type.

D. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Concrete Pipes: ASTM C 443, rubber.
3. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
5. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

## 2.4 PRESSURE-TYPE PIPE COUPLINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cascade Waterworks Mfg.
2. Dresser, Inc.
3. Ford Meter Box Company, Inc. (The); Pipe Products Div.
4. JCM Industries, Inc.
5. Romac Industries, Inc.
6. Smith-Blair, Inc.; a Sensus company.
7. Victaulic Depend-O-Lok, Inc.
8. Viking Johnson.

B. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

C. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 150 psig minimum pressure rating and ends of same sizes as piping to be joined.

D. Center-Sleeve Material: Manufacturer's standard

E. Gasket Material: Natural or synthetic rubber.

F. Metal Component Finish: Corrosion-resistant coating or material.

G. Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Josam Company.
- b. Smith, Jay R. Mfg. Co.

- c. Watts Water Technologies, Inc.
- d. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

3. Top-Loading Classification(s): Heavy Duty

4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

#### H. PVC Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. IPS Corporation.
- b. NDS.
- c. Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
- d. Sioux Chief Manufacturing Company, Inc.
- e. Zurn Light Commercial Products Operation; Zurn Plumbing Products Group.

2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to clean out of same material as sewer piping.

### PART 3 - EXECUTION

#### 3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 02200.

#### 3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.

2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.

3. Install piping with 24-inch minimum cover.

4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

6. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.

7. Install PVC profile sewer piping according to ASTM D 2321 and ASTM F 1668.

8. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.

### 3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

4. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.

5. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.

6. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

7. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

a. Unshielded flexible or rigid couplings for pipes of same or slightly different OD.

b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.

c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure pipe couplings for force-main joints.

C. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

D. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

E. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

### 3.4 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section "Sanitary Waste and Vent Piping."

B. Connect to grease oil and sand interceptors specified in Section "Sanitary Waste Interceptors."

### 3.5 IDENTIFICATION

A. Comply with requirements in Section 02200 for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use warning tape or detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

### 3.6 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
  - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
  - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
  - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
  - d. Infiltration: Water leakage into piping.
  - e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
  - a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
  - b. Close openings in system and fill with water.
  - c. Purge air and refill with water.
  - d. Disconnect water supply.
  - e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

b. Option: Test concrete gravity sewer piping according to ASTM C 924.

C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### 3.7 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION

SECTION 15155  
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Condition, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Trench drains.
5. Channel drainage systems.
6. Air-admittance valves.
7. Roof flashing assemblies.
8. Through-penetration firestop assemblies.
9. Miscellaneous sanitary drainage piping specialties.
10. Flashing materials.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. FOG disposal systems.
2. Grease interceptors.
3. Grease removal devices.
4. Oil interceptors.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

## 1.6 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

## PART 2 - PRODUCTS

### 2.1 CLEANOUTS

#### A. Exposed Metal Cleanouts

##### 1. ASME A112.36.2M, Cast-Iron Cleanouts:

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

- 1) Josam Company.
- 2) Smith, Jay R. Mfg. Co.
- 3) Watts Drainage Products.
- 4) Zurn Plumbing Products Group.

#### B. Metal Floor Cleanouts

##### 1. ASME A112.36.2M, Cast-Iron Cleanouts:

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

- 1) Josam Company.
- 2) Oatey.
- 3) Sioux Chief Manufacturing Co., Inc.
- 4) Smith, Jay R. Mfg. Co.
- 5) Tyler Pipe.
- 6) Watts Drainage Products.
- 7) Zurn Plumbing Products Group.

#### C. Plastic Floor Cleanouts

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Canplas LLC.
- b. IPS Corporation.
- c. NDS Inc.
- d. Plastic Oddities.
- e. Sioux Chief Manufacturing Company, Inc.
- f. Zurn Plumbing Products Group; Light Commercial Operation.

2. Size: Same as connected branch.
3. Body: PVC.
4. Closure Plug: PVC.
5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

## 2.2 FLOOR DRAINS

### A. Cast-Iron Floor Drains

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Commercial Enameling Co.
- b. Josam Company; Josam Div.
- c. Smith, Jay R. Mfg. Co.
- d. Tyler Pipe; Wade Div.
- e. Watts Drainage Products.
- f. Zurn Plumbing Products Group;

2. Body Material: Gray iron
3. Seepage Flange: Not required
4. Anchor Flange: Not required
5. Clamping Device: Required.
6. Outlet: Bottom
7. Heavy Duty
8. Trap Pattern: Standard P-trap

### B. Plastic Floor Drains :

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Josam Company; Josam Div.
- b. Oatey.
- c. Sioux Chief Manufacturing Company, Inc.
- d. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASME A112.6.3.
3. Material: ABSPVC
4. Seepage Flange: Not required

5. Clamping Device: Required.
6. Outlet: Bottom
7. Sediment Bucket: Not required
8. Top or Strainer Material: Plastic
9. Top of Body and Strainer Finish: Nickel bronze
10. Top Shape: Round

## 2.3 TRENCH DRAINS

### A. Trench Drains

1. Manufacturers: Subject to compliance with requirements, provide products by the following::

- a. Josam Company; Josam Div.
- b. MIFAB, Inc.
- c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- d. Tyler Pipe; Wade Div.
- e. Watts Drainage Products Inc.
- f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3 for trench drains.
3. Material: Ductile or gray iron.
4. Flange: Anchor
5. Clamping Device: Required.
6. Outlet: Bottom.
7. Grate Material: cast iron.
8. Top Loading Classification: Heavy Duty

### B. Polymer-Concrete Channel Drainage Systems :

1. Narrow, Sloped-Invert, Polymer-Concrete Channel Drainage Systems:  
a. Manufacturers: Subject to compliance with requirements, provide products by the following:

- 1) ACO Polymer Products, Inc.
- 2) Josam Company.
- 3) Smith, Jay R. Mfg. Co.
- 4) Strongwell Corporation.

b. Channel Sections: Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps. Include rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.

1) Dimensions: 4-inch inside width. Include number of units required to form total lengths indicated.

2) Frame: cast iron].

c. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

1) Material: Ductile iron

2) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections

d. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.

e. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

f. Channel Sections: Narrow, interlocking-joint, precast, polymer-concrete modular units with end caps. Include rounded bottom, with level invert and with NPS 4 outlets in number and locations indicated.

## 2.4 AIR-ADMITTANCE VALVES

### A. Fixture Air-Admittance Valves

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Ayrlett, LLC.
- b. Durgo, Inc.
- c. Oatey.
- d. ProSet Systems Inc.
- e. RectorSeal.
- f. Studor, Inc.

2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.

3. Housing: Plastic.

4. Operation: Mechanical sealing diaphragm.

5. Size: Same as connected fixture or branch vent piping.

B. Wall Box Insert drawing designation if any:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Durgo, Inc.
- b. Oatey.
- c. RectorSeal.
- d. Studor, Inc.

2. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve. Valve box shall be easily accessible. If valve installed above ceiling, installation shall be easily accessible for maintenance.

## 2.5 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- [6.0-lb/sq. ft., 0.0938-inch thick, lead flashing collar and skirt extending at least [8 inches from pipe, with galvanized-steel boot reinforcement and counter flashing fitting.

- a. Open-Top Vent Cap: Without cap.
- b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
- c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

## 2.6 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies

1. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.

2. Size: Same as connected soil, waste, or vent stack.

3. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

4. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.

5. Special Coating: Corrosion resistant on interior of fittings.

## 2.7 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps

1. Description: Cast-iron or schedule 40 PVC, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

2. Size: Same as connected waste piping.

a. NPS 2: 4-inch- minimum water seal.

b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Floor-Drain, Trap-Seal Primer Fittings :

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

C. Air-Gap Fittings :

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

2. Body: Bronze or cast iron.

3. Inlet: Opening in top of body.

4. Outlet: Larger than inlet.

5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Sleeve Flashing Device :

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.

2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings

1. Description: Counter flashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

2. Size: Same as connected stack vent or vent stack.

F. Vent Caps

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.

2. Size: Same as connected stack vent or vent stack.

G. Frost-Resistant Vent Terminals

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.

2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counter flashing.

H. Expansion Joints

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

## 2.8 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft..
2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
- F. Install fixture air-admittance valves on fixture drain piping.
- G. Install stack air-admittance valves at top of stack vent and vent stack piping.
- H. Install air-admittance-valve wall boxes recessed in wall.
- I. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- J. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- K. Install through-penetration fire stop assemblies in plastic conductors and stacks at floor penetrations.

- L. Assemble open drain fittings and install with top of hub 1 inch above floor.
- M. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- N. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- O. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- P. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- Q. Install vent caps on each vent pipe passing through roof.
- R. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- S. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- T. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- U. Assemble components of FOG disposal systems and install on floor. Install trap, vent, fresh-air inlet, and flow-control fitting according to authorities having jurisdiction. Install shelf fastened to reinforcement in wall construction and adjacent to unit, unless otherwise indicated. Install culture bottle, culture metering pump, timer, and control on shelf. Install tubing between culture bottle, metering pump, and chamber.
- V. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
  - 1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
  - 2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
  - 3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
  - 4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

### 3.2 CONNECTIONS

- A. Comply with requirements in Section "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment in accordance with electrical specifications. See division 16.
- D. Connect wiring in accordance with electrical specifications. See division 16.

### 3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings.

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

### 3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION



SECTION 15181  
CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Condensate-drain piping.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver pipes and tubes with factory applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed. Stored piping shall be elevated above grade. Stored piping shall not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from dirt, debris, and moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Condensate drain piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Condensate-Drain Piping: 150 deg F.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L .

B. Copper or Bronze Pressure-Seal Fittings:

1. Housing: Copper.
2. O-Rings and Pipe Stops: EPDM.
3. Tools: Manufacturer's special tools.
4. Minimum 200-psig working-pressure rating at 250 deg F.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

## 2.3 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:

1. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

B. Plastic-to-Metal Transition Unions:

1. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

## 2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Description:
  - a. Standard: ASSE 1079.
  - b. Pressure Rating: 125 psig minimum at 180 deg F.
  - c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Description:

- a. Standard: ASSE 1079.
- b. Factory-fabricated, bolted, companion-flange assembly.
- c. Pressure Rating: 125 psig minimum at 180 deg F.
- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Description:
  - a. Nonconducting materials for field assembly of companion flanges.

- b. Pressure Rating: 150 psig.
- c. Gasket: Neoprene or phenolic.
- d. Bolt Sleeves: Phenolic or polyethylene.
- e. Washers: Phenolic with steel backing washers.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

A. Condensate-Drain Piping: Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

### 3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved by the engineer.

B. Install piping tight to slabs, beams, joists, columns, walls, and other building elements unless noted otherwise.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation plus 1-inch clearance around insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

M. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

N. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

- O. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- P. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install shutoff valve immediately upstream of each dielectric fitting.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for HVAC Piping."

### 3.3 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or flange kits.

### 3.4 HANGERS AND SUPPORTS

- A. Comply with requirements in Section "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.

5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### 3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

G. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

### 3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

### 3.7 CLEANING

A. Before installation of copper tubing, clean tubing and fittings with trichloroethylene.

END OF SECTION

SECTION 15183  
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.3 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:

1. Thermostatic expansion valves.
2. Solenoid valves.
3. Hot-gas bypass valves.
4. Filter dryers.
5. Strainers.
6. Pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

C. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control test reports.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

## 1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver pipes and tubes with factory applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed. Stored piping shall be elevated above grade. Stored piping shall not exceed structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from dirt, debris, and moisture.

## 1.9 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8.

E. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.

2. End Connections: Socket ends.

3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.

4. Pressure Rating: Factory test at minimum 500 psig.

5. Maximum Operating Temperature: 250 deg F.

## 2.2 VALVES AND SPECIALTIES

A. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.
8. Manual operator.

B. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat Disc: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig.
6. Maximum Operating Temperature: 240 deg F.

C. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: suitable for application.
6. Reverse-flow option (for heat-pump applications).
7. End Connections: Socket, flare, or threaded union.
8. Working Pressure Rating: Suitable for application.

D. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

- E. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
  2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
  3. Desiccant Media: Activated alumina or charcoal.
  4. Designed for reverse flow (for heat-pump applications).
  5. End Connections: Socket.
  6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
  7. Maximum Pressure Loss: 2 psig.
  8. Working Pressure Rating: 500 psig.
  9. Maximum Operating Temperature: 240 deg F.
- F. Receivers: Comply with ARI 495.
1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
  2. Comply with UL 207; listed and labeled by an NRTL.
  3. Body: Welded steel with corrosion-resistant coating.
  4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
  5. End Connections: Socket or threaded.
  6. Working Pressure Rating: 500 psig.
  7. Maximum Operating Temperature: 275 deg F.

## 2.3 REFRIGERANTS

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

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

B. Liquid Lines and Suction Lines for Heat-Pump Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.

### 3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

B. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.

2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.

3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

C. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

D. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

E. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

### 3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved by the engineer.

B. Verify final equipment locations before roughing in piping.

C. Install piping tight to slabs, beams, joists, columns, walls, and other building elements unless noted otherwise.

D. Install refrigerant piping according to ASHRAE 15.

E. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

H. Install piping adjacent to machines to allow service and maintenance.

- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Refer to Section "HVAC Instrumentation & Controls" and Section "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.
- M. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- N. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.
- O. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- P. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- Q. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- R. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:
  - 1. Shot blast the interior of piping.
  - 2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
  - 3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
  - 4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.

5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.
- S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for HVAC Piping."

### 3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.

2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Support multifloor vertical runs at least at each floor.

### 3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
  - a. Fill system with nitrogen to the required test pressure.
  - b. System shall maintain test pressure at the manifold gage throughout duration of test.
  - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

### 3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
  2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
  4. Charge system with a new filter-dryer core in charging line.

### 3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
1. Open shutoff valves in condenser water circuit.
  2. Verify that compressor oil level is correct.
  3. Open compressor suction and discharge valves.
  4. Open refrigerant valves except bypass valves that are used for other purposes.
  5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION



SECTION 15195  
FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Service meters.
7. Concrete bases.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Minimum Operating Pressure of Service Meter: 2 psig

B. Natural-Gas System Pressure within Buildings: 7" Water column.

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.

2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Service meters shall be provided by local gas utility and installation shall be where indicated on contract documents.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

#### 1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

C. Protect stored PE pipes and valves from direct sunlight.

#### 1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of natural-gas service.

2. Do not proceed with interruption of natural-gas service without Architect's written permission.

## 1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces.

## PART 2 - PRODUCTS

### 2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.

3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

a. Material Group: 1.1.

b. End Connections: Threaded or butt welding to match pipe.

c. Lapped Face: Not permitted underground.

d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.

e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

f. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

5. Mechanical Couplings:

a. Steel flanges and tube with epoxy finish.

b. Buna-nitrile seals.

c. Steel bolts, washers, and nuts.

d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

- a. OmegaFlex, Inc.
- b. Parker Hannifin Corporation; Parflex Division.
- c. Titeflex.
- d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.

3. Coating: PE with flame retardant.

a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- 1) Flame-Spread Index: 25 or less.
- 2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.

5. Striker Plates: Steel, designed to protect tubing from penetrations.

6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.

7. Operating-Pressure Rating: 5 psig.

C. Aluminum Tubing: Comply with ASTM B 210 and ASTM B 241/B 241M.

1. Aluminum Alloy: Alloy 5456 is prohibited.

2. Protective Coating: Factory-applied coating capable of resisting corrosion on tubing in contact with masonry, plaster, insulation, water, detergents, and sewerage.

3. Flare Fittings: Comply with ASME B16.26 and SAE J513.

- a. Copper-alloy fittings.
- b. Metal-to-metal compression seal without gasket.
- c. Dryseal threads shall comply with ASME B1.20.3.

D. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.

a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.

b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.

E. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.

2. Flare Fittings: Comply with ASME B16.26 and SAE J513.

a. Copper fittings with long nuts.

b. Metal-to-metal compression seal without gasket.

c. Dryseal threads complying with ASME B1.20.3.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

F. Tin-Lined Copper Tube: ASTM B 280, seamless, annealed, with interior tin-plated lining.

1. Flare Fittings: Comply with ASME B16.26 and SAE J513.

a. Copper fittings with long nuts.

b. Metal-to-metal compression seal without gasket.

c. Dryseal threads complying with ASME B1.20.3.

G. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.

2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.

b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.

c. Aboveground Portion: PE transition fitting.

d. Outlet shall be threaded or flanged or suitable for welded connection.

e. Tracer wire connection.

f. Ultraviolet shield.

g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Transition Service-Line Risers: Factory fabricated and leak tested.
  - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
  - b. Outlet shall be threaded or flanged or suitable for welded connection.
  - c. Bridging sleeve over mechanical coupling.
  - d. Factory-connected anode.
  - e. Tracer wire connection.
  - f. Ultraviolet shield.
  - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
  - h. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Lyall, R. W. & Company, Inc.
    - 2) Mueller Co.; Gas Products Div.
    - 3) Perfection Corporation; a subsidiary of American Meter Co.
  - i. PE body with molded-in, stainless-steel support ring.
  - j. Buna-nitrile seals.
  - k. Acetal collets.
  - l. Electro-zinc-plated steel stiffener.
5. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
  - a. Steel flanges and tube with epoxy finish.
  - b. Buna-nitrile seals.
  - c. Steel bolts, washers, and nuts.
  - d. Factory-installed anode for steel-body couplings installed underground.

## 2.2 PIPING SPECIALTIES

### A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

## 2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

## 2.4 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

- 1. CWP Rating: 125 psig
- 2. Threaded Ends: Comply with ASME B1.20.1.
- 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
- 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
- 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
- 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

- 1. CWP Rating: 125 psig
- 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
- 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
- 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. BrassCraft Manufacturing Company; a Masco company.
  - b. Conbraco Industries, Inc.; Apollo Div.
  - c. Lyall, R. W. & Company, Inc.
  - d. McDonald, A. Y. Mfg. Co.
  - e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. BrassCraft Manufacturing Company; a Masco company.
  - b. Conbraco Industries, Inc.; Apollo Div.
  - c. Lyall, R. W. & Company, Inc.
  - d. McDonald, A. Y. Mfg. Co.
  - e. Perfection Corporation; a subsidiary of American Meter Company.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

- a. BrassCraft Manufacturing Company; a Masco company.
- b. Conbraco Industries, Inc.; Apollo Div.
- c. Lyall, R. W. & Company, Inc.
- d. McDonald, A. Y. Mfg. Co.
- e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.

3. Ball: Chrome-plated bronze.

4. Stem: Bronze; blowout proof.

5. Seats: Reinforced TFE.

6. Packing: Threaded-body packnut design with adjustable-stem packing.

7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

8. CWP Rating: 600 psig.

9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.

10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. General Requirements:

1. Single stage and suitable for natural gas.

2. Steel jacket and corrosion-resistant components.

3. Elevation compensator.

4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

G. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Actaris.
- b. American Meter Company.
- c. Fisher Control Valves and Regulators; Div. of Emerson Process Management.
- d. Invensys.
- e. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig

H. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Actaris.
  - b. American Meter Company.
  - c. Eclipse Combustion, Inc.
  - d. Fisher Control Valves and Regulators; Div. of Emerson Process Management.
  - e. Invensys.
  - f. Maxitrol Company.
  - g. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

6. Orifice: Aluminum; interchangeable.
  7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
  8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
  9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
  10. Overpressure Protection Device: Factory mounted on pressure regulator.
  11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
  12. Maximum Inlet Pressure: 2 psig
- I. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Canadian Meter Company Inc.
    - b. Eaton Corporation; Controls Div.
    - c. Harper Wyman Co.
    - d. Maxitrol Company.
    - e. SCP, Inc.
  2. Body and Diaphragm Case: Die-cast aluminum.
  3. Springs: Zinc-plated steel; interchangeable.
  4. Diaphragm Plate: Zinc-plated steel.
  5. Seat Disc: Nitrile rubber.
  6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
  7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
  8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
  9. Maximum Inlet Pressure: 7" water column.

## 2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Capitol Manufacturing Company.
- b. Central Plastics Company.
- c. Hart Industries International, Inc.
- d. Jomar International Ltd.
- e. Matco-Norca, Inc.
- f. McDonald, A. Y. Mfg. Co.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- h. Wilkins; a Zurn company.

2. Description:

- a. Standard: ASSE 1079.
- b. Pressure Rating: 125 psig minimum at 180 deg F.
- c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Capitol Manufacturing Company.
- b. Central Plastics Company.
- c. Matco-Norca, Inc.
- d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- e. Wilkins; a Zurn company.

2. Description:

- a. Standard: ASSE 1079.
- b. Factory-fabricated, bolted, companion-flange assembly.
- c. Pressure Rating: 125 psig minimum at 180 deg F.
- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Advance Products & Systems, Inc.
- b. Calpico, Inc.
- c. Central Plastics Company.
- d. Pipeline Seal and Insulator, Inc.

2. Description:

- a. Nonconducting materials for field assembly of companion flanges.
- b. Pressure Rating: 150 psig

- c. Gasket: Neoprene or phenolic.
- d. Bolt Sleeves: Phenolic or polyethylene.
- e. Washers: Phenolic with steel backing washers.

## 2.6 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

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

### 3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

### 3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

3. Replace pipe having damaged PE coating with new pipe.
- E. Copper Tubing with Protective Coating:
1. Apply joint cover kits over tubing to cover, seal, and protect joints.
  2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
- F. Install fittings for changes in direction and branch connections.

### 3.4 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.

2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.

3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.

4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.

b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for Plumbing Piping."

### 3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

### 3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.

2. Cut threads full and clean using sharp dies.

3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.

4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.

2. Bevel plain ends of steel pipe.
  3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Braze Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
  2. Plain-End Pipe and Socket Fittings: Use socket fusion.

### 3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 1 and Smaller: Maximum span, 96"; minimum rod size, 3/8".
  2. NPS 1-1/4: Maximum span, 108"; minimum rod size, 3/8".
  3. NPS 1-1/2 and NPS 2: Maximum span, 108"; minimum rod size, 3/8".
  4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 ft.; minimum rod size, 1/2".
  5. NPS 4 and Larger: Maximum span, 10 ft.; minimum rod size, 5/8".
- C. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
1. NPS 3/8: Maximum span, 48"; minimum rod size, 3/8".
  2. NPS 1/2 and NPS 5/8: Maximum span, 72"; minimum rod size, 3/8".
  3. NPS 3/4 and NPS 7/8: Maximum span, 84"; minimum rod size, 3/8".
  4. NPS 1: Maximum span, 96"; minimum rod size, 3/8".
- D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
1. NPS 3/8: Maximum span, 48"; minimum rod size, 3/8".
  2. NPS 1/2: Maximum span, 72"; minimum rod size, 3/8".
  3. NPS 3/4 and Larger: Maximum span, 96"; minimum rod size, 3/8".

### 3.8 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

### 3.9 LABELING AND IDENTIFYING

- A. Comply with requirements in Section "Identification for Plumbing Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.10 PAINTING

- A. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.

- 1. Alkyd System: MPI EXT 5.1D.
  - a. Prime Coat: Alkyd anticorrosive metal primer.
  - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
  - c. Topcoat: Exterior alkyd enamel flat.
  - d. Color: Gray

- B. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

- 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
  - a. Prime Coat: Quick-drying alkyd metal primer.
  - b. Intermediate Coat: Interior latex matching topcoat.
  - c. Topcoat: Interior latex flat
  - d. Color: Gray
- 2. Alkyd System: MPI INT 5.1E.
  - a. Prime Coat: Quick-drying alkyd metal primer.
  - b. Intermediate Coat: Interior alkyd matching topcoat.
  - c. Topcoat: Interior alkyd flat
  - d. Color: Gray

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

### 3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

### 3.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

B. Aboveground natural-gas piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Annealed temper copper tube with wrought-copper fittings and brazed joints.

C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and flared joints. Install piping embedded in concrete with no joints in concrete.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

### 3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
3. Annealed-temper, copper tube with wrought-copper fittings and flared joints.
4. Aluminum tube with flared fittings and joints.
5. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

### 3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
3. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
4. Aluminum tube with flared fittings and joints.
5. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with steel welding fittings and welded joints.
3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

### 3.15 MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

1. Two-piece, full port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, non-lubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, fullport, bronze ball valves with bronze trim.
3. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Two-piece, full port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, plug valve.

E. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, fullport, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION



SECTION 15416  
COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets Floor mounted, bottom outlet, top spud.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Standard America.
- b. Briggs Plumbing Products, Inc.
- c. Crane Plumbing, L.L.C.

- d. Kohler Co.
- e. Mansfield Plumbing Products LLC.
- f. Peerless Pottery Sales, Inc.
- g. TOTO USA, INC.
- h. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Bowl:

- a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
- b. Material: Vitreous china.
- c. Type: Siphon jet.
- d. Style: Flushometer valve.
- e. Rim Contour: Elongated.
- f. Water Consumption: 1.28 gal. per flush.
- g. Spud Size and Location: NPS 1-1/2; top.
- h. Color: White

## 2.2 FLUSHOMETER VALVES

### A. Lever-Handle, Diaphragm Flushometer Valves

1. Manufacturers: Subject to compliance with requirements, provide products by the following :

- a. Coyne & Delany Co.
- b. Gerber Plumbing Fixtures LLC.
- c. Sloan Valve Company.
- d. Zurn Industries, LLC; Commercial Brass and Fixtures.

- 2. Standard: ASSE 1037.
- 3. Minimum Pressure Rating: 125 psig.
- 4. Features: Include integral check stop and backflow-prevention device.
- 5. Material: Brass body with corrosion-resistant components.
- 6. Exposed Flushometer-Valve Finish: Chrome plated.
- 7. Panel Finish: Chrome plated or stainless steel.
- 8. Style: Exposed
- 9. Consumption: 1.28 gal. per flush.
- 10. Minimum Inlet: NPS 1.
- 11. Minimum Outlet: NPS 1-1/4.

## 2.3 TOILET SEATS

### A. Toilet Seats

1. Manufacturers: Subject to compliance with requirements, provide
  - a. American Standard America.
  - b. Bemis Manufacturing Company.
  - c. Church Seats.
  - d. Kohler Co.
  - e. Olsonite Seat Co.
  - f. TOTO USA, INC.
  - g. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial open front
5. Hinge: Self-sustaining
6. Color: White

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Water-Closet Installation:
  1. Install level and plumb according to roughing-in drawings.
  2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
  3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- B. Support Installation:
  1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
  2. Use carrier supports with waste-fitting assembly and seal.

3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.

4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.

2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.

3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.

4. Install actuators in locations that are easy for people with disabilities to reach.

5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.

2. Install deep-pattern escutcheons if required to conceal protruding fittings.

3. Comply with escutcheon requirements specified in Section "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.

2. Match sealant color to water-closet color.

3. Comply with sealant requirements specified in Section 07900.

### 3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

### 3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

### 3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION



SECTION 15417  
COMMERCIAL URINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Urinals.
2. Flushometer valves.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

1. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.

B. Urinals: Wall hung, bottom outlet, washout.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Standard America.
- b. Briggs Plumbing Products, Inc.
- c. Ferguson Enterprises, Inc.; ProFlo Brand.
- d. Kohler Co.
- e. Mansfield Plumbing Products LLC.
- f. Peerless Pottery Sales, Inc.

2. Fixture:

- a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
- b. Material: Vitreous china.
- c. Drain: Separate removable chrome-plated dome strainer with chrome-plated, NPS 1-1/2 tailpiece.
- d. Strainer or Trapway: Manufacturer's standard strainer and NPS 1-1/2 tailpiece.
- e. Design Consumption: Water saving
- f. Inlet Spud Size and Location: NPS 3/4; top.
- g. Outlet Size and Location: NPS 1-1/2; bottom.
- h. Color: White

3. Waste Fitting:

- a. Standard: ASME A112.18.2/CSA B125.2.
- b. Trap:
  - 1) Size: NPS 1-1/2.
  - 2) Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch- thick brass tube to wall..
  - 3) Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

- 4. Support: ASME A112.6.1M, Type II, urinal carrier with hanger and bearing plates

## 2.2 URINAL FLUSHOMETER VALVES

### A. Lever-Handle, Diaphragm Flushometer Valves

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Coyne & Delany Co.
- b. Gerber Plumbing Fixtures LLC.
- c. Sloan Valve Company.
- d. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Consumption: 1.0 gal per flush.
10. Minimum Inlet: NPS 3/4

### 2.3 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 2.4 INSTALLATION

- A. Urinal Installation:
  1. Install urinals level and plumb according to roughing-in drawings.
  2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
  3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
  4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
  5. Install trap-seal liquid in waterless urinals.
- B. Support Installation:
  1. Install supports, affixed to building substrate, for wall-hung urinals.
  2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
  3. Use carriers without waste fitting for urinals with tubular waste piping.
  4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

- C. Flushometer-Valve Installation:
  - 1. Install flushometer-valve water-supply fitting on each supply to each urinal.
  - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
  - 3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
  - 4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- D. Wall Flange and Escutcheon Installation:
  - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
  - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
  - 3. Comply with escutcheon requirements specified in Section "Escutcheons for Plumbing Piping."
- E. Joint Sealing:
  - 1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
  - 2. Match sealant color to urinal color.
  - 3. Comply with sealant requirements specified in Section 07900.

## 2.5 CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

## 2.6 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

## 2.7 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION



SECTION 15421  
COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

B. Related Requirements:

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory Rectangular, self-rimming, vitreous china, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Standard America.
- b. Crane Plumbing, L.L.C.
- c. Kohler Co.
- d. TOTO USA, INC.

2. Fixture:
    - a. Standard: ASME A112.19.2/CSA B45.1.
    - b. Type: Self-rimming for above-counter mounting.
    - c. Nominal Size: Rectangular, 21 by 19 inches coordinate exact dimensions with that of architectural drawings.
    - d. Faucet-Hole Punching: One hole
    - e. Faucet-Hole Location: Top.
    - f. Color: White
    - g. Mounting Material: Sealant.
  3. Faucet: Solid-Brass, Manually Operated Faucets
- B. Lavatory Oval self-rimming, vitreous china, counter mounted.
1. Manufacturers: Subject to compliance with requirements, provide products by the following
    - a. American Standard America.
    - b. Briggs Plumbing Products, Inc.
    - c. Capizzi.
    - d. Crane Plumbing, L.L.C.
    - e. Kohler Co.
    - f. Mansfield Plumbing Products LLC.
    - g. Peerless Pottery Sales, Inc.
    - h. TOTO USA, INC.
    - i. Zurn Industries, LLC; Commercial Brass and Fixtures.
  2. Faucet: Solid-Brass, Manually Operated Faucet

## 2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Lavatory Vitreous china, wall mounted, with back.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. American Standard America.
    - b. Briggs Plumbing Products, Inc.
    - c. Crane Plumbing, L.L.C.
    - d. Kohler Co.
    - e. Mansfield Plumbing Products LLC.
    - f. Peerless Pottery Sales, Inc.
    - g. Zurn Industries, LLC; Commercial Brass and Fixtures.

- Faucets
2. Fixture:
    - a. Standard: ASME A112.19.2/CSA B45.1.
    - b. Type: For wall hanging.
    - c. Nominal Size: Oval, 19 by 16 inches
    - d. Faucet-Hole Punching: One hole
    - e. Faucet-Hole Location: Top.
    - f. Color: White
    - g. Mounting Material: Chair carrier.
  3. Faucet: Insert lavatory faucet designation Solid-Brass, Manually Operated
  4. Support: ASME A112.6.1M,
  5. Type I, exposed-arm lavatory carrier

B. Lavatory : Ledge back, vitreous china, wall mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Standard America.
- b. Briggs Plumbing Products, Inc.
- c. Crane Plumbing, L.L.C.
- d. Ferguson Enterprises, Inc.; ProFlo Brand.
- e. Gerber Plumbing Fixtures LLC.
- f. Kohler Co.
- g. Mansfield Plumbing Products LLC.
- h. Peerless Pottery Sales, Inc.

2. Fixture:
  - a. Standard: ASME A112.19.2/CSA B45.1.
  - b. Type: For wall hanging.
  - c. Nominal Size: Oval, 19 by 16 inches .
  - d. Faucet-Hole Punching: One hole
  - e. Faucet-Hole Location: Top.
  - f. Color: White
  - g. Mounting Material: Chair carrier.
3. Faucet: Solid-Brass, Manually Operated
4. Support: ASME A112.6.1M, Type I, exposed-arm lavatory carrier

### 2.3 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets Manual-type, single-control mixing.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Standard America.
- b. Bradley Corporation.
- c. Chicago Faucets.
- d. Delta Faucet Company.
- e. Elkay Manufacturing Co.
- f. Grohe America, Inc.
- g. Just Manufacturing.
- h. Kohler Co.
- i. Moen Incorporated.
- j. Speakman Company.
- k. T & S Brass and Bronze Works, Inc.
- l. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: ASME A112.18.1/CSA B125.1.

3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.

4. Body Type: Single hole

5. Body Material: Commercial, solid brass.

6. Finish: Polished chrome plate

7. Maximum Flow Rate: 0.5 gpm

8. Mounting Type: Deck, exposed Spout: Rigid type.

9. Spout Outlet: Aerator

10. Operation: Compression, manual

11. Drain: Not part of faucet

## 2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle

- F. Risers:
  - 1. NPS 3/8.
  - 2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces

## 2.5 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/2 by NPS 1-1/4
  - 2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall and chrome-plated, brass or steel wall flange.
  - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07900.

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section "Plumbing Piping Insulation."

### 3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

### 3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

### 3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 15422  
COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Service sinks.
2. Supply fittings.
3. Waste fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins Terrazzo, floor mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Acorn Engineering Company.
- b. Crane Plumbing, L.L.C.
- c. Florestone Products Co., Inc.
- d. Stern-Williams Co., Inc.
- e. Powers Fiat

2. Fixture:

- a. Standard: IAPMO PS 99.
- b. Shape Rectangular
- c. Nominal Size: 24 by 24 inches
- d. Height: 6 inches
- e. Tiling Flange: Not required
- f. Drain: Grid with NPS 3 outlet.

3. Mounting: On floor and flush to wall.

4. Faucet: wall mounted with integral vacuum breaker.

5. Copy "Service Sinks" Paragraph below and re-edit for each type of vitreous-china, trap-standard-mounted service sink required.

## 2.2 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets : Manual type, two-lever-handle mixing valve.

1. Commercial, Solid-Brass Faucets.

a. Manufacturers: Subject to compliance with requirements,

- 1) American Standard America.
- 2) Bradley Corporation.
- 3) Chicago Faucets.
- 4) Delta Faucet Company.
- 5) Elkay Manufacturing Co.
- 6) Just Manufacturing.
- 7) Kohler Co.
- 8) Moen Incorporated.
- 9) Speakman Company.
- 10) T & S Brass and Bronze Works, Inc.
- 11) Zurn Plumbing Products Group.
- 12) Powers fiat

## 2.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

#### 2.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

#### 2.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION



SECTION 15423  
COMMERCIAL SHOWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes shower faucets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers

2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower faucets to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 INDIVIDUAL SHOWERS

A. Individual FRP Showers

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

2.2 SHOWER FAUCETS

A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.

B. Shower Faucets

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. American Standard America.
- b. Chicago Faucets.
- c. Kohler Co.
- d. Lawler Manufacturing Co., Inc.
- e. Leonard Valve Company.
- f. Matco-Norca.
- g. Moen Incorporated.
- h. Powers; a division of Watts Water Technologies, Inc.
- i. Speakman Company.
- j. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.

2. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.

3. Faucet:

- a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
- b. Body Material: Solid brass.
- c. Finish: Polished chrome plate.
- d. Maximum Flow Rate: 2.5 gpm unless otherwise indicated.
- e. Mounting: Concealed
- f. Operation: Single-handle, twist or rotate control.
- g. Antiscald Device: integral with mixing valve
- h. Check Stops: Check-valve type, integral with or attached to body;

on hot- and cold-water supply connections.

4. Supply Connections: NPS 1/2.

5. Shower Head:

- a. Standard: ASME A112.18.1/CSA B125.1.
- b. Type: Ball joint with arm and flange
- c. Shower Head Material: Metallic with chrome-plated finish.
- d. Spray Pattern: Adjustable
- e. Integral Volume Control: Required.
- f. Shower-Arm, Flow-Control Fitting 1.5 gpm

C. Shower Faucets

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Chicago Faucets.
- b. Lawler Manufacturing Co., Inc.
- c. Leonard Valve Company.
- d. Powers; a division of Watts Water Technologies, Inc.
- e. Delta
- f. Sloan
- g. Kohler
- h. American standard

2. Description: Single-handle, thermostatic mixing valve with hot- and cold-water indicators; check stops; and shower head.

3. Faucet:

- a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
- b. Body Material: Solid brass.
- c. Finish: Polished chrome plate.
- d. Maximum Flow Rate: 2.5 gpm
- e. Mounting: Concealed
- f. Operation: Single-handle, twist or rotate control.
- g. Antiscald Device: Integral with mixing valve
- h. Check Stops: Check-valve type, integral with or attached to body;

on hot- and cold-water supply connections.

4. Supply Connections: NPS 1/2.

5. Shower Head:

- a. Standard: ASME A112.18.1/CSA B125.1.
- b. Type: Ball joint with arm and flange
- c. Shower Head Material: Metallic with chrome-plated finish.
- d. Spray Pattern: Adjustable
- e. Integral Volume Control: Not required
- f. Shower-Arm, Flow-Control Fitting: 1.5 gpm

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.

B. Examine walls and floors for suitable conditions where showers will be installed.

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

### 3.2 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions.

B. Install showers level and plumb according to roughing-in drawings.

C. Install water-supply piping with stop on each supply to each shower faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with shower. Comply with valve requirements specified in Section "Ball Valves for Plumbing Piping" and Section "Gate Valves for Plumbing Piping."

2. Install stops in locations where they can be easily reached for operation.

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section "Escutcheons for Plumbing Piping."

F. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07900.

### 3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Comply with traps and soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

### 3.4 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

### 3.5 CLEANING AND PROTECTION

A. After completing installation of showers inspect and repair damaged finishes.

B. Clean shower faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of showers for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 15427  
PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes pressure water coolers and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Equal to 10 percent of quantity installed for each type and size indicated, but no fewer than 2.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers Flush to wall.

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Elkay Manufacturing Co.
- b. Halsey Taylor.
- c. acorn.

2. Standards:

- a. Comply with NSF 61.
- b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

3. Cabinet: All stainless steel

4. Bubbler: One, with adjustable stream regulator, located on deck.
5. Control: Push button
6. Drain: Grid with NPS 1-1/4 tailpiece.
7. Supply: NPS 3/8 with shutoff valve.
8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards, with capacity sized for unit peak flow rate.
10. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

11. Capacities and Characteristics:

- a. Cooled Water: 8 gph
- b. Ambient-Air Temperature: 90 deg F.
- c. Inlet-Water Temperature: 80 deg F.
- d. Cooled-Water Temperature: 50 deg F.
- e. Electrical Characteristics:
  - 1) Volts: 120-V ac.
  - 2) Phase: Single.
  - 3) Hertz: 60.

B. Pressure Water Coolers Wall mounted standard wheelchair accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by the following

- a. Elkay Manufacturing Co.
- b. Halsey Taylor.
- c. Acorn

2. Cabinet: Single
3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
4. Control: Push button or Push bar
5. Drain: Grid with NPS 1-1/4 tailpiece.
6. Supply: NPS 3/8 with shutoff valve.
7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.

8. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.

9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

10. Capacities and Characteristics:

- a. Cooled Water: 8 gph
- b. Ambient-Air Temperature: 90 deg F.
- c. Inlet-Water Temperature: 80 deg F.
- d. Cooled-Water Temperature: 50 deg F.
- e. Electrical Characteristics:
  - 1) Volts: 120-V ac.
  - 2) Phase: Single.
  - 3) Hertz: 60.

11. Support: ASME A112.6.1M, Type I water-cooler carrier.

C. Pressure Water Coolers standard wheelchair accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Elkay Manufacturing Co.
- b. Halsey Taylor.
- c. acorn

2. Standards:

a. Comply with NSF 61.

b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

c. Comply with ICC A117.1.

3. Cabinet: All stainless steel

4. Bubbler: One, with adjustable stream regulator, located on deck.

5. Control: Push button

6. Drain: Grid with NPS 1-1/4 tailpiece.

7. Supply: NPS 3/8 with shutoff valve.

8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
10. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
  - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

11. Capacities and Characteristics:

- a. Cooled Water: 8 gph
- b. Ambient-Air Temperature: 90 deg F.
- c. Inlet-Water Temperature: 80 deg F.
- d. Cooled-Water Temperature: 50 deg F.
  - 1) Volts: 120-V ac.
  - 2) Phase: Single.
  - 3) Hertz: 60.

12. Support: Mounting frame or brackets for attaching to substrate.

D. Pressure Water Coolers Recessed.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Elkay Manufacturing Co.
- b. Halsey Taylor.
- c. Acorn

2. Standards:

- a. Comply with NSF 61.
- b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

3. Cabinet: All stainless steel.

4. Bubbler: One, with adjustable stream regulator, located on deck.

5. Control: Push button

6. Drain: Grid with NPS 1-1/4 tailpiece.

7. Supply: NPS 3/8 with shutoff valve.

8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
10. Cooling System: Electric, hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
  - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Capacities and Characteristics:
  - a. Cooled Water: 8 gph
  - b. Ambient-Air Temperature: 90 deg F.
  - c. Inlet-Water Temperature: 80 deg F
  - d. Cooled-Water Temperature: 50 deg F.
  - e. Electrical Characteristics:
    - 1) Volts: 120-V ac.
    - 2) Phase: Single.
    - 3) Hertz: 60.
12. Ventilation Grille: Stainless steel, located below water cooler.
13. Support: Mounting frame for attaching to substrate.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Set freestanding pressure water coolers on floor.
- C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- D. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers to mounting frames.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section "Ball Valves for Plumbing Piping" and Section "Gate Valves for Plumbing Piping."

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section "Escutcheons for Plumbing Piping."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07900.

### 3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section "Ball Valves for Plumbing Piping" and Section "Gate Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section "Sanitary Waste and Vent Piping."

### 3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

### 3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 15485  
ELECTRIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Commercial, electric, domestic-water booster heaters.
2. Commercial, electric, storage, domestic-water heaters.
3. Commercial, light-duty, storage, electric, domestic-water heaters.
4. Residential, collector-to-tank, solar, electric, domestic-water heaters.
5. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Product Certificates: For each type of commercial electric, domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

## 1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

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

- a. Structural failures including storage tank and supports.
- b. Faulty operation of controls.
- c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Electric, Domestic-Water Booster Heaters:

1) Controls and Other Components: Five years.

b. Commercial, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.

2) Controls and Other Components: Three years.

c. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1) Storage Tank: Five years.

2) Controls and Other Components: Three years.

## PART 2 - PRODUCTS

### 2.1 COMMERCIAL, ELECTRIC, domestic-WATER HEATERS

A. Commercial, Electric, Domestic-Water Booster Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bradford White Corporation.

b. Coates Heater Company, Inc.

c. Electric Heater Company (The).

d. Hatco Corporation.

e. HESco Industries, Inc.

f. Lochinvar Corporation.

g. Rheem Manufacturing Company.

h. Smith, A. O. Water Products Co.; a division of A. O. Smith Corp.

2. Standard: UL 1453.
3. Tank Construction: Corrosion-resistant metal
  - a. Tappings: ASME B1.20.1 pipe thread.
  - b. Pressure Rating: 150 psig.
  - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
4. Factory-Installed Tank Appurtenances:
  - a. Anode Rod: Replaceable magnesium.
  - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
  - c. Insulation: Comply with ASHRAE/IESNA 90.1.
  - d. Jacket: Rectangular shaped, with stainless-steel front panel, unless otherwise indicated.
  - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
    - 1) Option: Booster heaters with total of 9 kW or less may have two or three elements.
  - f. Temperature Control: Adjustable thermostat, to setting of at least 180 F.
  - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
  - h. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valve. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
  - i. Gages: Combination temperature-and-pressure type or separate thermometer and pressure gage.

B. Commercial, Electric, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Bradford White Corporation.
  - b. Cemline Corporation.
  - c. Electric Heater Company (The).
  - d. GSW Water Heating.
  - e. HESco Industries, Inc.
  - f. Lochinvar Corporation.
  - g. Precision Boilers, Inc.
  - h. PVI Industries, LLC.
  - i. Rheem Manufacturing Company.
  - j. Smith, A. O. Water Products Co.; a division of A. O. Smith Corp.
  - k. State Industries.

2. Standard: UL 1453.
  3. Storage-Tank Construction: ASME-code, steel vertical arrangement.
    - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
      - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
    - b. Pressure Rating: 150 psig
    - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
  4. Factory-Installed Storage-Tank Appurtenances:
    - a. Anode Rod: Replaceable magnesium.
    - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    - c. Insulation: Comply with ASHRAE/IESNA 90.1.
    - d. Jacket: Steel with enameled finish.
    - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
    - f. Temperature Control: Adjustable thermostat.
    - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
    - h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
  5. Special Requirements: NSF 5 construction.
- C. Capacity and Characteristics:
1. Capacity: 120 gal. .
  2. Recovery: 100 deg F rise.
  3. Temperature Setting: 110 deg F
  4. Heating Elements:
    - a. Number of Elements: One
    - b. Kilowatts Each Element: 4.5kw.

5. Electrical Characteristics: Coordinate all electrical requirements with that of electrical drawings.

D. Residential, Collector-to-Tank, Solar, Electric, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

- a. Alternate Energy Technologies, LLC.
- b. American Water Heaters.
- c. Bradford White Corporation.
- d. Lochinvar Corporation.
- e. Rheem Manufacturing Company.

2. Standard: UL 174 with piping and electrical connections for UL 1279 solar collector system.

3. Storage-Tank Construction: Steel.

- a. Tappings: ASME B1.20.1 pipe thread.
- b. Pressure Rating: 150 psig.
- c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Water Heaters.
- b. Bradford White Corporation.
- c. Electric Heater Company (The).
- d. GSW Water Heating.
- e. Heat Transfer Products, Inc.
- f. HESco Industries, Inc.
- g. Lochinvar Corporation.
- h. Rheem Manufacturing Company.
- i. Smith, A. O. Water Products Co.; a division of A. O. Smith Corp.
- j. State Industries.
- k. Vaughn Manufacturing Corporation.

5. Standard: UL 174.

E. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

F. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

G. Heat-Trap Fittings: ASHRAE 90.2.

H. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and memory-stop balancing valves to provide balanced flow through each domestic-water heater.

1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section "Ball Valves for Plumbing Piping" and Section "Gate Valves for Plumbing Piping."

2. Comply with requirements for balancing valves specified in Section "Domestic Water Piping Specialties."

I. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- maximum outlet pressure unless otherwise indicated.

J. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

K. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

L. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

M. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

N. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

O. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

## 2.2 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases.

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.

2. Maintain manufacturer's recommended clearances.

3. Arrange units so controls and devices that require servicing are accessible.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Install anchor bolts to elevations required for proper attachment to supported equipment.

8. Anchor domestic-water heaters to substrate.

B. Comply with requirements for piping specified in Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

C. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### 3.2 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section "Identification for Plumbing Piping and Equipment."

### 3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

#### 3.4 DEMONSTRATION

A. Owner's maintenance personnel to adjust, operate, and maintain commercial electric, domestic-water heaters.

END OF SECTION

SECTION 15486  
FUEL-FIRED WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Commercial, atmospheric, gas-fired, storage, domestic-water heaters.
2. Commercial, gas-fired domestic-water heaters.
3. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Product Certificates: For each type of commercial, gas-fired domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

## 1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

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

- a. Structural failures including storage tank and supports.
- b. Faulty operation of controls.
- c. Deterioration of metals, metal finishes, and other materials beyond

normal use.

2. Warranty Periods: From date of Substantial Completion.

- a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
  - 1) Controls and Other Components: Two year(s).
- b. Gas-Fired, Tankless, Domestic-Water Heaters:
  - 1) Heat Exchanger: Five years.
  - 2) Controls and Other Components: Three years.

## PART 2 - PRODUCTS

### 2.1 COMMERCIAL, GAS-Fired, STORAGE, domestic-WATER HEATERS

A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Bradford White Corporation.
- b. Lochinvar Corporation.
- c. PVI Industries, LLC.
- d. RECO USA.

- e. Rheem Manufacturing Company.
  - f. Smith, A. O. Water Products Co.; a division of A. O. Smith Corp.
  - g. State Industries.
2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
- a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
    - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
    - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
  - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
  - c. Lining: Glass complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
4. Factory-Installed Storage-Tank Appurtenances:
- a. Anode Rod: Replaceable magnesium.
  - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
  - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
  - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
  - e. Jacket: Steel with enameled finish.
  - f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
  - g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
  - h. Temperature Control: Adjustable thermostat.
  - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
  - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

## 2.2 GAS-FIRED, TANKLESS, domestic-WATER HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

1. Bosch Water Heating.
2. Bradford White Corporation.
3. NORITZ America Corp.
4. Rheem Manufacturing Company; Rheem Water Heating.
5. Rinnai Corporation.
6. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
7. State Industries.

B. Standard: ANSI Z21.10.3/CSA 4.3 for gas-fired, instantaneous, domestic-water heaters for indoor application.

C. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.

1. Tappings: ASME B1.20.1 pipe thread.
2. Pressure Rating: 150 psig.
3. Heat Exchanger: Copper tubing.
4. Insulation: Comply with ASHRAE/IESNA 90.1
5. Jacket: Metal, with enameled finish, or plastic.
6. Burner: For use with tankless, domestic-water heaters and natural-gas fuel.
7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
8. Temperature Control: Adjustable thermostat.

D. Support: Bracket for wall mounting.

E. Capacity and Characteristics:

1. Temperature Setting: 110 deg F.
2. Fuel Gas Demand: 199 cfh.
3. Gas Pressure Regulator:
  - a. Inlet Pressure: 7 inches water column.
4. Electrical Characteristics:
5. Coordinate all electrical with electrical drawings. Minimum Vent Diameter: 4".

## 2.3 Domestic-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

- a. AMTROL Inc.
- b. Flexcon Industries.
- c. Honeywell International Inc.
- d. Pentair Pump Group (The); Myers.
- e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corp.

- f. State Industries.
- g. Taco, Inc.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.

b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig

b. Capacity Acceptable: 4 gal minimum.

c. Air Pre-charge Pressure: 85 psi

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.

F. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section "Ball Valves for Plumbing Piping" and Section "Gate Valves for Plumbing Piping."

1. Comply with requirements for balancing valves specified in Section "Domestic Water Piping Specialties."

G. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

H. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

I. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

J. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

K. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

L. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

M. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

N. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

## 2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base.

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.

2. Maintain manufacturer's recommended clearances.

3. Arrange units so controls and devices that require servicing are accessible.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Install anchor bolts to elevations required for proper attachment to supported equipment.

8. Anchor domestic-water heaters to substrate.

B. Residential, Domestic-Water Heater Mounting: Install residential domestic-water heaters on floor

1. Maintain manufacturer's recommended clearances.

2. Arrange units so controls and devices that require servicing are accessible.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

5. Anchor domestic-water heaters to substrate.

C. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 18 inches above floor on wall bracket.

1. Maintain manufacturer's recommended clearances.

2. Arrange units so controls and devices that require servicing are accessible.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

5. Anchor domestic-water heaters to substrate.

D. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section "Ball Valves for Plumbing Piping" and Section "Gate Valves for Plumbing Piping."

- E. Install gas-fired, domestic-water heaters according to NFPA 54.
  - 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
  - 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
  - 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
  - 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves.
- F. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- G. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- H. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section "Domestic Water Piping Specialties."
- I. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section "Meters and Gages for Plumbing Piping."
- J. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section "Ball Valves for Plumbing Piping" and Section "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section "Meters and Gages for Plumbing Piping."
- K. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- L. Fill domestic-water heaters with water.
- M. Charge domestic-water compression tanks with air.

### 3.2 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Section "Domestic Water Piping."

B. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### 3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section "Identification for Plumbing Piping and Equipment."

### 3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

### 3.5 DEMONSTRATION

A. Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, gas-fired, tankless domestic-water heaters.

END OF SECTION



SECTION 15530  
FURNACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Gas-fired, condensing furnaces and accessories complete with controls.
2. Air filters.
3. Refrigeration components.

1.3 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each of the following:

1. Furnace.
2. Air filter.
3. Refrigeration components.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals for each of the following:

1. Furnace and accessories complete with controls.
2. Air filter.
3. Refrigeration components.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. Comply with NFPA 70.

## 1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

## 1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

1. Warranty Period, Commencing on Date of Substantial Completion:
  - a. Furnace Heat Exchanger: 10 years.

## PART 2 - PRODUCTS

### 2.1 GAS-FIRED FURNACES, CONDENSING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Corporation; Div. of United Technologies Corp.
2. Lennox Industries Inc.
3. Rheem Manufacturing Company; Air Conditioning Division.
4. Trane.
5. York International Corp.; a division of Unitary Products Group.

B. General Requirements for Gas-Fired, Condensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.

C. Cabinet: Steel.

1. Cabinet interior around heat exchanger shall be factory-installed insulation.

2. Lift-out panels shall expose burners and all other items requiring access for maintenance.

3. Factory paint external cabinets in manufacturer's standard color.

4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.

1. Fan Motors: Comply with requirements in "Common Motor Requirements for HVAC Equipment."

2. Special Motor Features: Single speed, Premium (TM) efficiency, as defined in Section 15058 "Common Motor Requirements for HVAC Equipment," and with internal thermal protection and permanent lubrication.

3. Special Motor Features: Multi-tapped, multispeed with internal thermal protection and permanent lubrication.

4. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control.

E. Type of Gas: Natural.

F. Heat Exchanger:

1. Aluminized steel with aluminum finned, stainless steel tube condensing coil.

G. Burner:

1. Gas Valve: 100 percent safety modulating main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.

2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

H. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.

2. Flame Rollout Switch: Installed on burner box; prevents burner operation.

3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

I. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

J. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories; diagnostic light with viewport.

K. Accessories:

1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through outside wall or roof as shown on the drawings.

2. CPVC Plastic Vent Materials.

a. CPVC Plastic Pipe: Schedule 40, complying with ASTM F 441/F 441M.

b. CPVC Plastic Fittings: Schedule 40, complying with ASTM F 438, socket type.

c. CPVC Solvent Cement: ASTM F 493.

1) CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

3. PVC Plastic Vent Materials:

a. PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.

b. PVC Plastic Fittings: Schedule 40, complying with ASTM D 2466, socket type.

c. PVC Solvent Cement: ASTM D 2564.

1) PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 THERMOSTATS

A. Controls shall comply with requirements in ASHRAE/IESNA 90.1, "Controls."

B. Thermostat as specified in division 15 section "HVAC Instrumentation & Controls"

## 2.3 AIR FILTERS

A. Disposable Filters: 1-inch- thick fiberglass media with ASHRAE 52.2 MERV rating of 8 or higher, in sheet metal frame.

## 2.4 REFRIGERATION COMPONENTS

A. General Refrigeration Component Requirements:

1. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.

2. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."

B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with furnace. Include condensate drain pan with accessible drain outlet complying with ASHRAE 62.1.

1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.

C. Refrigerant Piping: Comply with requirements in Section "Refrigerant Piping."

D. Air-Cooled, Compressor-Condenser Unit:

1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

2. Compressor: Hermetically sealed reciprocating or scroll type.

a. Crankcase heater.

b. Vibration isolation mounts for compressor.

c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.

e. Refrigerant: R-410A.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

4. Heat-Pump Components: Reversing valve and low-temperature air cut-off thermostat.

5. Fan: Aluminum-propeller type, directly connected to motor.

6. Motor: Permanently lubricated, with integral thermal-overload protection.
7. Low Ambient Kit: Permits operation down to 45 deg F.
8. Mounting Base: Polyethylene.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for gas and refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
- B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.
  1. Install seismic restraints to limit movement of furnace by resisting code-required seismic acceleration.
- C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.
  1. Anchor furnace to substrate to resist code-required seismic acceleration.
- D. Controls: Install thermostats and humidistats at mounting height of 60 inches above floor.
- E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.
- F. Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit.
- G. Install roof-mounted, compressor-condenser components on equipment supports.

### 3.3 CONNECTIONS

A. Gas piping installation requirements are specified in "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

c. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

d. Requirements for Low-Emitting Materials:

1) CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2) PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

4) Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

4. Slope pipe vent back to furnace or to outside terminal.

D. Connect ducts to furnace with flexible connector. Comply with requirements in Section "Air Duct Accessories."

E. Comply with requirements in Section "Refrigerant Piping" for installation and joint construction of refrigerant piping.

### 3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

### 3.5 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for physical damage to unit casings.
2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Verify that all bolts and screws are tight.
5. Adjust vibration isolation and flexible connections.
6. Verify that controls are connected and operational.

B. Adjust fan belts to proper alignment and tension.

C. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.

D. Measure and record airflows.

E. Verify proper operation of capacity control device.

F. After startup and performance test, lubricate bearings and adjust belt tension.

### 3.6 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

### 3.7 CLEANING

A. After completing installation, clean furnaces internally according to manufacturer's written instructions.

B. Install new filters in each furnace within 14 days after Substantial Completion.

### 3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain condensing units.

END OF SECTION



SECTION 15544  
GAS-FIRED UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes gas-fired unit heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of gas-fired unit heater.

1. Include rated capacities, operating characteristics, and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which equipment will be attached.
2. Items penetrating roof and the following:
  - a. Vent and gas piping rough-ins and connections.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas-fired unit heaters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace heat exchanger of gas-fired unit heater that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lennox International, Inc.
2. Modine Manufacturing Company.
3. Reznor/Thomas & Betts Corporation.
4. Sterling HVAC Products; Div. of Mestek Technology Inc.
5. Trane; a brand of Ingersoll Rand

### 2.2 MANUFACTURED UNITS

A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.

B. Gas Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

C. Type of Venting: Separated combustion, power vented.

D. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.

1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.

2. Discharge Louvers: Independently adjustable, horizontal or vertical blades as indicated on drawings.

E. Accessories:

1. Four-point suspension kit.

2. Power Venter: Centrifugal aluminized-steel fan, with stainless-steel shaft; 120-V ac motor.

3. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall or roof caps. Include adapter assembly for connection to inlet and outlet pipes, and flashing for wall or roof penetration.

F. Heat Exchanger: Aluminized steel.

G. Burner Material: Aluminized steel with stainless-steel inserts.

H. Propeller Unit Fan:

1. Aluminum propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.

2. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.

I. Centrifugal Unit Fan:

1. Steel, centrifugal fan dynamically balanced and resiliently mounted.
2. Belt-Driven Drive Assembly:
  - a. Resiliently mounted to housing, with the following features:
    - 1) Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
    - 2) Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
    - 3) Pulleys: Cast-iron, adjustable-pitch motor pulley.

J. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section "Common Motor Requirements for HVAC Equipment."

K. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

1. Gas Control Valve: Two stage.
2. Ignition: Electronically controlled electric spark with flame sensor.
3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
4. Vent Flow Verification: Combustion air proving switch.
5. Control transformer.
6. High Limit: Thermal switch or fuse to stop burner.
7. Control wiring is specified in Section "HVAC Instrumentation and Controls."
8. Wall Mounted Thermostat:
  - a. Two stage.
  - b. Fan on-off-automatic switch.
  - c. 50 to 90 deg F operating range.

L. Electrical Connection: Factory wire motors and controls for a single electrical connection.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install and connect gas-fired unit heaters and associated gas and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written instructions.

### 3.2 EQUIPMENT MOUNTING

A. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

B. Substrate-Mounted Units: Provide supports connected to substrate. Secure units to supports.

1. Spring hangers and seismic restraints are specified in other division 15 sections.

2. Threaded Rods, Spring Hangers, and Building Attachments: Comply with requirements in Section "Hangers and Supports for HVAC Piping and Equipment" and Section "Vibration and Seismic Controls for HVAC."

3. Threaded Rods, Spring Hangers, Building Attachments, and Seismic Restraints: Comply with requirements in Section "Hangers and Supports for HVAC Piping and Equipment." and Section "Vibration Controls for HVAC."

4. Anchor the unit to resist code-required horizontal acceleration.

### 3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to gas-fired unit heater, allow space for service and maintenance.

C. Gas Piping: Comply with Section "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

D. Vent Connections: Comply with manufacturer's printed instructions.

E. Ground equipment according to Division 16.

F. Connect wiring according to Division 16.

### 3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections :

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

2. Verify bearing lubrication.

3. Verify proper motor rotation.

4. Test Reports: Prepare a written report to record the following:
  - a. Test procedures used.
  - b. Test results that comply with requirements.
  - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Gas-fired unit heater will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.5 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.

### 3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain gas-fired unit heaters.

END OF SECTION



SECTION 15738  
SPLIT-SYSTEM HEAT PUMP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system heat pump air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

D. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes as required.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendations.

B. The unit controller shall be shipped separately and shall be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

#### 1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

#### 1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

##### 1. Warranty Period:

- a. For Compressor: Five year(s) from date of Substantial Completion.
- b. For Parts: One year(s) from date of Substantial Completion.
- c. For Labor: One year(s) from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Friedrich Air Conditioning Company.
2. LG Electronics, HVAC Division
3. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
4. McQuay International.
5. SANYO North America Corporation; SANYO Fisher Company.

#### 2.2 INDOOR UNITS (5 TONS OR LESS)

A. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: High strength molded plastic with smooth finish, flat front panel with removable panels on front for filter access, in manufacturer's standard color, and discharge drain pans with drain connection.

2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110. Factory pressure tested and purge with dry air before shipment.

3. Fan: Direct drive, double inlet, forward curve, with single motor.

a. Statically and dynamically balanced and run on a motor with permanently lubricated bearings

b. Fan shall have a minimum of three fan speeds and an AUTO setting. The selectable Auto fan setting shall adjust the fan speed based on the difference between controller set-point and space temperature.

4. Fan Motors:

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section "Common Motor Requirements for HVAC Equipment."

b. Multi-tapped, multispeed with internal thermal protection and permanent lubrication.

c. Enclosure Type: Totally enclosed, fan cooled.

d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.

e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

f. Mount unit-mounted disconnect switches when indoor unit is powered by outdoor unit.

5. Vanes: motorized, horizontal vanes that automatically direct air flow in a horizontal and downward direction for uniform air distribution.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

7. Condensate Drain Pans:

a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.

2) Depth: A minimum of 1 inch deep.

b. Single-wall, galvanized-steel sheet.

c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

- d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
- e. Furnish drain pan level switch, installed on the condensate pan and connected to the control board to prevent condensate from spilling.

8. Air Filtration Section:

a. General Requirements for Air Filtration Section:

- 1) Comply with NFPA 90A.
- 2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
- 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on front of unit. Filters shall be easily removable.

b. Disposable Panel Filters:

- 1) Factory-fabricated, washable type.
- 2) Thickness: 1 inch.
- 3) Merv according to ASHRAE 52.2: minimum 8.

9. Controls:

a. The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from a wireless or wired controller, providing emergency operation and controlling the outdoor unit.

b. Furnish wired remote controller to be mounted on wall below unit. Controller shall have LCD display. There shall be a built-in weekly timer with up to 8 pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor.

## 2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Galvanized Steel, thermally applied fused acrylic or powder coat finish, with easily removable panels for access to all service parts. Microprocessor controls, weep holes for water drainage, mounting feet, and fan grill. Provide brass service valves, fittings, and gage ports on exterior of casing.

2. Compressor: Hermetically sealed and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

- a. Compressor Type: Twin rotor rotary type or scroll with variable speed inverter drive technology.
  - b. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant.
  - c. Compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load.
  - d. High-pressure safety switch and accumulator.
  - e. Refrigerant Charge: R-410A.
  - f. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110. Protect coil with integral metal guard.
  - g. Electronic linear expansion valve for metering refrigerant flow controlled by microprocessor controlled step motor.
- 3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
  - 4. Fan: Aluminum-propeller type, directly connected to motor.
  - 5. Motor: Permanently lubricated bearings, with integral thermal-overload protection.
  - 6. Low Ambient: Permits cooling operation down to 0 deg F.

## 2.4 ACCESSORIES

- A. Control equipment and sequence of operation are specified in Section "HVAC Instrumentation and Controls" and Section "Sequence of Operation."
- B. Automatic-reset timer to prevent rapid cycling of compressor.
- C. Drain Hose: For condensate.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Equipment Mounting:
  - 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s).

2. Comply with requirements for vibration isolation devices specified in Section "Vibration Controls for HVAC."

### 3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Piping Connections: Comply with piping requirements specified in other sections.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Electrical: Comply with all applicable sections regarding electrical and grounding requirements.

### 3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

C. Prepare test and inspection reports.

### 3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Furnish startup worksheet with close out documents.

B. Perform the following commissioning for all units:

1. Level unit on support structure.

2. Inspect for visible damage to unit casing.

3. Inspect for visible damage to compressor, air-cooled condenser coil, and fans.

4. Verify that clearances have been provided for servicing.

5. Check that labels are clearly visible.

6. Verify that controls are connected and operable.
7. Remove shipping bolts, blocks, and tie-down straps.
8. Verify that filters are installed.
9. Adjust vibration isolators.
10. Check acoustic insulation.
11. Lubricate bearings on fan.
12. Check fan-wheel rotation for correct direction without vibration and binding.
13. Adjust fan belts to proper alignment and tension.
14. Start unit according to manufacturer's written instructions.
15. Perform starting of refrigeration in summer only.
16. Complete startup sheets and attach copy with Contractor's startup report.
17. Check and record performance of interlocks and protection devices; verify sequences.
18. Operate unit for an initial period as recommended or required by manufacturer.
19. Calibrate thermostats.
20. Check internal isolators.
21. Check controls for correct sequencing of heating, refrigeration, and normal and emergency shutdown.
22. Simulate maximum cooling demand and check the following:
  23. Compressor refrigerant suction and hot-gas pressures.
  24. Short circuiting air through condenser or from condenser to outside-air intake.
  25. After starting and performance testing, install clean filters, vacuum heat exchanger and cooling and condenser coils, lubricate bearings and adjust belt tension.

### 3.5 DEMONSTRATION

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

END OF SECTION



SECTION 15792  
PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes propeller unit heaters with electric-resistance heating coils.

1.3 DEFINITIONS

A. PTFE: Polytetrafluoroethylene plastic.

B. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include location and size of each field connection.

4. Include details of anchorages and attachments to structure and to supported equipment.

5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.

6. Indicate location and arrangement of piping valves and specialties.

7. Indicate location and arrangement of integral controls.

8. Wiring Diagrams: Power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Airtherm.
2. Raywall
3. Reznor
4. Trane.
5. Q Mark, A Marley Engineered Products Brand.

### 2.2 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers as indicated on the drawings.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 2021.

D. Comply with UL 823.

### 2.3 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

### 2.4 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

### 2.5 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated, manufacturers standard motor. Comply with requirements in Section "Common Motor Requirements for HVAC Equipment."

## 2.6 CONTROLS

### A. Control Devices:

1. Wall-mounted, variable fan-speed switch.
2. Wall-mounted thermostat.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

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

### 3.2 INSTALLATION

A. Install propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with all-thread hanger rods.. Hanger rods and attachments to structure are specified in Section "Hangers and Supports for HVAC Piping and Equipment."

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

### 3.3 CONNECTIONS

A. Comply with safety requirements in UL 1995.

B. Ground equipment according to Division 16.

C. Connect wiring according to Division 16.

### 3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

2. Operate electric heating elements through each stage to verify proper operation and electrical connections.

3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

### 3.5 ADJUSTING

A. Adjust initial temperature set points.

### 3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

END OF SECTION

SECTION 15793  
WALL AND CEILING UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.

2. Include details of anchorages and attachments to structure and to supported equipment.

3. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.

4. Wiring Diagrams: Power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wall and ceiling unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berko.
2. Chromalox, Inc.
3. INDEECO.
4. Markel Products; TPI Corporation.
5. Marley Engineered Products.
6. QMark Electric Heating.

## 2.2 DESCRIPTION

A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.3 CABINET

A. Front Panel: Stamped-steel louver or Extruded-aluminum bar grille, with removable panels fastened with tamperproof fasteners.

B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

## 2.4 COIL

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

## 2.5 FAN AND MOTOR

A. Fan: Aluminum propeller directly connected to motor.

B. Motor: Permanently lubricated. Comply with requirements in Section "Common Motor Requirements for HVAC Equipment."

## 2.6 CONTROLS

A. Controls: Unit-mounted thermostat.

B. Electrical Connection: Factory wire motors and controls for a single field connection.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas to receive wall and ceiling unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

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

### 3.2 INSTALLATION

A. Install wall and ceiling unit heaters to comply with NFPA 90A.

B. Install wall and ceiling unit heaters level and plumb.

C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

D. Ground equipment according to Division 16.

E. Connect wiring according Division 16.

END OF SECTION



SECTION 15815  
METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

2. Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

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

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

## PART 2 - PRODUCTS

### 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 or G90 for interior, concealed ductwork, G90 for exterior and exposed ductwork.

2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

3. Butt transverse joints without gaps, and coat joint with adhesive.

4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.

6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

- a. Fan discharges.
- b. Intervals of lined duct preceding unlined duct.
- c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

D. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

### 3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 09900.

### 3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests: Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

### 3.9 START UP

A. Air Balance: Comply with requirements in Section "Testing, Adjusting, and Balancing for HVAC."

### 3.10 DUCT SCHEDULE

A. Supply Ducts:

1. Pressure Class: Positive 2-inch wg.

2. Minimum SMACNA Seal Class: A for ducts located outdoors and exposed in conditioned spaces, B for ducts located in unconditioned spaces, and C for concealed ductwork in conditioned spaces.

B. All Return Ducts:

1. Pressure Class: negative 2-inch wg.

2. Minimum SMACNA Seal Class: A for ducts located outdoors, B for ducts located in unconditioned spaces and exposed in conditioned spaces, C for concealed ductwork in conditioned spaces.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting Air:

- a. Pressure Class: Negative 1-inch wg.
- b. Minimum SMACNA Seal Class: B.

2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

- a. Exposed to View: Type 304, stainless-steel sheet, No. 3 finish.
- b. Concealed: Carbon-steel sheet.

- c. Welded seams and joints.
- d. Pressure Class: negative 4-inch wg.
- e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
- f. SMACNA Leakage Class: 3.

D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

Units:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal

- a. Pressure Class: Positive 2-inch wg.
- b. Minimum SMACNA Seal Class: A.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

2. Stainless-Steel Ducts:

- a. Exposed to Airstream: Match duct material.
- b. Not Exposed to Airstream: Match duct material.

F. Liner:

- 1. Supply Air Ducts: Fibrous glass, Type I 1 inch thick.
- 2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
- 3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
- 4. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

- 1) Radius Type RE 1 with min. 0.5 radius-to-diameter ratio.
- 2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

- 1) Radius Type RE 1 with min. 1.0 radius-to-diameter ratio.

- 2) Radius Type RE 3 with min. 0.5 radius-to-diameter ratio

and two vanes.

- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

- 1) Radius Type RE 1 with min. 1.5 radius-to-diameter ratio.

2) Radius Type RE 3 with min. 1.0 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with min. 1.5 radius-to-diameter ratio.

b. Radius Type RE 3 with min. 1.0 radius-to-diameter ratio and two vanes.

c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

- a. Rectangular Main to Rectangular Branch: 45-degree entry.
- b. Rectangular Main to Round Branch: Adjustable takeoff fitting.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

- a. Velocity 1000 fpm or Lower: 90-degree tap.
- b. Velocity 1000 to 1500 fpm: Conical tap.
- c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 15820  
DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Fire dampers.
3. Turning vanes.
4. Duct-mounted access doors.
5. Flexible connectors.
6. Flexible ducts.
7. Duct accessory hardware.

B. Related Requirements:

1. Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 16 for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

- a. Special fittings.
- b. Manual volume damper installations.
- c. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
- d. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

### 2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 3 finish for exposed ducts.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

### 2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. American Warming and Ventilating.
- b. Flexmaster U.S.A., Inc.
- c. McGill AirFlow LLC.
- d. Nailor Industries Inc.
- e. Pottorff.
- f. Ruskin Company.
- g. Vent Products Co., Inc.

2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.

4. Frames:

- a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
- b. Mitered and welded corners.
- c. Flanges for attaching to walls and flangeless frames for installing

in ducts.

5. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch thick.
  6. Blade Axles: Galvanized steel.
  7. Bearings: Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  8. Tie Bars and Brackets: Galvanized steel.
- B. Jackshaft:
1. Size: 1-inch diameter.
  2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
  2. Include center hole to suit damper operating-rod size.
  3. Include elevated platform for insulated duct mounting.

## 2.4 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Air Balance Inc.; a division of Mestek, Inc.
  2. Arrow United Industries; a division of Mestek, Inc.
  3. Cesco Products; a division of Mestek, Inc.
  4. Greenheck Fan Corporation.
  5. Nailor Industries Inc.
  6. NCA Manufacturing, Inc.
  7. Pottorff.
  8. Prefco; Perfect Air Control, Inc.
  9. Ruskin Company.
  10. Vent Products Company, Inc.
  11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity. Dampers used on medium pressure (VAV systems) shall be rated for 3000 fpm and 8"wg static pressure.

D. Fire Rating: 1-1/2 or 3 hours as indicated by the wall ratings on the architectural plans

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.05 or 0.138 inch thick, as indicated, and of length to suit application.

2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.024-inch-0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

## 2.5 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. METALAIRE, Inc.
5. SEMCO Incorporated.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vaness and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single wall for ducts up to 48 incheswide and double wall for larger dimensions.

## 2.6 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cesco Products; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Elgen Manufacturing.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff.
9. Ventfabrics, Inc.
10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:
  - a. Double wall, rectangular.
  - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
  - c. Vision panel where indicated.
  - d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
  - e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

## 2.7 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.

4. Ventfabrics, Inc.
  5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..
  2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  3. Service Temperature: Minus 40 to plus 200 deg F.

## 2.8 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
4. ATCO.

B. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: 6.0.

C. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

## 2.9 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

2. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Install flexible connectors to connect ducts to equipment.

K. Label access doors according to Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect diffusers to ducts with maximum 48-inch lengths of flexible duct clamped or strapped in place.

N. Connect flexible ducts to metal ducts with draw bands.

O. Install duct test holes where required for testing and balancing purposes.

P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

### 3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 15838  
POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceiling-mounted ventilators.
2. In-line centrifugal fans.
3. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Field quality-control reports.

## 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

## 1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

## 1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

## PART 2 - PRODUCTS

### 2.1 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme
2. Barry Blower
3. Breidert Air Products.
4. Broan-NuTone LLC.
5. Carnes Company.
6. Cincinnati Fan & Ventilator Co.
7. Greenheck Fan Corporation.
8. JencoFan.
9. Loren Cook Company.
10. PennBarry.
11. Twin City
12. W.W. Grainger, Inc.; Dayton Products.

B. Housing: Steel, lined with acoustical insulation. Furnish inline configuration where indicated on the drawings.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.

3. Isolation: Rubber-in-shear vibration isolators.

4. Manufacturer's standard roof jack or wall cap, and transition fittings as indicated on the drawings.

## 2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Manufacturing Corporation.
2. Barry Blower.
3. Breidert Air Products.
4. Carnes Company.
5. Cincinnati Fan & Ventilator Co.
6. Greenheck Fan Corporation.
7. Hartzell Fan Incorporated.
8. JencoFan.
9. Loren Cook Company.
10. PennBarry.
11. Twin City.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

- E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- F. Accessories:
  - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
  - 3. Companion Flanges: For inlet and outlet duct connections.
  - 4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
  - 5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
  - 6. Vibration Isolators:
    - a. Type: Hanging spring isolator.
    - b. Static Deflection: 1 inch.

## 2.3 PROPELLER FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acme Engineering & Manufacturing Corporation.
  - 2. Barry Blower
  - 3. Breidert Air Products.
  - 4. Broan-NuTone LLC; NuTone Inc.
  - 5. Carnes Company.
  - 6. Cincinnati Fan.
  - 7. Greenheck Fan Corporation
  - 8. Hartzell Fan Incorporated.
  - 9. JencoFan.
  - 10. Loren Cook Company.
  - 11. PennBarry.
  - 12. Twin City
  - 13. W.W. Grainger, Inc.; Dayton Products.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- D. Fan Drive:
  - 1. Resiliently mounted to housing.
  - 2. Statically and dynamically balanced.

3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
4. Extend grease fitting to accessible location outside of unit.
5. Service Factor Based on Fan Motor Size: 1.4.
6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
  - a. Ball-Bearing Rating Life: ABMA 9,  $L_{10}$  of 100,000 hours.
8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
  9. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
11. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

E. Accessories:

1. Motorized Wall Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
3. Wall Collar: Galvanized steel with heavy gauge mounting flanges and pre punched mounting holes.
4. Wall Sleeve: Galvanized steel to match fan and accessory size.
5. Weathershield Hood: Galvanized steel to match fan and accessory size.
6. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

## 2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

## 2.5 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- C. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch deflection.
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Section "Identification for HVAC Piping and Equipment."

### 3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 16.
- D. Connect wiring according Division 16.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.
  4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  5. Adjust belt tension.
  6. Adjust damper linkages for proper damper operation.
  7. Verify lubrication for bearings and other moving parts.
  8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  10. Shut unit down and reconnect automatic temperature-control operators.
  11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

#### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION



SECTION 15855  
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. This Section includes ceiling and wall mounted diffusers, registers, grilles and exterior louvers.

B. Related Sections:

1. Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS, REGISTERS AND GRILLES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Anemostat Products; a Mestek company.
- b. Carnes.
- c. Hart & Cooley Inc.
- d. Krueger
- e. METALAIRE, Inc.
- f. Nailor Industries Inc.
- g. Price Industries.
- h. Titus.
- i. Tuttle & Bailey.

2.2 EXTERIOR LOUVERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a.

Arrow

- b. Greenheck
- c. Vent Products
- d. Ruskin

2. Depth: 6 inches.

### 2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

### 3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. After installation of diffusers, registers, grilles and louvers, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

### 3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 15856  
HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes roof hoods.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which roof curbs and ventilators will be attached.
2. Sizes and locations of roof openings.

1.5 QUALITY ASSURANCE

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

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

1.6 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

E. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.2 FABRICATION, GENERAL

A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

## 2.3 ROOF HOODS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Mfg. Corporation.
2. Aerovent.
3. Carnes.
4. Greenheck Fan Corporation.
5. JencoFan.
6. Loren Cook Company.
7. PennBarry.

B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.

C. Materials: Heavy Gage Aluminum construction suitably reinforced and corrosion resistant.

D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Built-in raised cant and mounting flange.
2. Overall Height: 12 inches above roof surface.

E. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work. Secure ventilator to roof curb with cadmium plated screws, minimum two per side.

B. Install gravity ventilators with clearances for service and maintenance.

C. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 07900 for sealants applied during installation.

E. Label gravity ventilators according to requirements specified in Section "Identification for HVAC Piping and Equipment."

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

### 3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in Section "Metal Ducts". Drawings indicate general arrangement of ducts and duct accessories.

### 3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION



SECTION 15870  
COMMERCIAL KITCHEN HOODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. This Section includes Type I commercial kitchen hoods.

1.3 DEFINITIONS

A. Listed Hood: A hood, factory fabricated and tested for compliance with UL 710 by a testing agency acceptable to authorities having jurisdiction.

B. Type I Hood: A hood designed for grease exhaust applications.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Standard hoods.
2. Filters/baffles.
3. Fire-suppression systems.
4. Lighting fixtures.

B. Shop Drawings:

1. Shop Drawing Scale: 1/4 inch = 1 foot.
2. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection sizes, and attachments to other work.
3. Show cooking equipment plan and elevation to confirm minimum code-required overhang.
4. Indicate performance, exhaust and makeup air airflow, and pressure loss at actual Project-site elevation.
5. Show control cabinets.
6. Show fire-protection cylinders, piping, actuation devices, and manual control devices.
7. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
8. Wiring Diagrams: Power, signal, and control wiring.

9. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Include roughing-in requirements for drain connections. Show cooking equipment plan and elevation to illustrate fire-suppression nozzle locations.

## 1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Coordination Drawing Scale: 1/4 inch = 1 foot.
2. Suspended ceiling assembly components.
3. Structural members to which equipment will be attached.
4. Roof framing and support members for duct penetrations.
5. Items penetrating finished ceiling, including the following:
  - a. Lighting fixtures.
  - b. Air outlets and inlets.
  - c. Speakers.
  - d. Sprinklers.
  - e. Access panels.
  - f. Moldings on hoods and accessory equipment.

B. Welding certificates.

C. Field quality-control test reports.

## 1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D 1.1M, "Structural Welding Code - Steel," for hangers and supports; and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for joint and seam welding.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Contractor shall certify to the authority having jurisdiction that the installation is in complete agreement with the terms of the listing and the manufacturer's instructions and or approved design.

## 1.7 COORDINATION

A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

B. Hood, grease extractor's, and grease ducts shall have a clearance of at least 18 inches to combustible materials. See NFPA 96 Appendix for protection required to reduce the clearances to combustibles.

## PART 2 - PRODUCTS

### 2.1 HOOD MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304.
1. Minimum Thickness: 0.050 inch.
  2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.
    - a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.
  3. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
  4. Exposed Surfaces: ASTM A 480/A 480M, No. 3 finish (intermediate polished surface).
  5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Carbon-Steel Sheets: ASTM A 1008/A 1008M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.
1. Minimum Thickness: 0.0478 inch.
- C. Galvanized-Steel Sheet: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation.
1. Minimum Thickness: 0.052 inch.
- D. Zinc-Coated Steel Shapes: ASTM A 36 zinc coated according to ASTM A 123 requirements.
- E. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR, for use in areas that come in contact with food.
1. Color: As selected by Architect from manufacturer's full range.
  2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.
- F. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch thickness that does not chip, flake, or blister.
- G. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

## 2.2 GENERAL HOOD FABRICATION REQUIREMENTS

A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.

1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.

2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.

3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.

4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.

5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.

B. For metal butt joints, comply with SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.

D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.

E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.

F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.

G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.

H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.

I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.

J. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

K. Fabricate enclosure panels to ceiling and wall as follows:

1. Fabricate panels on all exposed side(s) with same material as hood, and extend from ceiling to top of hood canopy and from canopy to wall.
2. Wall Offset Spacer: Minimum of 3 inches.
3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," with minimum 0.0625-inch- thick, stainless-steel shelf tops.

### 2.3 TYPE I EXHAUST HOOD FABRICATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Duo-Aire, Inc.
2. Captive-Aire Systems.
3. Gaylord Industries, Inc.
4. Grease Master; a division of Custom Industries, Inc.
5. Greenheck.
6. Vent Master; Div. of Garland Commercial Ranges, Ltd.

B. Hood Material: Stainless Steel.

C. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.

1. Fabricate hoods according to NSF 2, "Food Equipment."
2. Hoods shall be designed, fabricated, and installed according to NFPA 96.
3. Duct Collars: Min. 0.0598-inch thick steel at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a 0.5-inch wide duct flange.

D. Hood Configuration: Exhaust with makeup air.

1. Makeup air shall be introduced through plenum at rear of hood, extending down below appliance cooking surfaces.

E. Hood Style: Wall-mounted canopy.

F. Filters/Baffles: Removable, stainless-steel, with spring-loaded fastening. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction. Size of filters shall be no larger than 20"x 20" and selected for 0.5" w.c. clean pressure drop.

G. Lighting Fixtures: incandescent fixtures and lamps with lenses sealed vaportight. Wiring shall be installed in conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc at 30 inches above finished floor.

1. Light switches shall be mounted in hood control panel.
2. Lighting Fixtures: Incandescent complying with UL 1598.

H. Comply with requirements in Section "HVAC Instrumentation & Controls" and Section "Sequence of Operation" for hood controls.

I. Hood Controls: Hood mounted control cabinet, fabricated of stainless steel.

1. Exhaust Fan: On-off switches shall start and stop the exhaust fan. Interlock exhaust fan with makeup air supply fan to operate simultaneously. Interlock exhaust fan with fire-suppression system to operate fan(s) during fire-suppression-agent release and to remain in operation until manually stopped. Include red pilot light to indicate fan operation. Motor starters shall comply with Section "Motor Controllers for HVAC equipment."

2. Fan and light controls shall be mounted on face of canopy in factory installed stainless steel wireway system similar to Wiremold boxes with a stainless steel vertical raceway welded to the hood face. All surfaces to have No. 3 finish.

3. High-Temperature Control: Alarm shall sound and cooking equipment shall shut down before hood discharge temperature rises to actuation temperature of fire-suppression system.

4. Temperature sensor and fan delay relay shall be installed in exhaust duct collar of hood to turn on exhaust fan with set point is reached.

5. The prewired remote control center shall include but not be limited to, an integral master disconnect switch with fuse blocks for the main power connection, magnetic motor starters with thermal overloads and manual reset, fused 120 volt control transformer, and distribution terminal control strip for control wiring connection. All electrical components shall be UL Listed or classified where applicable and wired in compliances with the National Electrical Code. Wiring shall be complete, requiring only one point for field connection for power service and one point for field connection for control voltage.

6. Factory wiring shall be provided in conduit conforming to NFPA Standard 70 and designed to withstand the effects of heat, vapor and grease on the equipment. Wiring shall include control wiring to conduit to the opening in the top of canopy, connecting wiring and conduit from master electric control panel to the exhaust and makeup air fans.

## 2.4 EXHAUST FAN

A. Furnish hinged upblast exhaust fan of size and capacity listed on drawings. Fan shall be constructed of all aluminum and shall conform to AMCA, U.L. 762 Listed for use with restaurant exhaust applications. Fan shall have grease drain container with tight fitting lid.

B. Furnish pre-fabricated roof curb constructed of minimum 18 gauge galvanized steel with integral non-combustible nailer, run-off cant and 1" rigid insulation. Furnish extensions as required for exhaust fan to meet N.F.P.A. requirements for discharge height. Roof curb shall be approved by the National Roofing Contractors Association.

C. Master electric pre wired weatherproof control panel, factory mounted on rooftop fan package with: Main power source fused disconnects switch; control circuit terminal strip; magnetic motor starters with motor overload protection, relays, transformers and fused control circuit. Furnish heat detection sensor and controls to automatically energize exhaust fan when heat is detected in the hood shell. Panel shall be mounted on exterior of the unit and shall be weather proof construction.

D. Furnish grease guard system to protect roof around kitchen range hood exhaust fan. System shall protect all four sides of the base of the fan and shall consist of: Grease deflecting flashing at a base of fan with three layer filter assembly contained in an anodized aluminum frame. Three layers shall consist of upper layer to trap large debris, middle layer to absorb grease and allow rainwater to pass thru and lower layer to keep assembly above standing water and allow air to circulate thru the assembly. Manufactured by Grease Guard, Inc. or equivalent.

## 2.5 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ansul Incorporated; a Tyco International Ltd. Company.
2. Badger Fire Protection.
3. Kidde Fire Systems.
4. Pyro Chem.
5. Safety First.

B. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.

1. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S, Grade A, Schedule 40, plain ends.

2. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.

3. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on wall. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.

4. All piping except for nozzle drops, piping shall be run above the hood. Hood penetration shall be made with Ansul "quick-seal" adapters or equivalent.

5. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.

6. Agent tank shall be chrome-plated carbon steel.

7. The regulated release mechanism shall be the spring loaded type capable of providing the expellant gas supply to the agent tank. The regulated release mechanism shall have the following actuation capabilities: automatic actuation by fusible link detection system; remote manual actuation by a mechanical pull station' local manual actuation by a push button located at the front of the release mechanism enclosure.

8. The tank and bracket assembly shall contain a chrome-plated, welded steel bracket and an agent tank.

9. Each discharge nozzle shall be tested and listed with a restaurant system for specific applications. Nozzle placement shall be determined by the size of the orifice in the nozzle tip.

10. The fusible link shall be selected and installed according to the operating temperature in the ventilating system.

11. Furnish a manual remote pull station as the primary means of actuation.

12. Furnish electric-operated U.L. listed gas shutoff valve; refer to Section "Facility Natural-Gas Piping" to shut off all equipment under the hood upon activation of fire suppression system.

13. Furnish U.L. listed electric switch to shut off electrical power to appliances or to activate electrically operated devices and fire alarm system to shut off all equipment under the hood upon activation of the fire suppression system.

14. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.

15. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.

16. The fire extinguishing system shall also meet the requirements of the State Fire Marshal. Submit copies of Drawings bearing the stamp of Approval of the State Fire Marshal; one copy of which shall remain at the job site.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

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

### 3.2 INSTALLATION

A. Complete field assembly of hoods where required.

1. Make closed butt and contact joints that do not require filler.

2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in Part 2 "General Hood Fabrication Requirements" Article.

B. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.

C. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.

D. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.

E. Install hoods to operate free from vibration.

F. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.

G. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

H. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

I. Set initial temperatures, and calibrate sensors.

J. Set field-adjustable switches.

### 3.3 CONNECTIONS

A. Connect ducts according to requirements in Section "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquid tight joint.

B. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

### 3.4 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.

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. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Test water, drain, gas, and liquid-carrying components for leaks. Repair or replace leaking components.

4. Perform hood performance tests required by authorities having jurisdiction.

5. Perform fire-suppression system performance tests required by authorities having jurisdiction. Submit letter of certification to the State Fire Marshal (and a copy to the architect) that the installation is in complete agreement with the terms of the listing and the manufacturer's instructions and or approved design

E. Prepare test and inspection reports.

### 3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial kitchen hoods.

END OF SECTION

SECTION 15880  
VEHICLE EXHAUST REMOVAL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section includes Vehicle Exhaust Removal Systems.

B. Related Requirements:

1. Section "Hangers and Supports for HVAC Piping and Equipment"

1.3 ACTION SUBMITTALS.

A. Product Data: For each type of product.

1. Include manufacturer's literature and data sheets including construction details, material descriptions, and dimensions and weights of individual components and profiles for vehicle exhaust removal systems.

2. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include fan curves with specified operating point clearly marked.

3. Include installation and Startup Instructions.

B. Shop Drawings:

1. Measure and record building dimensions, note vehicle type and prepare shop drawings which include equipment position, dimensions, size, weights, performance data, and also location and size of field connections.

2. Include plans, elevations, sections, and mounting attachment details.

3. Include details of equipment assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.

4. Include electrical requirements, diagrams for power, signal, and control wiring, location, voltage, phase and capacity of field connections.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For vehicle exhaust removal systems to include in operation and maintenance manuals. Manual shall outline the procedures required for system installation, start up, operation and shutdown. The instructions shall include the manufacturer's name, telephone number, model number, service manual number, parts list, and brief description of all equipment and the basic operating features. The maintenance instructions shall list routine maintenance procedures and trouble-shooting guide.

B. Certification letter from the manufacturer stating that the ventilation system has been through startup procedures and that it is functioning properly.

## 1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: All workmanship, manufacturing procedure, airflow design, and materials shall be tested and performance guaranteed. Firm shall be experienced in manufacturing vehicle exhaust ventilation systems similar to those indicated for this Project and that have a record of successful in-service performance.

B. Equipment Manufacturer's Certification: International Quality System Standard ISO 9001 Certified. Compliance with NFPA 1500, Chapter 7-1.3, 1996 International Mechanical Code 502.11, NIOSH CIB #50, OSHA, 1996 American Conference of Governmental Industrial Hygienists (ACGIH) proposed regulations for Benzene and Diesel Exhaust Fumes, Federal Communications Commission approvals.

C. Equipment shall be in compliance with all State and Local mechanical, electrical and building codes: Uniform Mechanical Code (UMC), American Society of Manufacturing Engineers (ASME), National Electric Code (NEC), Uniform Building Code (UBC), American Institute of Steel Construction (AISC), Sheet Metal and Air Conditioning Contractors National Association (SMACNA), American Society of Testing Materials (ASTM).

D. Installer Qualifications: A factory trained and insured Contractor shall furnish and install a Source Capture Emergency Vehicle Exhaust Extraction System as designed and specified.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Protect ventilation system and components from damage by factory packing.

B. Acceptance on Site: Reject any damaged equipment upon arrival.

C. The Contractor shall be responsible for the delivery, safe storage and handling of the products, and to protect them from the weather, dirt, fumes, water, and construction debris. Store products indoors whenever possible.

D. Handling: Handle systems and components according to manufacturer's instructions.

## 1.7 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace materials, equipment, and workmanship that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: one year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Amnerman

2. CarMon
3. Engwald
4. Nederman

## 2.2 SUMMARY

A. The function of the vehicle exhaust removal system will be to source capture 100% of the exhaust emissions directly at the tail pipe of the vehicle and exhaust those emissions to a specified area safely outside of the building.

B. The exhaust system must not interfere with access to the vehicle, nor impede doorways/ walkways or exits which would endanger the welfare of personnel. Drooping loops of hose or the hose assembly touching the floor will not be permitted.

C. As safety to personnel is the utmost importance, the system shall be so designed as not whip or fly back into quarters upon disconnection. Vehicles shall be capable of exiting quarters at normal speed without causing damage to the system or taking any portion of the hose or nozzle assembly along with the exiting vehicle.

D. The fan shall start, optionally, by system push button, door opener push button or override switch.

E. The exhaust system must move with the vehicle in a forward or reverse direction of travel and have an automatic release design without any positive locking device or air bladder that clamps or binds to the tail pipe.

F. The exhaust system shall utilize a minimum 6" diameter hose in order to insure that the exhaust system can accommodate vehicle apparatus checks; and not limited to just emergency departures. Any smaller hose does not offer the required cross sectional area considered adequate for the volume of hot exhaust fumes discharged during extended run times required during routine vehicle check procedures.

## 2.3 SYSTEM OPERATION

A. The auto disconnect exhaust system shall be a 24-volt electromagnetic release type that captures 100% of the exhaust emissions directly from the tail pipe and discharges those emissions to a specific location by means of an exhaust fan. Upon emergency dispatch of the vehicle, the exhaust fan shall automatically start prior to the engine being energized. The exhaust fan shall remain in the "on" position for as long as any engine is running. Upon vehicle exit, the hose assembly shall remain connected to the anchor plate and shall automatically disconnect at a specified distance from the door by de-energizing the electromagnet. The nozzle and hose assembly shall smoothly separate from the vehicle and safely retract to the stored position ready to connect to the vehicle upon re-entry. Upon disconnection, the hose assembly shall not be permitted to swing wide or touch the floor, possibly endangering personnel or apparatus. Once the apparatus has left the building, the fan will automatically shut down after a preset time interval.

B. Upon return, the fan shall be activated as in Item 4 of "Vehicle Exhaust Removal System", prior to vehicle entry and the nozzle is to be manually connected to the fire vehicle from a standing position. This prevents bending over to connect the exhaust system and will not expose the operator to harmful exhaust fumes at close range. No positive locking device nor moving part shall be permitted to be connected to the tail pipe. After the vehicle has been turned off, the fan can be timed to continue operating for an adjustable period of time.

## 2.4 EQUIPMENT

A. Overhead Guide Track: Horizontal Guide Track which carries the horizontal flexible hose and trolleys shall be made or extruded aluminum alloy formed into a double channel measuring 3.5" high and 1.5" wide with the bottom side having a continuous open slot measuring .5" wide, giving an overall throat depth of 1.25". Guide Track sections shall be connected with a 4 bolt form fitting internal aluminum bar connectors for perfectly aligned field assembly to the length specified. Guide Tracks shall have non-toxic anodized clear finish and shall be connected to support brackets with shock absorbing links.

B. Extraction Hose: The horizontal extraction hose shall be suspended from the Guide Track, which stores the hose up and out of the way, to ensure a safer approach to the apparatus during a run. The horizontal extraction hose shall be 6" in diameter and of suitable flexibility to withstand at least 100,000 cycles without tearing, perforating or collapsing (under normal use with proper installation and care.) The upper vertical extraction hose shall be 6" in diameter, and of suitable flexibility. All hoses to have an extension to compression ratio of 6:1. The material for the hose shall be Trevira fabric covered with HYPALON (CSM, Chloro-sulfonated polyethylene). The hose shall be fire resistant according to DIN 4102 B1. The hose shall be capable of withstanding temperatures of 340° F continuously and up to 370° F on an intermittent usage basis. (Note: in closed type sealed systems, the temperature ratings must be 680° F and 740° respectively.) A hose diameter which is equal to or smaller than the exhaust tail pipe diameter shall not be permitted as it does not have the volume capacity to handle all fumes emitted.

C. Nozzle:

1. The nozzle shall be designed to capture 100% of the vehicle exhaust fumes generated at the vehicle tail pipe and be held in place by spring tension in conjunction with the electromagnet connection. The oversized nozzle is to permit ambient air to enter the exhaust air stream to immediately reduce exhaust emission temperature by at least 50% at the point of capture. The reduced air stream temperatures are to prolong component life by not permitting thermal breakdown of materials.

D. The Nozzle shall be designed so as not to cause or create back pressure on any vehicle engine, nor to draw raw diesel fumes in the exhaust hose while connected to a non-operating vehicle, nor to create the possibility of spinning a non-lubricated turbo which could result in bearing failure. (If a "closed type sealed system" nozzle is utilized, a pressurized container can be created presenting an explosive potential when drawing raw fumes from a non-operating vehicle. In which case, all system electrical components must be of explosion proof design. These conditions are non-existent with an ambient air mix nozzle design.)

E. Balancer: The adjustable tension Balancer shall retract the hose and nozzle away from the vehicle as it leaves the building and safely suspend the assembly off the floor in the storage position when not in use. The Balancer shall be of a cone shape drum design with centrifugal brake and reverse spring characteristics. The centrifugal brake shall ensure that the cord is wound onto the drum at a constant speed with constant torque. The reverse spring characteristic shall permit full spring power to the Balancer when the cord is wound into the drum. The Balancer shall freely roll in the guide track via a trolley with four composition wheels. A corrosion resistant aluminum bracket shall attach the trolley to the Balancer.

F. Disconnection Switch: Affixed to the Guide Track near the exit door, shall be a small permanent magnet, which in conjunction with an electronic disconnection box, causes the 24-volt electromagnet to lose power and disconnect the hose assembly from the vehicle at an adjustable distance from the door opening. The separation of the entire hose assembly from the vehicle to be a one step process whereby no stress or strain is transferred from the vehicle to the tail pipe, the exhaust hose or overhead brackets. (Numerous mechanical functions to achieve nozzle separation such as valve activation, pneumatic deflation and pulling forces to remove the nozzle from the tail pipe are not permitted.) If a proper disconnection does not occur, the electromagnet shall be designed to release at a 50 pound shear force and to retain the hose and nozzle assembly intact.

G. End Stop: The Guide Track shall be equipped with an End Stop, which is designed to stop the travel of the entire hose, nozzle, and balancer assembly to prevent the assembly from coming to an abrupt and immediate halt. The End Stop shall consist of a coiled spring and viscous oil damper, which is located at the end of the Guide Track nearest to the exit door.

H. Electromagnet Assembly:

1. An electromagnet shall be used as the means of keeping the nozzle and hose assembly attached to the vehicle, whether at rest or as it moves to the point of exit. The electromagnet shall be 24 volt, DC with power supplied via an insulated conductor encapsulated within the helix of the vertical hose. The electromagnet assembly shall consist of an electromagnet disc, a manual override switch, and an anchor plate. The electromagnet disc assembly shall be slightly recessed to serve as a guide for ease of connection to the anchor plate mounted on the vehicle and to serve as the energized contact point. The formed collar shall be of a smooth and rounded configuration to prevent hooking or catching on external devices of the vehicle.

2. A manual override switch shall be easily accessible to de-energize the electromagnet and disconnect the hose assembly for accessing storage compartments or performing vehicle maintenance.

I. Fan Multi-Start System:

1. The fan Multi-Start serves as a multi remote control system for fan start up to ensure the exhaust system is always running whenever an emergency vehicle is in operation. Upon dispatch, the exhaust fan shall start and be running at full rpm prior to engine start up. To be controlled by a fan push button, door opener push button or door opener remove control device. The fan shall stay on for a variable period of time, then automatically shut off.

2. A by-pass switch shall be mounted to the exterior of the Multi-Start cabinet to allow fan operation during apparatus testing.

J. Centrifugal Fans: The fan shall be a direct drive centrifugal type, high pressure, single width, single inlet as required or indicated. Impeller wheels shall be of a modified radial tip design, with a top forward curve and airfoil thickness configuration characteristics. Impeller wheels shall be made of heavy-duty high strength steel. The impeller shall be dynamically and static balanced, and of the non-overloading type to provide maximum efficiency while achieving quiet, vibration free operation. The fan housing shall be constructed of high strength steel. The fan and motor assembly shall be mounted on a galvanized steel frame which shall protect the motor, while also serving as a mounting platform for field installation.

1. Vibration isolators, of the rubber-in-shear type, shall be provided with the exhaust fan. Isolators shall be matched to equipment weight and support locations.

2. Furnish flexible connection where exhaust duct connects to the exhaust fan. Flexible connections shall be 6" width woven fabric, Underwriters' Guide.

K. Air Flow Performance: Fan capacity shall be sized as such as to deliver 600 cfm (or as otherwise specified) at each hose drop to the vehicle being served. The delivered volume shall take into account all lengths of duct work, elbows, branches, shut off, wyes, etc., which accumulate the static pressure at the fan inlet. Manufacturer provided fans shall be performance guaranteed.

## 2.5 DUCT SYSTEM

A. Ductwork: Duct, unless otherwise specified or approved, shall be round and conform to the dimensions as shown on the drawings. Ducts shall be spiral type, minimum 26 ga. straight and smooth on the inside with airtight joints. Ducts shall be constructed of galvanized steel and sealed in accordance with standard SMACNA methods, for the system designed negative pressure in inches w.g. All duct joints to be sealed and air tight with high velocity duct sealant.

B. Duct Fittings: Reducing fittings shall have a minimum of 1" graduating increase in diameter per 8" length. Elbows up to 12" in diameter shall have a centerline radius of not less than 1.5 times the diameter. Elbows beyond 12" in diameter shall have a centerline radius of not less than 2.5 times the diameter. Branches shall enter the mains at a specified angle of not less than 30 degrees with the centerline of the main duct in the direction of airflow, unless otherwise indicated or approved. Flexible connections to the main for branch duct shall be braced with approved metal straps or members.

C. Connections: Where duct of dissimilar metals are connected or where sheet metal connections are made to fan inlet and outlet, only an approved fireproof flexible connection shall be used. The connection shall be installed and securely fastened by zinc coated steel clinch type draw bands for round ducts.

D. Stack-head: The exhaust discharge stack-head will be a "no loss" type as recommended by ACGIH or as otherwise specified. The stack-head design will protect against weather elements or introduction of debris.

## 2.6 CONTROLS AND COMPONENTS

A. The Contractor shall provide and install a multi-functional fan start control system in a NEMA 12 box. The control system console and all internal components shall be UL listed.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Exhaust System: The exhaust removal system shall be installed as indicated and recommended by the manufacturer. Welding and brazing shall conform to ASME-17. Slip joints shall be sealed. Riser duct shall be supported to the structure as indicated on the drawings. Main duct shall be attached to building structural members.

B. Building Surface Penetrations: All penetrations shall be sealed. Sleeves or framed openings shall be utilized where duct penetrates building surfaces. The space between the sleeve or framed opening and the duct shall be packed with mineral wool or approved material. Collars shall fit tight against the building surfaces and snug around the duct.

C. Guide Track: Installation shall adhere strictly to factory instructions, dimensions and recommendations.

### 3.2 TESTING

A. Each exhaust system shall be tested and operating according to these specifications within 10 percent at the conditions shown. Any fans with bearings shall be lubricated and the speed, direction and rotation of each fan shall be checked and verified as running correctly. The running current of each motor shall be checked and verified as correct. Upon completion and prior acceptance of the installation, the exhaust system shall be tested at the operating conditions to demonstrate satisfactory functional and operating efficiency. All instruments, facilities and labor required to properly conduct the tests shall be provided by the Contractor.

### 3.3 DEMONSTRATION

A. The contractor or authorized approved personnel shall provide Owner's maintenance personnel training in the daily operation of and maintenance of the vehicle exhaust removal system.

END OF SECTION



SECTION 15900  
HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Related Sections include the following:

1. Section "Sequence of Operation" for requirements that relate to this Section.

1.3 DEFINITIONS

A. PID: Proportional plus integral plus derivative.

B. RTD: Resistance temperature detector.

1.4 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.

2. Schematic flow diagrams showing fans, coils, dampers, and control devices.

3. Wiring Diagrams: Power, signal, and control wiring.

4. Schedule of dampers including size, leakage, and flow characteristics.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. Include the following:

1. Maintenance instructions and lists of spare parts for each type of control device.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

B. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

## 1.7 QUALITY ASSURANCE

A. Installer Qualifications: control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Manufacturer Qualifications: Engage a firm experienced in manufacturing control systems similar to those indicated for this Project and that have a record of successful in-service performance.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

## 1.9 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment with Division 16 to achieve compatibility with equipment that interfaces with the fire alarm system.
- C. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.
- D. Coordinate equipment with Division 16 to achieve compatibility of communication interfaces.
- E. Coordinate equipment with Division 16 to achieve compatibility with starter coils and annunciation devices.
- F. Coordinate equipment with Division 16 to achieve compatibility with motor starters and annunciation devices.
- G. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section "Cast-in-Place Concrete."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 CONTROL SYSTEM

- A. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.
- B. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. UL recognized DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
  - 1. Output ripple of 5.0 mV maximum peak to peak.
  - 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
  - 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

C. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

D. Relays:

1. Control relays shall be UL listed plug-in type with dust cover. Contract rating, configuration and coil voltage suitable for application.

2. Time delay relays shall be UL listed solid state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration and coil voltage suitable for application. Provide NEMA 1 Type enclosure when not installed in local control panel.

### 2.3 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Room Sensor Cover Construction: Manufacturer's standard locking covers.

1. Set-Point Adjustment: Exposed.
2. Set-Point Indication: Exposed.

C. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.
2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base.

### 2.4 THERMOSTATS

A. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.

1. Label switches "FAN ON-OFF".
2. Mount on single electric switch box.

B. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

C. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.

2. Selector Switch: Integral, manual on-off-auto.

D. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, and the following:

1. Reset: Manual.

E. Programmable Thermostats:

1. HVAC unit thermostats shall be manufacturer's standard electronic 7-day programmable model having a Off-Em-Ht.-Heat-Auto-Cool System switch and an Auto-On Fan switch. Provide multi-stage heating and cooling thermostat where controlled unit has multi-stage capability. Outdoor thermostat shall prevent strip heat from being energized above 45 degrees F. (Emergency heat position not required for non-heat pump unit.)

2. System switching positions shall control thermostat operation as follows:

a. OFF - heating and cooling systems are off. If the fan switch is at the AUTO position, the cooling fan is also off.

b. HEAT - heating system is controlled by the thermostat. Cooling system is off.

c. AUTO - thermostat automatically switches between heat and cool modes, depending upon the indoor temperature.

d. COOL - thermostat controls the cooling system. Heating system if off.

e. EM.HT (Heat Pump Units Only) - emergency heat relay is energized on call for heat. Cooling system is off. Compressor is de-energized.

3. Fan switching positions shall control fan operation as follows:

a. ON - fan operates continuously.

b. AUTO - fan operates as controlled by the thermostat in heat pump systems for conventional cooling mode; fan shall operate as controlled by plenum switch in conventional heating mode.

4. Thermostat shall be furnished with the following features:

a. Override function.

b. Set up for four separate temperatures per day.

c. Battery replacement without program loss.

d. Proportional plus integral control.

e. Automatic changeover from cooling to heating.

f. Keypad lockout.

5. Thermostat display features include the following:
  - a. Time of day.
  - b. Actual room temperature.
  - c. Programmed temperature.
  - d. Day of week.
  - e. System mode indications include "heating," "off," "fan auto," and "fan on."

## 2.5 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Section "Common Motor Requirements for HVAC Equipment."

2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

3. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.

4. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Dampers: Size for running torque calculated as follows:
  - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
  - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
  - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
  - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
  - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
  - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

2. Coupling: V-bolt and V-shaped, toothed cradle.

3. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
4. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
5. Power Requirements (Two-Position Spring Return): 24 Volt.
6. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
7. Temperature Rating: Minus 22 to plus 122 deg F.
8. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
9. Run Time: 12 seconds open, 5 seconds closed.

## 2.6 DAMPERS

### A. Manufacturers:

1. Air Balance Inc.
2. Don Park Inc.; Autodamp Div.
3. TAMCO (T. A. Morrison & Co. Inc.).
4. United Enertech Corp.
5. Vent Products Company, Inc.

B. Dampers: AMCA-rated, parallel or opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.

2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.

4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

## 2.7 SMOKE DETECTORS

A. Smoke detectors shall be located in the duct upstream of each smoke or combination fire/smoke damper. Detectors shall also be located on the wall adjacent to each smoke or combination fire/smoke damper located in plenum smoke partition.

B. In systems of over 2,000 cfm capacity smoke detectors approved for duct installation shall be installed at a suitable location in:

1. The main supply duct downstream of the unit filter and supply fan.

C. Smoke detectors and duct housings shall be provided under Div. 16. Detectors shall be compatible with existing fire alarm system and shall be approved by the Owner.

D. Detectors and duct housings used to activate smoke dampers and shut down air handlers shall be mounted under Division 15. Detectors shall be mounted in accordance with NFPA 72.

1. Sampling tubes shall extend full width of duct.
2. Provide access door at smoke detector.
3. Test/reset switches for smoke detectors are furnished and installed under Division 16.

## 2.8 SMOKE DAMPERS AND COMBINATION SMOKE AND FIRE DAMPERS

A. Smoke dampers and combination smoke and fire dampers will be provided under Division 15. Control of dampers shall be under this section and in sequence of operation.

B. A status panel for smoke dampers shall be provided in the ceiling below the individual dampers. Panel shall contain a red neon pilot light that shall be illuminated when damper is closed.

C. Provide damper position interlock to ensure that smoke dampers are open 100% before unit fan is started.

## 2.9 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 16 Sections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify that power supply is available to control units. Where not indicated otherwise, obtain power for control units from the nearest un-switched receptacle circuit.

B. Verify that all field end devices and wiring are installed before proceeding with installation.

### 3.2 INSTALLATION

A. Install software in control units. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 54 inches above the finished floor unless noted otherwise. Install wall thermostats minimum 8" away from door or window frames. Coordinate location with switches and other devices provided under other Divisions.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.
3. Where indicated.

E. Install automatic dampers according to Section "Air Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install labels and nameplates to identify control components according to Section "Identification for HVAC Piping and Equipment."

H. Install refrigerant instrument wells, valves, and other accessories according to Section "Refrigerant Piping."

I. Install duct volume-control dampers according to Section "Metal Ducts".

J. Install electronic and fiber-optic cables according Division 16.

### 3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 16.

B. Install building wire and cable according to Division 16.

C. Install signal and communication according to Sections in division 16.

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.

2. Route all wiring in plenum rated cable secured to structure.

a. Exception: All wiring associated with smoke detectors, smoke dampers, fire alarm shutdowns and similar systems shall be routed in conduit.

3. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.

4. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

5. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

6. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

### 3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.

2. Test and adjust controls and safeties.

3. Test each point through its full operating range to verify that safety and operating control set points are as required.

4. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.

5. Test each system for compliance with sequence of operation.

6. Test software and hardware interlocks.

B. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

### 3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.

2. Make three-point calibration test for both linearity and accuracy for each analog instrument.

3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.

4. Temperature:

a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.

b. Calibrate temperature switches to make or break contacts.

5. Stroke and adjust control dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.

6. Stroke and adjust control dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.

7. Provide diagnostic and test instruments for calibration and adjustment of system.

8. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

### 3.6 DEMONSTRATION AND TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls.

B. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

C. Include a minimum of 4 hours dedicated instructor time on-site.

D. Schedule training with Owner with at least 7 days' notice.

END OF SECTION



SECTION 15940  
SEQUENCE OF OPERATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Section "HVAC Instrumentation & Controls" for control equipment and devices and for submittal requirements.

1.3 SMOKE DETECTORS AND SMOKE DAMPERS

A. In systems with air handling capacity above 2,000 CFM and up to and including 15,000 CFM and all units serving egress corridors, the smoke detector mounted in the unit or main ductwork shall, when sensing smoke, shut down the Air Handling Unit. The smoke detectors shall be connected to the fire alarm system. The actuation of smoke detector shall activate a visible and supervisory signal at a constantly attended location. Where an outdoor condensing unit or heat pump is used it shall shut down those components.

B. Smoke (or Combination) Damper/Smoke Detector: Upon sensing smoke at the detector, the damper shall close. When the damper is closed, the indicator light shall illuminate on the ceiling below the damper.

1.4 ENERGY CONSERVATION

A. Dead Band: Where used to control both heating and cooling, zone thermostats shall be capable of providing a temperature dead band of at least 5°F in accordance with ASHRAE standard 90.1.

B. All HVAC systems/units shall be scheduled for operation by the programmable thermostat. Coordinate the occupancy schedules with the Owner.

C. In unoccupied mode, the temperature set point shall be set back to 50°F (adjustable) for heating 85°F (adjustable) for cooling. Units shall run only as required to maintain setback temperatures. Outside air dampers shall be closed during unoccupied mode.

D. HVAC systems shall energize to cool or warm the spaces to normal occupied setpoint in morning warm up/ cool down mode. Outside air dampers shall NOT be open during warm-up/cool-down mode.

E. Outside air dampers shall only be open when the building is in occupied mode.

F. Individual HVAC units shall be equipped with override features on unit thermostats. When the button is activated, the unit shall operate in occupied mode for a period determined by the Owner.

## 1.5 SAFETY SYSTEMS

A. All Air-handling units shall de-energize on any general building fire alarm activation.

B. An emergency air handling system shutdown switch shall be located adjacent to the main fire alarm panel. All air handling units shall de-energize whenever the master shutdown switch located at the main fire alarm panel is activated.

## 1.6 RELIABILITY AND GENERAL ALARM SYSTEMS

A. Auto Restart: All HVAC systems and equipment shall be configured such that normal operation is resumed after a power failure.

## 1.7 TERMINAL UNIT OPERATING SEQUENCE

A. Unit Heater, Electric: Room thermostat cycles fan and sequences stages of heating.

## 1.8 UNITARY SYSTEMS

A. Gas furnace Units with evaporator coils:

1. Units shall be controlled by programmable thermostats.
2. Runtime of the unit shall be scheduled by the programmable thermostat. During unoccupied mode, outside air damper shall be closed (where applicable.)
3. When unit is scheduled to run, the compressor, furnace, and supply fan shall energize in heating or cooling mode as required to satisfy the thermostat setpoint.
4. Outside air damper shall be open.

B. Split Systems (ductless):

1. Split systems shall be controlled by individual, unit furnished thermostats. Heating or cooling shall be energized as required to maintain space temperature.

## 1.9 VENTILATION SEQUENCES

A. Exhaust Fan: See fan schedule on drawings.

1. Where fans are indicated to be interlocked with room lighting, furnish starters/contactors as required for control operation.

2. Exhaust Fan: Where exhaust fan serves more than a single space; provide a line voltage relay for each room and connect relays in parallel so that turning lights on in any room will start exhaust fan.

B. Commercial Kitchen Ventilation:

1. Range Hood control panel shall have separate switches for supply fan and exhaust fan. Fans shall be interlocked such that supply (makeup air) fan cannot run unless exhaust fan is running.

2. Exhaust fan (and makeup unit) shall energize whenever switched on manually or when heat is detected in the hood.

3. Equipment under range hood shall be interlocked such that all fuel and power sources are shut off in the event of a fire suppression system discharge.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION



SECTION 15950  
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems: Constant-volume air systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article in Part 3.

D. Sample report forms.

E. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

F. Progress Reports: as specified in "Reporting" Article in Part 3.

G. Certified TAB reports: as specified in "Final Report" Article in Part 3.

## 1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.

2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms certified by the test and balance agent.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

## 1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## 1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Contract Document Review:

1. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment. Notify Architect of any such conditions.

2. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible. Notify Architect if any devices are found to be in inaccessible locations.

3. Examine the approved submittals for HVAC systems and equipment. Notify Architect of any discrepancies found between design contract documents and approved submittals.

B. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

C. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

D. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

F. Examine test reports specified in individual system and equipment Sections.

G. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

H. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

I. Examine operating safety interlocks and controls on HVAC equipment.

J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Automatic temperature-control systems are operational.
  - 3. Equipment and duct access doors are securely closed.
  - 4. Balance, smoke, and fire dampers are open.
  - 5. Isolating and balancing valves are open and control valves are operational.
  - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section "Air Duct Accessories."
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section "Duct Insulation," and Section "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section "Metal Ducts."

### 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  - 2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### 3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

### 3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

### 3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load.
5. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

### 3.9 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 to minus 5 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

### 3.10 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Progress Reports: Conduct regular site inspections and prepare progress reports to include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.

2. Manufacturers' test data.

3. Field test reports prepared by system and equipment installers.

4. Other information relative to equipment performance; do not include Shop

Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.

2. Name and address of the TAB contractor.

3. Project name.

4. Project location.

5. Architect's name and address.

6. Engineer's name and address.

7. Contractor's name and address.

8. Report date.

9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
  - a. Indicated versus final performance.
  - b. Notable characteristics of systems.
  - c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
  - a. Settings for outdoor-, return-, and exhaust-air dampers.
  - b. Conditions of filters.
  - c. Cooling coil, wet- and dry-bulb conditions.
  - d. Fan drive settings including settings and percentage of maximum pitch diameter.
  - e. Settings for supply-air, static-pressure controller.
  - f. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Balancing stations.
4. Position of balancing devices.

E. Apparatus-Coil Test Reports:

1. Coil Data:
  - a. System identification.
  - b. Location.
  - c. Coil type.

- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft..
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Refrigerant expansion valve and refrigerant types.
- h. Refrigerant suction pressure in psig.
- i. Refrigerant suction temperature in deg F.

F. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Fuel type in input data.
- g. Output capacity in Btu/h.
- h. Ignition type.
- i. Burner-control types.
- j. Motor horsepower and rpm.
- k. Motor volts, phase, and hertz.
- l. Motor full-load amperage and service factor.
- m. Sheave make, size in inches, and bore.
- n. Center-to-center dimensions of sheave, and amount of

adjustments in inches.

2. Test Data (Indicated and Actual Values):

- a. Total air flow rate in cfm.
- b. Entering-air temperature in deg F.
- c. Leaving-air temperature in deg F.
- d. Air temperature differential in deg F.
- e. Entering-air static pressure in inches wg.
- f. Leaving-air static pressure in inches wg.
- g. Air static-pressure differential in inches wg.
- h. Low-fire fuel input in Btu/h.
- i. High-fire fuel input in Btu/h.

- j. Manifold pressure in psig.
- k. High-temperature-limit setting in deg F.
- l. Operating set point in Btu/h.
- m. Motor voltage at each connection.
- n. Motor amperage for each phase.
- o. Heating value of fuel in Btu/h.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches, and bore.
- h. Center-to-center dimensions of sheave, and amount of

adjustments in inches.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Suction static pressure in inches wg.

H. Round, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

- a. System and air-handling-unit number.
- b. Location and zone.
- c. Traverse air temperature in deg F.
- d. Duct static pressure in inches wg.
- e. Duct size in inches.
- f. Duct area in sq. ft..
- g. Indicated air flow rate in cfm.

- h. Indicated velocity in fpm.
- i. Actual air flow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

I. Instrument Calibration Reports:

- 1. Report Data:
  - a. Instrument type and make.
  - b. Serial number.
  - c. Application.
  - d. Dates of use.
  - e. Dates of calibration.

3.12 INSPECTIONS

- A. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 16000  
GENERAL

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS

A. All work of Section 16 shall comply with the requirements of:

1. General Conditions
2. Supplementary General Conditions
3. General Requirements
4. Specifications
5. Drawings
6. Modifications incorporated in the documents before their execution.

1.2 WORK INCLUDED

A. This Division of the specifications (16000) covers the complete interior and exterior electrical system for all work shown on the drawings as specified herein providing all material, labor and equipment required for the installation of the electrical systems complete and in operating condition.

B. Include in the electrical work all the necessary supervision and the issuing of all coordinating information to any other trades who are supplying work to accommodate the electrical installations.

1.3 DRAWINGS

A. The drawings for electrical work utilize symbols and schematic diagrams which have no dimensional significance. The work shall therefore, be installed to fulfill the diagrammatic intent expressed on the electrical drawings.

B. Review architectural drawings for door swings, cabinets, counters, moldings and built-in equipment, conditions indicated on architectural drawings shall govern. Prior to rough-in of receptacles and systems outlets, refer to architectural casework drawings for rough-in coordination.

C. Coordinate electrical work with the architectural details, floor plans, elevations, structural and mechanical drawings. Provide fittings, junction boxes and accessories to meet conditions.

D. Do not scale drawings. Dimensions for layout of equipment, or spaces shall be obtained from architectural, structural or mechanical drawings unless specifically indicated on the electrical drawings.

E. Discrepancies shown on different drawings, between drawings and specifications or between drawings and field conditions shall be promptly brought to the attention of the Architect.

F. Provide as used on the drawings and in the specifications shall mean, furnish, install, connect, adjust and test.

G. The drawings and specifications are complimentary and any work or material shown in one and omitted in the other, or described in the one and not shown in the other, or which may be implied by both or either, shall be furnished as though shown on both, in order to give a complete and first class installation.

#### 1.4 SITE INVESTIGATION

A. Potential Contractors shall visit the project site prior to bid date to satisfy themselves as to the existing conditions and distances which may effect the cost of the project. Where work under this project requires extension, relocation, re-connecting or modifications to existing equipment or systems, the existing equipment or systems, shall be restored to their original condition, with the exception of the work under this contract, before the completion of this project.

#### 1.5 SHOP DRAWINGS

A. Submit for approval by the Architect all materials and equipment to be incorporated in the electrical work.

B. Submit only shop drawings which comply with the contract documents. Shop drawings shall be checked and corrected by the Contractor before they are submitted to the Architect. Shop drawings that are not corrected by the Contractor shall be returned for correction without detailed notations by the Architect as to the necessary corrections.

C. Mark each individual submittal item to show specification section which pertains to the item.

D. Submit information as required under SUBMITTALS, for each of the individual electrical sections of the specifications.

E. Data submitted shall contain all information required to indicate compliance with equipment specified.

F. Submit field information drawings to explain fully all procedures involved in erecting, mounting and connecting all items of equipment which differ from that specified.

G. When Shop Drawings are reviewed, some errors may be detected but others may be overlooked. This does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, the requirements of the Drawings and Specifications shall be followed and are not waived or superseded in any way by the Shop Drawing review.

#### 1.6 RECORD DRAWINGS:

A. One complete set of electrical drawings shall be reserved for as-built drawings. Any approved deviation from the contract drawings shall be recorded on these drawings. Drawings shall be checked monthly for completeness.

B. Completed as-built drawings shall be presented to the Architect prior to final inspection.

## 1.7 MAINTENANCE AND OPERATING INSTRUCTIONS:

A. Provide at the time of final inspection three sets of maintenance and operating instruction for:

1. Lighting and Power Panelboards
2. Fuses
3. Wiring Devices
4. Lighting Fixtures and Lamps
5. Occupancy Sensors
6. Disconnect Switches
7. Lighting Control System
8. Fire Alarm System
9. Engine Generator
10. Surge Protection System
11. Building Communication and Program System
12. Data/Voice Network Cabling System

B. Furnish a qualified and accredited factory trained technician to train personnel designated by the Owner in the proper operation and maintenance of specialized equipment.

C. The issuing of operating instructions shall include the submission of the name, address, and telephone number of the manufacturer's representative and service company for each item of equipment so that service and spare parts can be readily obtained.

## 1.8 CODES AND PERMITS:

A. All electrical work shall meet or exceed the latest requirements of the following codes and/or other authorities exercising jurisdiction over the electrical construction work and the project.

1. The National Electrical Code (NFPA 70) - 2014 Edition
2. The National Electrical Safety Code (ANSI C-2)
3. The Life Safety Code (NFPA 101) - 2008 Edition
4. The International Building Code - 2008 Edition
5. Regulations of the local utility company with respect to metering and service entrance.
6. Municipal and State ordinances governing electrical work.

B. All required permits and inspection certificates shall be obtained, and made available at the completion of the work. Permits, inspections, and certification fees shall be paid for as a part of the electrical work.

## 1.9 DEVIATIONS:

A. No deviations from the plans and specifications shall be made without the full knowledge and consent of the Architect or his authorized representative.

B. Should the Contractor find at any time during progress of the work that, in his judgment, existing conditions make desirable a modification in requirements covering any particular item or items, he shall report such items promptly to the Architect for his decision and instruction.

#### 1.10 COOPERATION:

A. This Contractor shall schedule his work and in every way possible cooperate with all other Contractors on the job to avoid delays, interferences, and unnecessary work. He shall notify them of all openings, hangers, excavations, etc., so that proper provisions shall be made for his work. This shall not relieve him of the cost of cutting, when such is required.

B. This Contractor shall do all cutting and excavating necessary for the complete installation of his work, but he shall not cut the work of any other Contractor without first consulting the Architect. He shall repair any work damaged by him or his workmen, employing the services of the Contractor whose work is damaged. Saw cut existing slab as required for routing conduits and floor boxes noted to be installed in existing floors. Restore to original finish.

C. This Contractor shall by all means coordinate the location of ceiling lighting fixtures, both recessed and surface mounted, with the Ceiling Contractor so that proper hangers and supports shall be provided.

D. Any conflict between electrical and other trades shall be reported before construction starts. No extra charges will be approved for work resulting from failure to coordinate with other trades.

#### 1.11 INSTALLATION:

A. Raceways, fixtures, devices, and other electrical equipment shall be installed in a neat and workmanlike manner and in accordance with recognized good practice for a first class installation.

B. The Architect or his representative shall have the authority to reject any workmanship not complying with the contract documents.

C. The Electrical Contractor shall personally or through an authorized licensed and competent electrician, constantly supervise the work from beginning to complete and final inspection.

D. Electrical equipment shall be installed in accordance with manufacturer's recommendations.

E. Locations of proposed raceway, riser, location of structural elements, location and size of chases method and type of construction of floors, walls, partitions, etc., shall be verified before construction starts.

F. Consult owner and utility companies for underground lines before any underground work is started. Contractors shall be responsible for any damage.

G. All empty conduits shall have a pull string installed. All flush recessed boxes shall have blank plates installed.

## 1.12 EXCAVATION, TRENCHING AND BACKFILLING:

A. General. The Contractor shall perform all excavation to install conduit structures and equipment specified in this Division of the Specifications. During excavation, materials for backfilling shall be piled back from the banks of the trench to avoid over-loading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and other excavations and water accumulating therein shall be removed by pumping. All excavations shall be made by open cut. No tunneling shall be done. All requirements of OSHA shall be complied with.

B. Trench Excavation. The bottom of the trenches shall be graded to provide uniform bearing and support for each section of the conduit on undisturbed soil at every point along its entire length. Over depths shall be backfilled with loose, granular, moist earth, tamped. Removed unstable soil that is not capable of supporting the conduit and replace with specified material.

C. Backfilling. The trenches shall not be backfilled until it is reviewed by the Architect or his representative. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, and gravel or soft shale, free from large clods of earth or stones, deposited in 6" layers and tamped until the conduit has a cover of not less than the adjacent existing ground but not greater than 2" above existing ground. The backfilling shall be carried on simultaneously on both sides of the trench so that conduit is not displaced. The compaction of the filled trench shall be at least equal to that of the surrounding undisturbed material, except that trenches occurring under paved areas or in areas to be filled shall be backfilled in 6" maximum layers and each layer compacted to 95% maximum density. Settling the backfill with water will not be permitted. Any trenches not meeting compaction requirements or where settlement occurs shall have backfill removed down to the top of the conduit then backfill with approved materials as specified hereinbefore.

D. Positively no tree roots are to be damaged, hand dig where required. Damaged trees or shrubbery shall be replaced in kind and must be approved by Engineer.

## 1.13 MATERIALS:

A. Materials specified by manufacturer's name shall be used unless approval of other manufacturers are listed in addenda to these specifications. Request for prior approval shall be submitted by mail only. Facsimile will not be acceptable.

B. Drawings indicating proposed layout of space, all equipment to be installed therein and clearance between equipment shall be submitted, where substitution of materials alter space requirements on the drawings.

C. Material Standards: All materials shall be new and shall conform to the standards where such have been established for the particular material in question. Publications and Standards of the organization listed below are applicable to materials specified herein.

1. American Society for Testing and Materials (ASTM)
2. Underwriter's Laboratories, Inc. (UL)
3. National Electrical Manufacturer Association (NEMA)
4. Insulated Cable Engineers Association (ICEA)
5. Institute of Electrical and Electronic Engineers (IEEE)

6. National Fire Protection Association (NFPA)
7. American National Standards Institute (ANSI)

D. Material of the same type shall be the product of one manufacturer.

E. Materials not readily available from local sources shall be ordered immediately upon approval.

F. The Architect shall have authority to reject any materials, or equipment, not complying with these specifications and have the Contractor replace materials so rejected immediately upon notification of rejection.

G. Any material or equipment so rejected shall be removed from the job within 24 hours of such rejection, otherwise the Architect may have same removed at the Contractor's expense.

#### 1.14 EQUIPMENT CONNECTIONS:

A. All equipment requiring electrical power connections shall be connected under this Division of these specifications.

B. Where electrical connections to equipment require specific locations, such locations shall be obtained from shop drawings.

C. Drawings for location of conduit stub-up boxes mounted in wall or floor to serve specific equipment, shall not be scaled.

D. Electrical circuits to equipment furnished under other sections of these specifications are based on design loads. If actual equipment furnished has loads other than design loads electrical circuits and protective devices shall be revised to be compatible with equipment furnished at no additional cost to the Owner. Any revisions must have prior approval by the Architect. Before submitting shop drawings, Electrical Sub-Contractor shall along with the Mechanical and Plumbing Sub-Contractor review voltage and load requirements for mechanical and plumbing equipment to determine the compatibility between what is being furnished and what is shown in the contract drawings. The Electrical Sub-Contractor shall along with his submittals submit a statement that he has reviewed all shop drawings including review with the Mechanical and Plumbing Sub-Contractors.

E. Where equipment is indicated to be served thru conduit stub-up, conduit shall be stubbed up not less than four inches above floor where transition shall be made to seal-tite flexible conduit for connection to equipment.

F. The Contractor's attention is invited to other Divisions of these specifications, where equipment requiring electrical service or electrically related work is specified to become fully aware of the scope of work required for electrical service or related work.

G. Where electricity utilizing equipment is supplied separate from the electrical work, and is energized, controlled or otherwise made operative by electrical work, the testing to provide the proper functional performance of such wiring systems shall be conducted by the trade responsible for the equipment. The electrical work shall, however, include cooperation in such testing and the making available of any necessary testing or adjustments to the electrical equipment.

H. Heating, air conditioning, and ventilating equipment is specified to be furnished and installed under other sections of these specifications. The controls, likewise are specified to be furnished thereunder. All necessary wiring, wiring troughs and circuit breakers for power for this equipment shall be furnished and installed under this section of the specifications, in accordance with the plans and/or diagrams furnished with the equipment, or shown on these plans. Starters furnished by the Mechanical Contractor shall be installed under this Division of the specifications. Power wiring to auxiliary equipment on a piece of equipment remote from its main terminal box and interlocking of apparatus shall be accomplished under Heating Ventilating Equipment section of the specifications. Conduit and outlets for control wiring shall be furnished and installed under Division 15 of these specifications. Control conductors for mechanical equipment shall not be installed in same conduit with power conductors.

I. Contractor is to note that location of disconnect switches shown are schematic in nature. Exact location of disconnect switch and mounting height shall be coordinated with field conditions and equipment shop drawings. Locate disconnect as required to maintain clearances required by National Electrical Code.

J. Contractor shall provide a rooftop mounted, GFCI receptacle with weatherproof cover within 20' of a rooftop mounted HVAC unit. Serve from closest receptacle circuit with ½"C., 3#12's. See mechanical plan for unit locations.

#### 1.15 PRODUCT DELIVERY, STORAGE, HANDLING, & PROTECTION

A. Inspect materials upon arrival at Project and verify conformance to Contract Documents. Prevent unloading of unsatisfactory material. Handle materials in accordance with manufacturer's applicable standards and suppliers recommendations, and in a manner to prevent damage to materials. Store packaged materials in original undamaged condition with manufacturer's labels and seals intact. Containers which are broken, opened, damaged, or watermarked are unacceptable and shall be removed from the premises.

B. All material, except items specifically designed to be installed outdoors such as pad mounted transformers or stand-by generators, shall be stored in an enclosed, dry building or trailer. Areas for general storage shall be provided by the Contractor. Provide temperature and/or humidity control where applicable. No material for interior installation, including conductors, shall be stored other than in an enclosed weather tight structure. Equipment stored other than as specified above shall be removed from the premises.

C. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Conditions shall be those for which the equipment or materials are designed to be installed. Equipment and materials shall be protected from water, direct sunlight, cold or heat. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

#### 1.16 CLEANING AND PAINTING

A. Remove oil, dirt, grease and foreign materials from all raceways, fittings, boxes, panelboard trims and cabinets to provide a clean surface for painting. Touch-up scratched or marred surfaces of lighting fixtures, panelboard and cabinet trims, motor control center, switchboard or equipment enclosures with paint furnished by the equipment manufacturers specifically for that purpose.

B. Do not paint trim covers for flush mounted panelboards, telephone cabinets, pull boxes, junction boxes and control cabinet unless required by the Architect. Remove trim covers before painting. Under no conditions shall locks, latches or exposed trim clamps be painted.

C. Unless indicated on the drawings or specified herein to the contrary, all painting shall be done under the PAINTING Section of these Specifications.

D. Where plywood backboards are used to mount equipment provided under Division 16, paint backboards with two coats of light grey semi-gloss paint. Plywood shall be 3/4" fire rated plywood. Paint shall be fire retardant paint.

#### 1.17 GUARANTEE:

A. Defective lamps shall be replaced up-to-date of acceptance and shall be guaranteed for one year.

B. All systems and component parts shall be guaranteed for one year from the date of final acceptance of the complete project. Defects found during this guaranteed period shall be promptly corrected at no additional cost to the Owner.

#### 1.18 SERVICE:

A. Before installing service conduit (underground or mast), Contractor shall contact Utility Company and verify voltage, location and type of service. Prior to rough-in, coordinate an on-site meeting with each Utility Company to review exact requirements. Submit letter of coordination to Engineer for review.

B. Where contract documents show a pad mount transformer provide by Utility Company, the following items shall be coordinated with Civil Plans, Architectural Plans, and Utility Company prior to rough-in.

1. Transformer pad locations shall be a minimum of 10'-0" from any building overhangs, canopies, exterior walls, balcony, exterior stairs and or walkways connected to the building.

2. Transformer pad edge shall be no less than 14'-0" from any door way or window.

3. If the building has an overhang, the 10'-0" clearance shall be measured from a point below the edge of the overhang only if the building is three (3) stories or less. If the building is four (4) stories or more, 10'-0" shall be measured from the outside building wall.

4. Fire escapes, outside stairs, and covered walkways attached to or between buildings, shall be considered part of the building.

Note: The information above has been obtained from the NFPA Section 450-27 and the Office of Insurance and Safety Fire Commissioner Chapter 120-3-3.

5. If required by Utility Company, Contractor shall provide concrete pad for transformer per Utility Company requirements.

6. Contractor shall install meter (provided by Utility Company) on a 6" channel iron set in concrete. Paint channel iron to match transformer. Install 1 ¼" galvanized rigid steel conduit from meter to transformer C.T. compartment.

7. Install a 1" galvanized rigid steel conduit from meter and stubbed up into Main Electrical Room for future energy management monitoring. Install pull string and cap conduit.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION



SECTION 16010  
LIGHTING AND POWER PANELBOARDS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Complete panelboard shop drawings shall be submitted, listing as a minimum the following items:

1. Voltage rating.
2. Bus assembly rating.
3. Main breaker rating by capacity, number of poles and interrupting rating in RMS symmetrical amperes.
4. Surface or flush mounting.
5. Listing of branch breakers by capacity number of poles and interrupting rating in RMS symmetrical amperes.
6. Top or bottom feed.
7. A schedule similar to that shown on the drawings, depicting branch breaker arrangement and breaker sizes and giving full explanation for any difference between the two.
8. Coordinate lug sizes as required for feeders shown on drawings.

B. Contractor shall submit ¼" layouts of all electrical rooms delineating placement of equipment of minimum required clearances specified in National Electrical Code.

PART 2 - PRODUCTS

1.2 MANUFACTURERS

A. For the purpose of selecting quality and types of panels, equipment as manufactured by Square "D" Company has been specified. Following manufacturers meeting these specifications are acceptable.

1. G. E.
2. Siemens
3. Cutler Hammer

PART 3 - EXECUTION

1.3 EQUIPMENT

A. Furnish and install circuit breaker lighting and power panelboards as indicated in the panelboard schedule and where shown on the plans. Panelboards shall be of the dead-front safety type, equipped with thermal magnetic molded case circuit breakers with frame and trip rating as shown in the schedule.

B. Circuit breakers shall be HACR rated, quick-make, quick-break, thermal-magnetic, trip-indicating, and have common trip on all multi-pole breakers. Trip indication shall be clearly shown by the breaker handle taking position between ON and OFF, when the breaker is tripped. Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip setting of not more than 10 times the trip rating of the breakers. Connection to bus in all panels shall be bolted. All breakers shall be 20 ampere trip, unless otherwise shown. All breakers shall be minimum for 120/208 volts (22,000) A.I.C. unless otherwise noted.

C. Bus bar connections to the branch circuit breakers shall be the distributed phase type. Three-phase, four-wire bussing shall be such that any three adjacent single-pole breakers are individually connected to each of the three different phases in such a manner that two or three-pole breakers can be installed at any location. All current-carrying parts of the bus assembly shall be copper. Main ratings shall be as shown in the panelboard schedule on the drawings.

D. Panel front shall be provided with a continuous piano hinge on one side. Cutler Hammer "EZ-Trim" is not acceptable.

E. A steel circuit directory frame permanently attached (spot welded) at factory (not glued), and card with a clear plastic covering shall be provided on the inside of the door. The directory card shall provide a space at least 1/4" high x 3" long for each circuit.

F. All panels shall be equipped with a copper equipment grounding bar. The bar shall have lugs of sufficient size to handle all grounding conductors.

G. Sub-feed circuit breakers are not permitted in panels unless specifically called for.

H. Provide mounting hardware for all spaces shown on panelboard schedule.

I. Panelboard circuit numbering shall be such that starting at the top, odd numbering shall be used in sequence down the left hand side and even numbers down the right hand side.

J. Except where otherwise indicated on the drawings or required to avoid conflicts, mount the panelboards so the tops of the cabinets will be 6 feet above the finished floors. For panelboards which are too high, mount them so the bottoms of the cabinets will be not less than 6 inches above the finished floors.

K. Locate the cabinets so that present and future conduits can be connected to them conveniently. Coordinate the dimensions of the cabinets with the dimensions of the spaces designated for installation prior to fabrication of the cabinets. Cabinet shall be minimum 20" wide.

L. Wiring in panelboards shall be neatly grouped and secured with ty-wraps.

M. Electrical panels shall not be used as wireways or junction boxes for control conductors.

N. Where spaces are called for in a panel, all mounting hardware shall be provided for the frame size indicated.

O. Splices in panelboards are not permitted.

END OF SECTION

SECTION 16015  
FUSES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop drawings shall be submitted and shall consist of manufacturer's published literature and technical data sufficient for the engineer to determine whether system function will be adversely affected, whether proposed fuses meet this specification, and whether they are equal in quality.

1.2 MANUFACTURERS

A. Acceptable manufacturers are:

1. Littelfuse
2. Cefco
3. Gould - Shawmut

1.3 EQUIPMENT / MATERIAL

A. All fuses rated 600 volts or less and used for main, feeder, or branch circuit protection with 200,000 ampere interrupting rating and shall be so labeled. Fuse classes and sizes indicated on the drawings have been selected to provide a fully coordinated selective protection system. To maintain this design, all fuses provided shall be furnished by the same manufacturer. Should equipment provided require a different U.L. Class or fuse size, the engineer shall be furnished with sufficient data to ascertain that system function will not be adversely affected.

B. Current-Limiting Fuses 601-6000 Amperes

Fuses rated over 600 amperes shall be U.L. Class "L" fuses, and shall have a minimum time delay of 10 seconds at 500% rating.

C. Current-Limiting Fuses 600 Amperes or Less

All fuses 600 amperes and below shall be true dual-element time delay fuses with separate spring-loaded thermal overload elements in all ampere ratings. All ampere ratings shall be designed to open at 400 degrees Fahrenheit or less when subjected to a non-load oven test. To eliminate induction heating, all fuse ferrules and end caps shall be non-ferrous and shall be bronze or another alloy not subject to stress cracking.

D. Spare Fuses

At the time of final acceptance, the contractor shall furnish the owner's representative, not less than three (3) spare fuses of each size and type installed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION



SECTION 16020  
RACEWAYS

1.1 SUBMITTALS

A. Submit manufacturer's literature for each type of conduit or tubing and fittings used in the project.

1.2 MANUFACTURERS

A. Acceptable manufacturers of rigid steel and electrical metallic tubing conduit are:

1. Allied Tube and Conduit Co. (Kwik-Fit)
2. Wheatland Tube Co.
3. Triangle
4. Republic Conduit
5. American Brass
6. E.T.P.
7. Robroy
8. PYTCO
9. RYMCO
10. Galvite

B. Acceptable manufacturer's of polyvinyl chloride (PVC) conduit are:

1. Certainteed
2. Georgia Pipe
3. Carlon
4. Can-Tex
5. Queen City

C. Acceptable manufacturer's of conduit fittings, bushings, and locknuts are:

1. O-Z/Gedney
2. Thomas and Belts
3. Raco

1.3 MATERIALS

A. All metallic conduit and electric metallic tubing shall be steel, of standard pipe dimensions, smooth inside and out, and shall be galvanized. Where the word "conduit" is used hereinafter it shall mean either rigid steel conduit, electric metallic tubing, flexible steel conduit, liquid tight flexible steel conduit or schedule 40 plastic conduit. Intermediate grade conduit is not acceptable.

B. Galvanized rigid steel conduit shall be used in all areas where it will be exposed to physical damage. Schedule 40 plastic conduit shall be used underground and in slab-on-grade. In no case shall plastic conduit be exposed; switch to rigid steel conduit when turning up exposed. All other conduit, unless otherwise specified or called for on the plans, may be galvanized electric metallic tubing. Any exposed conduit on exterior of the building shall be galvanized rigid steel only.

C. Plastic conduit shall be made from virgin polyvinyl chloride C-300 compound. Conduit and fittings shall carry a UL label. Fitting and cement shall be produced by the same manufacturer as the conduit to assure system integrity.

D. All conduit shall be concealed in building construction except as noted or shown otherwise. In areas with no finished ceiling and where conduit is run exposed all runs down to switches, receptacles, etc. shall when possible be concealed in wall. It is the intent of these specifications that all conduit will be concealed whenever possible. Where outlets are required to be installed on existing walls in a finished space, raceway and outlet box shall be wiremold surface metal raceway.

E. EMT fittings shall be compression and made of steel for sizes two inches or smaller, steel set screw type fittings may be used on sizes 2 1/2" or larger. Connectors and couplings shall be rain tight and shall have a nylon insulated throat. All fittings shall be "UL" approved. EMT conduit (in sizes 2 1/2" through 4") provided with integral steel compression or set screw coupling on one (1) end of the conduit is acceptable. Die cast, and indenter type fittings are not acceptable. Fittings for flexible steel conduits and liquid tight flexible conduit shall be steel and have nylon insulated throat.

F. Rigid steel conduit and EMT shall be not less than 1/2 inch trade size, schedule 40 plastic conduit shall not be less than 3/4" trade size and not less than required by the NEC or indicated. Conduit runs with more than 5 #12 conductors shall not be less than 3/4".

G. Conduit and EMT systems indicated on the drawings for communication and signaling systems are for typical systems. Install conduit and EMT systems for the system being installed.

H. Connect individual recessed lighting fixtures to the conduit or EMT system with "maximum 6'-0" flexible, galvanized steel conduit. Use flexible galvanized, steel metal conduit for final connection to all rotating equipment and transformers. The flexible conduits shall be long enough to permit the full range of required movements without strain and to prevent the transmission of vibration. Do not utilize flexible conduit to loop between fixtures and devices.

I. Galvanized rigid steel conduit couplings and connections:

1. Install standard, conduit-threaded fittings.
2. Ream the ends of conduits after cutting and threading them.
3. For connection to sheet metal boxes, cabinets and other sheet metal enclosures, install locknuts on the inside and outside of the enclosure for each connection. See Section 16110 of these specifications.

J. EMT couplings and connectors:

1. Ream the ends of EMT after cutting them.
2. Install the following threadless type fittings:
  - a. Connectors: steel compression type with insulated throat or steel tap-on type with insulated throat.
  - b. Couplings: steel compression or tap-on type.

K. Installation of plastic conduit:

1. Shall be installed in complete accordance with manufacturer's recommendations.
2. Shall be a minimum of 2'-0" below finished grade when not covered by concrete.
3. Shall have properly sized bond wire installed with all circuits.
4. Bends and turns shall be kept to a bare minimum.
5. Extreme care shall be taken to avoid crushing or cracking conduit. "DO NOT" run vehicles over exposed conduit under any conditions.
6. All conduit and fittings shall be solvent welded.
7. Plastic conduit maybe turned up concealed in masonry and gypsum board walls. PVC conduit shall be allowed to be routed concealed in walls to a maximum height of 48" A.F.F.
8. Do not install conduit in slab. All conduit shall be installed a minimum of 6" below slab. Conduits shall not be bunched together. Maintain 1" clearance between conduits.
9. Plastic conduit shall not be bent with a propane torch or open flame. Contractor shall utilize a heat gun, heat blanket, or hot box. Plastic conduit bent with such shall not be scorched or marred.
10. All 90° elbows used for feeder conduits routed to service transformers, main switchgear and panelboards shall be galvanized rigid steel. 90° PVC elbows for feeder conduits shall not be permitted.

L. Insulated bushings:

1. Install nylon insulated bushings on the end of all rigid conduit.
2. The insulating material shall be designed for rugged, long service.
3. Bushings which consist of only insulating material will not be accepted.
4. Fittings which incorporate insulated bushings will be considered for approval in lieu of fittings with separate bushings.

M. All couplings and connections in location where water or other liquid or vapor might contact the conduit and EMT shall also be watertight.

N. Close empty conduit and EMT as complete runs before pulling in the cables and wires.

O. Install exposed conduit and EMT parallel to or at right angles with the lines of the building. Locate them so they will not obstruct headroom or walkways or cause tripping.

P. Avoid bends or offsets where practicable:

1. Do not install more bends, offsets or equivalent in any conduit or EMT run than permitted by the NEC.
2. Make bends with standard conduit bending machines.

3. Conduit hickies may be used for making slight offsets and for straightening conduits stubbed out of concrete.

4. Conduit or EMT bent with a pipe tee or vise will not be accepted.

5. Do not install crushed or deformed conduits or EMT.

Q. Install conduit or EMT clamps:

1. At intervals as required by the NEC.

2. Above suspended ceilings, metal supports may be installed as permitted by the NEC, except that conduit cannot be supported or secured to the T-bar grid or from the wire supporting the T-bar grid.

3. Trapeze, split ring, band or clevis hanger may be installed as permitted by the NEC. Trapeze hangers shall be structural metal channels, angle irons or preformed metal channel shapes with the conduit and EMT runs held on specific center by U bolts, clips or clamps. Do not support conduit from ceiling suspension wire or from other conduit.

4. Chain, wire or perforated strap supports will not be acceptable. Nor are they acceptable as a means of securing the conduit.

5. Fasten the clamps and other supports as follows:

a. For new masonry or concrete structures, install threaded metal inserts prior to pouring the concrete.

b. For existing solid masonry or reinforced concrete structures:

1. Install expansion anchors and bolts or approved power-set fasteners.

2. Expansion anchors and bolts shall be not less than 1/4 inch diameter and shall extend not less than 3 inches into the concrete or masonry.

3. Power-set fasteners shall be not less than 1/4-inch diameter and shall extend not less than 1-1/4-inch into the concrete.

c. For hollow masonry install toggle bolts. Bolts supported only by plaster will not be accepted.

d. For metal structures install machine screws.

e. Attachments to wood plug, rawl plug, soft metal insert or wood blocking will not be permitted.

R. For vertical runs of conduit or EMT:

1. Install supports for conduit, EMT, cables and wires at intervals as required by the NEC and as indicated on the drawings.

2. Conduit and EMT supports shall be supported by framing for the floors.

S. Conduits and EMT shall be kept 6" away from parallel runs of steam or hot water pipes.

T. Clogged raceways shall be entirely free of obstructions or shall be replaced.

U. Rigid steel conduit installed underground and in concrete shall be wrapped with Scotchwrap #50 corrosion protection tape.

V. All empty conduits shall have nylon pull cord installed to provide for installation of cables, conductors or wiring. All empty conduits stubbed out below grade shall have be capped and provided with a concrete marker. All spare conduits stubbed up through slab shall have a cap installed to prevent debris from entering conduit.

W. Do not combine conduit homeruns. Each homerun shall be separately routed directly to panel unless specifically noted otherwise.

X. Install service conduit (TV, electrical, and telephone) as follows:

1. All underground entrances shall have metallic sleeves through building foundation walls and extend to undisturbed ground to avoid shear, and shall be full weight, threaded hot-dipped galvanized rigid steel conduit.

2. All 90 degree bends to be rigid metallic conduit, with a radius of not less than 10 times the diameter of the conduit.

3. Maintain a minimum cover of 24 inches below final grade for conduits.

Y. Telephone conduits:

1. Where telephone conduit runs are longer than 100'-0" or have more than two 90° bends (or equivalent) or have a reverse bend, pull boxes shall be provided.

Z. Do not install conduit in cavity between concrete block and brick. Conduit shall not be stubbed up into this cavity or routed horizontally in cavity.

END OF SECTION



SECTION 16030  
CONDUCTORS

1.1 SUBMITTALS

A. Shop drawings shall be submitted and shall consist of manufacturer's published literature.

1.2 MANUFACTURERS

A. Acceptable manufacturers are:

1. General
2. Okonite
3. Senator
4. Triangle
5. Pirelli
6. Cyprus Rome
7. Essex
8. Carol
9. Southwire
10. American
11. Cerro
12. CME
13. Colonial Wire

B. All wiring shall be manufactured in the United States.

1.3 MATERIALS

A. Ratings and sizes:

1. Shall be not less than indicated on the drawings and not less than required by the NEC.

2. Minimum size shall be No. 12 AWG copper provided the maximum voltage drops in the control circuits will not adversely affect the operation of the controls.

3. Conductor sizes indicated on the drawings are for copper conductors.

B. Conductors and ground wires:

1. Shall be copper.

2. Size No. 8 AWG and larger shall be stranded.

3. Size No. 10 AWG and smaller shall be solid.

C. Conductor insulation:

1. Conductor insulation shall be the NEC type THHN.

D. Wire shall be factory color coded in size No. 6 and smaller. Color shall be by integral pigmentation with a separate color for each phase, neutral and grounding conductor. Color code per phase shall be continuous throughout the project.

E. Manufacturer's name and other pertinent information shall be marked or molded clearly on the overall jacket's outside surface or incorporated on marker tapes within the cables and wires at reasonable intervals along the cables and wires.

F. Cables and wires indicated on the drawings for communication and signaling systems are for typical systems. Install cables and wires for the system being installed.

G. All wiring shall be in conduit unless specifically noted otherwise.

H. Every coil of wire shall be in the original wrapping and shall bear the Underwriters' Label of approval.

I. Where wires are left for connection to any fixture or an apparatus, spare wire or cables shall be provided at the ends for connections. Fixture connections at the outlet box shall be made with insulated wire connectors.

J. Outer jackets shall be color coded as follows:

1. Three phase or single phase circuits, 120/208 volts:

- a. Phase A - Black
- b. Phase B - Red
- c. Phase C - Blue
- d. Neutral - White
- e. Insulated ground wire - Green
- f. Isolated ground wire - Green with Yellow tracer.

Note: Where dedicated neutrals are used for receptacle circuits. Outer jacket shall be white with appropriate colored tracer (i.e. white with red tracer, white with blue tracer, white with black tracer).

Note: Where dedicated neutrals are used for lighting circuits. Outer jacket shall be grey with appropriate colored tracer (i.e. grey with brown tracer, grey with orange tracer, grey with yellow tracer).

2. Dedicated neutrals shall be provided for all multi-wire branch circuits and outer jacket shall be provided with appropriate colored tracer.

a. 120/208V: white with red tracer, white with blue tracer, white with black tracer.

3. Only for large power cables and wires which do not have color coded jackets: No. 6 and larger.

a. Install bands of adhesive non-fading colored tape or slip-on bands of colored plastic tubing over the cables and wires at their originating and terminations points and at all outlets of junction boxes.

b. Color shall be permanent and shall withstand cleanings.

K. Wiring for signal circuits shall conform to the recommendations of manufacturers of the signal system being installed so the system shall have optimum performance and maximum service continuity. Communication and signaling circuit wiring where run in conduit below grade or in a damp location shall be listed for use in a damp or wet location. Communication and signaling conductors not in conduit shall be rated for plenum use.

L. No circuit wiring shall be smaller than number 12. Where the homerun exceeds 100'-0" in length, number 10 (minimum) wire shall be used even though all such circuits are not indicated on the plans. All wiring for emergency branch circuits shall be number 10 (minimum) unless noted otherwise.

M. When installing THHN extra care must be exercised so as not to damage nylon jacket. When nylon jacket is damaged wiring shall be removed from service, and replaced with new conductors.

END OF SECTION



SECTION 16040  
OUTLETS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop drawings shall be submitted and shall consist of manufacturer's published literature.

1.2 MANUFACTURERS

A. Acceptable manufacturers are:

1. Raco
2. Steel City
3. Appleton
4. Hubbell

1.3 MATERIALS

A. Boxes shall be galvanized pressed sheet steel for all concealed work.

B. Where conduit runs are exposed, outlet shall be of the cast metal type.

C. For concealed work each box shall be provided with a square cornered plaster ring.

D. Each surface lighting fixture, receptacle and switch shall be provided with flush mounted outlet box. All outlets installed in panels and other architectural features shall be centered. The location of any outlet may be moved as much as 10'-0" by the Architect before the outlet is placed without incurring any extra cost. All dimensions refer to the finished floor line. Outlet boxes shall be pressed sheet steel and shall be galvanized for all concealed work. Where conduit runs are exposed outlets shall be of the cast metal type.

E. Boxes shall be for the service and the type of outlet and shall not be less than 4" square and 1-1/2" deep except where otherwise specified. Boxes installed in walls shall be provided with a square cornered 1-1/2" plaster ring installed flush with surface of wall. Coordinate depth of plaster ring required for particular wall construction. Each outlet box above ceiling shall be supported from a structural member of the building either directly or by using a substantial and approved metal support. Conduit is not an approved means of support. Boxes installed in wall shall be supported either directly to a stud or between studs utilizing an approved bar hanger. In no case shall switch box support and clips used for mounting boxes in old work be used unless specifically called for. Top of outlet box shall be level.

F. All ceiling or wall recessed outlet boxes or their associated plaster rings shall be flush with the finished surface. Using coverplate to secure wiring devices or shimming the device is not acceptable. Contractor shall exercise due care when cutting opening in walls or ceilings for outlet boxes so that opening size will permit the proper installation of boxes and devices. Fixture studs in ceilings and bracket outlets shall be bolted with stove bolts or shall be locking type of stud mounting.

G. In addition to boxes indicated, install enough boxes to prevent damage to cables and wires during pulling-in operations.

H. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

I. "There shall be no outlets installed back to back. A minimum of 4" shall separate each outlet."

J. Where the volume allowed per conductor exceeds that allowed in Table 370-6(b) of the NEC for the minimum size outlet specified, a larger size outlet box shall be used and shall be sized in accordance with the table noted above.

K. Outlet boxes shall be clean and free from dust, paint, dirt, plaster ready mix joint compound and /or any other debris.

#### 1.4 LABELING AND IDENTIFICATION

A. All junction box cover plates shall be labeled identifying the system it contains. The label shall be neatly hand written with a wide tip permanent non-removable marker and be easily identified. Junction boxes containing line voltage wiring shall include panel and circuit designation (ex. HA - 1,3,5 or LA – 2,4,6). Junction boxes utilized for low voltage system shall be labeled in accordance with the system (ex. FA for Fire Alarm System).

END OF SECTION

SECTION 16050  
WIRING DEVICES AND DEVICE PLATE

1.1 SUBMITTALS

- A. Submit product data under provisions of Section 16000, GENERAL.
- B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

1.2 REFERENCES

- A. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
- B. FS W-S-896 - Switch, Toggle.
- C. NEMA WD 1 - General-Purpose Wiring Devices.
- D. NEMA WD 5 - Specific-Purpose Wiring Devices.

1.3 MANUFACTURERS

A. For the purpose of selecting quality and type of device, equipment manufactured by Hubbell has been specified. The following manufacturers meeting this specification are acceptable:

- 1. Pass and Seymour
- 2. Cooper
- 3. Leviton

1.4 PRODUCTS

A. Switches: All wall switches shall be rated 20 ampere, 120 volts, have self grounding provisions, side wiring only and shall be of the silent type. Color shall be gray with stainless steel plates.

- 1. Single pole: HBL 1221.
- 2. Double pole single throw: HBL 1222.
- 3. Three way: HBL 1223.
- 4. Four way: HBL 1224.
- 5. Key switch single pole HBL 1221I, three-way: HBL 1223L, four-way: HBL 1234L. Three way and four way key switches shall be keyed alike. Key switches shall be Corbin type tumbler locks. Fork tongue key switches are not acceptable.
- 6. Single pole, pilot light, red handle (lit in "on" position): HBL 1297.
- 7. Despard single pole switches installed in mullions. Pass & Seymour ACD 201.

B. Receptacle: All receptacles shall be of the grounding type, of the configuration shown on the drawings and shall be flush wall mounting type. Color shall be gray, with exception of receptacles mounted in Wiremold #V4000 raceway which shall be ivory with stainless steel plates.

1. Standard duplex receptacle: 20 ampere, 125 volt, NEMA type 5-20 R, 2 pole, 3 wire, straight blade, U-grounding slot, specification grade. HBL 5362.

2. Isolated grounding duplex receptacle: 20 ampere, 125 volt, NEMA type 5-20 R, straight blade type, 2 pole, 3 wire, U-grounding slot, specification grade. IG 5362.

3. Power, receptacle with matching plug: 20 ampere, 125/250 volt, NEMA type 14-20, 3 pole 4 wire grounded, straight blade type. HBL 8410.

4. Power receptacle with matching plug: 20 ampere, 250 volt, NEMA type 6-20R 2-pole, 3 wire grounded, straight blade type. HBL 5462.

5. Power receptacle with matching plug: 30 ampere, 250 volt, NEMA type 6-30R 2-pole, 3 wire, u-grounded slot, straight blade type. HBL 9330.

6. Power receptacle with matching plug: 50 ampere, 125/250 volt, NEMA type 14-50R, 3-pole, 4 wire grounded, straight blade type. HBL 9450A.

7. Ground fault interrupter receptacle: 20 ampere, 125 volts, NEMA type 5-20R, 2-pole, 3-wire with grounded U slot. GF 5262.

C. Device plates: Plates shall be furnished for all devices and outlets indicated on the drawings (telephone, computer, TV, etc.). All plates on masonry walls shall be oversized jumbo type.

1. Flush mounted plates: Beveled type with smooth rolled outer edge, stainless steel type 302 with brushed finish.

2. Surface box plates, beveled, galvanized steel, pressure formed for smooth edge to fit box.

3. Die cast weatherproof cover. Lockable hasp vertical mounting. Intermatic #WP1010MC.

## 1.5 INSTALLATION

### A. Switches:

1. Switches shall be connected to the live side of the circuit and shall control only the outlets indicated.

2. Conductors shall be looped around the terminal screw.

3. Where more than one switch is indicated in the same location switches shall be gang mounted under a common plate.

4. Where multi-wire switching (360 volt potential) occurs, a barrier shall be provided between switches.

5. Center line of switches in general, shall be set 3'-6" above the floor (off position down) and shall clear the door trim or corner by 4" or center the space occupied.

6. Architectural plans shall be consulted before placing switches so they will in every case be located on the strike side of the door and clear door, chair, window, and baseboard moldings.

7. Switches shall be screwed tight to the boxes and shall not depend on the cover plate to pull them tight.

B. Receptacles:

1. Conductors shall be looped around the terminal screws, "DO NOT BACK WIRE DEVICES."

2. Receptacles shall be grounded by the green wire bond and shall be pigtailed as shown on the drawings.

3. Receptacles shall be screwed tight to the plaster ring or outlet box and shall not depend on the device plate to pull them tight.

4. Center line of general use receptacles shall be in general, set 18" above the floor with receptacle mounted in the vertical position and with grounding pole at the bottom.

5. Coordinate receptacle height with Architectural drawings and locate so that bottom of receptacle plate shall be 1" above counter or back splash and clear all moldings.

6. Center line of receptacles located adjacent to lavatories in toilets shall be set 3'-6" above floor.

7. Receptacles serving water coolers shall be located within cooler housing or as close to bottom of housing as possible. Cord serving unit shall be as short as possible. In no case shall cord or receptacle be seen from normal viewing angle.

8. All receptacles installed in bathrooms or toilets or within 6 feet of lavatories or sinks, or any receptacle located on building exterior shall be ground fault circuit interrupter type.

9. All receptacles installed in kitchens or outdoors shall be GFCI type.

C. Plates:

1. Plates shall be level and all edges shall be in full contact with wall.

2. Plates shall be furnished for all devices and other outlets indicated on the drawings.

3. Install plates on outlet boxes and junction boxes in unfinished areas above ceilings and on surface mounted outlets.

4. Plates shall not be used to keep devices secure.

5. Plates shall be clean and free from dust, plaster or paint and spots.

6. Plate shall cover openings around outlets.

END OF SECTION



SECTION 16060  
LIGHTING FIXTURES AND LAMPS

1.1 SUBMITTALS

- A. Lighting fixture submittals shall consist of manufacturer's literature including photometric data and shall note on the submittals any special requirements which have been specified.
- B. The Architect reserves the right to require sample fixtures for approval.
- C. "Manufacturer's literature for all lamps."

1.2 MANUFACTURERS

- A. Lighting fixtures shall be selected from those fixtures included in the fixture schedule as noted on the drawings or in the specifications.
- B. Lamps:
  - 1. Sylvania
  - 2. Phillips
  - 3. General Electric
  - 4. E.Y.E.

1.3 EQUIPMENT

- A. Review architectural plans and specifications and provide lighting fixtures compatible with ceiling suspension system specified.
- B. Fixtures shall be selected from the fixture schedule not only by catalog number but with consideration to mounting, number and types of lamps, and reference notes as contained in the fixture schedule and as noted on the drawings and in the specifications. Manufacturers not listed on fixture schedule or added by addendum will not be accepted.
- C. Fluorescent ballast shall be electronic type as manufactured by Motorola, Advance, General Electric or Universal Lighting Technologies. Ballast shall have five year warranty, total harmonic distortion of less than 20%. Where fixtures are shown with inboard/outboard lamps switched separately provide two (2) ballast per fixture. Ballast shall be instant start and parallel lamp operation.
- D. Ballast for all H.I.D. lamps shall be high power factor (HPF) reactor type ballast.
- E. Support of lighting fixtures shall be the responsibility of the fixture installer and shall be as follows:
  - 1. Fluorescent fixture flush mounted in exposed tee, suspended acoustical tile ceilings shall be of the lay-in type and shall be supported at diagonal corners of the fixture, utilizing two (2) #14 gauge steel wires attached to the bar joist or overhead structure. Flexible conduit and wiring from outlet box to fixture shall be minimum 3/8"C., and minimum #14 THHN conductors. Factory supplied whips of smaller ratings are not acceptable.

2. Surface mounted fluorescent fixtures shall be supported by light weight channel to two members of the ceiling suspension system. Two support channels are required. Surface mounted fixtures mounted on sheet rock or plaster ceilings or low density acoustical tile ceilings shall be mounted with two 1/4" x 1/4" x 4" metal spacers between fixture and ceiling. Spacers shall be located to provide air gap between fixture and ceiling. Do not place spacers directly over ballast.

3. Recessed incandescent, mercury vapor, high pressure sodium, and metal halide fixtures shall be installed using standard manufacturer's mounting hardware.

4. Exit lights shall be mounted directly to the outlet box and in case of ceiling mounted units the outlet box shall be flush with the ceiling and shall be supported by a 1-1/2" channel spanning between main structural members of the suspension system. Secure channel with metal fasteners.

5. Provide two exit lights in addition to those shown in the event the Fire Marshall requires additional units. Turn over to the Owner any exits not used. Include in base bid labor and materials for exit light installation.

F. Align, mount and level the lighting fixtures uniformly.

G. Avoid interference with and provide clearance for equipment.

H. Lighting fixtures shall be located as shown on the lighting plan. If for any reason this is impossible or impractical, the Architect shall be notified immediately for a decision as to the best direction for the shift.

I. Upon completion of installation, lighting fixtures and equipment shall be in first class operating order, in perfect condition as to finish, free from defects. At final inspection, fixtures shall be completely lamped, be complete with required diffusers, reflectors, side panels, louvers or the other components necessary to complete fixtures. All fixtures and equipment shall be clean and free from dust, insects, plaster or paint spots. Any reflectors, diffusers, side panels or other parts broken prior to final inspection shall be replaced by contractor.

J. Lamps shall be provided for all fixtures:

1. Incandescent lamps shall be medium base, inside frost extended service (minimum 2500 hours).

2. 48" fluorescent lamps shall be 32 watt, T8, 4100K. Initial lumens output 2850 minimum, 82 CRI color rendering index.

3. U shaped lamps shall be F 32, T8, 4100K. Initial lumens output 2850 minimum, 82 CRI color rendering index.

4. Metal halide lamps shall be mogul base, of the wattage called for in the fixture schedule and shall be of the coated type.

END OF SECTION

SECTION 16065  
OCCUPANCY SENSORS

PART 1 – GENERAL

1.1 SUBMITTALS

A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.

B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.

C. Submit any interconnection diagrams per major subsystem showing proper wiring.

D. Submit standard catalog literature which includes performance specifications indicating compliance to the specification.

E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

1.2 WORK INCLUDED

A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 16.

C. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.3 ACCEPTABLE MANUFACTURERS

A. For the purpose of selecting quality and types of sensors, equipment as manufactured by "The Watt Stopper" has been specified. Following manufacturers meeting these specifications are acceptable.

1. Hubbell Building Automation
2. Cooper Controls
3. Leviton

B. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for sensors which meet or exceed the specifications included herein.

## 1.4 EQUIPMENT QUALIFICATION

A. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

B. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.

C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

## 1.5 SYSTEM DESCRIPTION

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The supplier's obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

## 1.6 SYSTEM OPERATION

A. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy system.

B. Factory Startup - It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. This service shall be provided in contract amount at no additional cost to the Owner.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Automatic Wall Switch Sensor (DW-100):

1. The passive infrared wall switch sensor shall be a 3 wire, self contained control system that replaces a standard toggle switch. Sensor shall have ground wire for safety. Switching mechanism shall be latching air gap relay, compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices shall not be allowed.

2. The passive infrared sensor shall be capable of detecting presence in the control area by detecting changes in the infrared energy. Small movements shall be detected such as when a person is writing while seated at a desk.

3. To avoid false ON activations and to provide high sensitivity to minor motion, Pulse Count Processing and Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of the signal received by the sensor to ensure response only to those signals caused by human motion.

4. Sensor shall utilize mixed signal ASIC (application-specific integrated circuit) technology, which combines analog and digital processing into one chip package, to provide immunity to RFI and EMI.

5. Zero Crossing Circuitry shall be used to increase the relay life, protect from the effects of inrush current, and increase the sensor's longevity.

6. To assure detection at the desktop level uniformly across the space, sensor shall have a 2 level, 28 segment, multi-element Fresnel lens system.

7. Sensor shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.

8. Fresnel lens shall be a Poly IR 4 based material to offer superior filtering capability of competing light sources, such as the sun and other visible light sources. Lens shall have grooves facing in to avoid dust and residue build-up which could affect IR reception.

9. Sensor shall cover up to 900 sq ft for walking motion, with a field of view of 180 degrees.

10. Sensor shall operate at either 120 VAC or 277 VAC.

11. Sensor shall have no minimum load requirement and shall be capable of switching 0 to 800 watt ballast or tungsten or 1/6 hp @ 120 volts, 60 Hz; 0 to 1200 watts for ballast or 1/3 hp @ 277 volts, 60 Hz.

12. Sensor shall have a built-in light level feature adjustable from 2 to 200 footcandles that holds lighting OFF when a desired footcandle level is present.

13. Sensor shall have a time delay adjustable from 30 seconds to 30 minutes.

14. Sensor shall have user-adjustable sensitivity setting.

15. Adjustments and mounting hardware shall be concealed under a removable cover to prevent tampering of adjustments and hardware.

16. For ease in installation and cleaner wiring, the sensor shall utilize terminal style wiring.

17. Sensor shall have in place a bypass pin which when removed will override sensor to ON and which requires no rewiring or modification to unit. To preserve savings and automatic operation, an attached, user accessible override-on feature shall not be allowed.

18. Sensor shall provide automatic equipment grounding to a metal junction box, and provide grounding to a metal cover plate.

19. For safety, sensor shall have 100% off switch with no leakage current to load in OFF mode.

20. For safety, in the event there is an open circuit in the AC line such as a ballast or lamp failure, the sensor shall automatically switch to OFF mode.

21. Sensor shall have two positions only: OFF and AUTO for normal operation.

22. Sensor shall not protrude more than 3/8" from the wall and shall blend in aesthetically.

23. For protection against lens damage, sensor shall utilize a full radius lens brace.

24. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

25. Color shall match all other wiring devices on project.

B. Vandal Resistant Automatic wall switch sensor (WA-200):

1. The passive infrared sensor shall be a completely self contained control system that replaces a standard toggle switch. Switching mechanism shall be a latching air gap relay, compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices shall not be allowed. Sensor shall have ground wire and grounded strap for safety.

2. Sensor shall be capable of detecting presence in the control area by detecting changes in infrared energy. Small movements shall be detected, such as when a person is writing while seated at a desk.

3. Sensor shall utilize advanced control logic based on RISC (Reduced Instruction-Set Circuit) microcontroller.

4. Detection Signature Processing (DSP) shall be used to avoid false offs and false activations and to provide immunity to RFI and EMI.

5. Continuously adjusting Zero Cross relay control shall be used to guarantee reliable operation with non-linear loads (electronic, PL lamp ballasts) even with temperature changes and product aging. This increases the WA -200 product longevity.

6. Sensor shall utilize SmartSet™ technology to optimize the sensor behavior to fit occupant usage patterns and adjust sensitivity and time delay to changing conditions. The use of SmartSet shall be selectable by user with a DIP switch.

7. Sensor shall have a time delay that is adjusted automatically (with the SmartSet setting) or shall have a fixed time delay of 5, 10, 15, 20 or 30 minutes, walk-through mode, or test mode, set by DIP switch. In walk-through mode, lights shall turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.

8. Sensor shall have the choice of light flash alert and/or audible alert of impending light shut off, selectable with DIP switch.

9. Sensor shall have sensitivity adjustment that is set to either automatic (SmartSet setting) or reduced sensitivity, and is set with DIP switch.

10. Sensor shall have a built-in light level feature selectable with DIP switch. During set up of light level control, sensor shall learn desired hold-off level, requiring only one step.

11. Sensor shall have automatic-ON or manual-ON operation adjustable with DIP switch.

12. Sensor shall operate at universal voltages of 100, 120, 230, or 277 VAC; 50/60 Hz.

13. Sensor shall have no minimum load requirement and shall be capable of switching 0 to 800 watts fluorescent/incandescent or 1/6 hp @ 100/120VAC, 50/60 Hz; 0 to 1200 watts fluorescent or 1/6 hp @ 230/277VAC, 50/60 Hz.

14. Sensor shall utilize a temperature compensated, dual element sensor, and a multi-element Fresnel lens.

15. For vandal resistance, Fresnel lens shall be made of hard, 1.0mm Poly IR 2 material that offers greater sensitivity to motion and superior detection performance. Lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.

16. To assure detection at desktop level uniformly across the space, sensor shall have a 2 level, 28 segment, multi-element Fresnel lens system.

17. Sensor shall cover up to 300 sq ft for walking motion, with a field of view of 180 degrees.

18. Adjustments and mounting hardware shall be concealed under a removable, tamper resistant cover to prevent tampering of adjustments and hardware.

19. For safety, sensor shall have a 100% off switch with no leakage current to the load.

20. Sensor shall not protrude more than 3/8" from the wall and shall blend in aesthetically.

21. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

22. Color shall match all other wiring devices on project.

C. Dual Technology sensors:

1. The Dual Technology sensor shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound and passive infrared heat changes.

2. Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.

3. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.

4. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

5. Sensor shall be capable of corner mounting to a wall or ceiling in order to eliminate detection through open doorways and outside of controlled area. To provide superior small motion detection and immediate activation upon entry, coverage of both technologies must be complete and overlapping throughout the controlled area.

6. To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.

7. Sensor shall operate at 24 VDC/VAC and halfwave rectified and utilize a Watt Stopper power pack.

8. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.

9. The lens shall cover up to 2000 sq ft for walking motion when mounted at 10 ft and 1000 sq ft of desktop motion.

10. DT-200 sensors shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.

11. Sensors shall utilize SmartSet™ technology to optimize time delay and sensitivity settings to fit occupant usage patterns. The use of SmartSet shall be selectable with a DIP switch.

12. Sensors shall have a time delay that is adjusted automatically (with the SmartSet setting) or shall have a fixed time delay of 5 to 30 minutes, set by DIP switch.

13. Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.

14. Sensor shall have an override ON function for use in the event of a failure.

15. Sensor shall have a built-in light level sensor that works from 10 to 300 footcandles.

16. Sensor shall have 8 occupancy logic options for customized control to meet application needs.

17. Sensor shall have a manual on function that is facilitated by installing a momentary switch.

18. Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled. The LED can be disabled.

19. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

D. 360° Dual Technology Sensors:

1. The Dual Technology sensor shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound and passive infrared heat changes.

2. Sensors shall use patent pending ultrasonic diffusion technology that spreads coverage to a wider area.

3. Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.

4. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.

5. Sensors shall be ceiling mounted with a flat, unobtrusive appearance and provide 360° coverage.

6. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall utilize Advanced Signal Processing that automatically adjusts the detection threshold dynamically to compensate for changing levels of activity and airflow throughout controlled space.

7. To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.

8. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.

9. DT-300 and DT-305 sensors shall operate at 24 VDC/VAC and halfwave rectified and utilize a Watt Stopper power pack.

10. DT-355 shall incorporate a switching power supply for reduced power consumption; shall operate at 120/230/277/347 VAC, 50/60 Hz and shall not require a power pack.

11. Sensors shall utilize SmartSet™ technology to optimize time delay and sensitivity settings to fit occupant usage patterns. The use of SmartSet shall be selectable with a DIP switch.

12. Sensors shall have a time delay that is adjusted automatically (with the SmartSet setting) or shall have a fixed time delay of 5 to 30 minutes, set by DIP switch.

13. Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.

14. The DT-300 and DT-355 sensors shall have a built-in light level sensor that works from 10 to 300 footcandles.

15. The DT-300 and DT-305 sensors shall have a manual on function that is facilitated by installing a momentary switch.

16. Sensors shall have eight occupancy logic options that give the ability to customize control to meet application needs.

17. The sensors shall feature terminal style wiring, which makes installation easier.

18. DT-300 sensor shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.

19. Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled. The LED can be disabled for applications that require less sensor visibility.

20. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

E. Ultrasonic Sensors:

1. The ultrasonic occupancy sensors shall be capable of detecting presence in the floor area to be controlled by detecting doppler shifts in transmitted ultrasound.

2. Ultrasonic sensing shall be volumetric in coverage with a frequency of 32.768 kHz at  $\pm 0.002\%$ . They shall utilize Advanced Signal Processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled areas.

3. Sensors of varying frequencies shall not be allowed so as to prevent sensors from interfering with each other and to assure compatibility in the event more sensors are added.

4. Sensors shall have temperature and humidity resistant, 32 kHz tuned ultrasonic receivers. Receivers shall have less than a 6dB shift in the humidity range of 10% to 90% and less than a 10dB shift in the temperature range of -20° to 60° C.

5. Detection shall be maintained when a person of average size and weight moves only within or a maximum distance of twelve inches either in a horizontal or vertical manner at the approximate speed of 12-in. per second. The sum of this distance, volume and speed represent the average condition ultrasonic sensors must meet in order for the lights to not go off when a person is reading or writing while seated at a desk.

6. Sensors shall have a DIP switch override-ON function for use in the event of failure. The LED is maintained ON so as to be visible from the floor as a constant reminder that the automatic function has been by-passed.

7. Sensors shall incorporate an output disable feature for easy troubleshooting.

8. Sensors shall be ceiling mounted and shall not protrude more than 1.50 inches to blend in aesthetically with the ceiling. The sensors shall offer two mounting options.

9. The WT-600, WT-1100, WT-2200, and WT-2250 shall have an additional single-pole, double-throw isolated relay with normally open, normally closed, and common outputs rated at 1 Amp for 24 VDC. The isolated relay is for use with HVAC control, data logging, and other control options.

10. For accuracy, sensors shall have a DIP switch controlled, digital time delay that shall be adjustable from 15 seconds to 30 minutes.

11. Sensors shall have user-adjustable sensitivity setting.

12. Sensors shall cover 360° and up to 600 square feet for WT-605 and WT-600, 1100 square feet for WT-1005 and WT-1100, and 2200 square feet for WT-2205 and WT-2200 of walking motion.

13. Hallway and corridor sensors shall be The Watt Stopper models WT-2255 and WT-2250 and shall cover up to 90 linear feet.

14. Sensitivity and timer controls shall be accessible from the front of the sensor and shall be concealed by a hinged cover.

15. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

#### F. Passive Infrared Sensors:

1. The passive infrared sensor shall be capable of detecting presence in the control area by detecting changes in the infrared energy. Small movements shall be detected such as when a person is writing while seated at a desk within 15 feet of the sensor.

2. To avoid false ON activations and to provide high sensitivity to minor motion, Pulse Count Processing and Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of the signal received by the sensor to respond only to those signals caused by human motion.

3. Sensor shall utilize mixed signal ASIC (application-specific integrated circuit) technology, which combines analog and digital processing into one chip package, to provide immunity to RFI and EMI.

4. Sensor shall utilize a temperature compensated dual element sensor and a multi-element Fresnel lens.

5. Fresnel lens shall be a Poly IR 4 based material (for standard and Long Range lens) to offer superior filtering capability of competing light sources, such as the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception. Aisleway lenses shall be a Poly IR 2 based material that offers greater sensitivity to motion and superior detection performance.

6. To ensure sensitivity to small motion at the desk top, the sensor shall have a standard 30 element lens with 15 layers horizontally and 4 layers vertically; a 14 element Long Range lens with 9 layers horizontally and 4 layers vertically; a 9 element 1-sided Aisle Way lens with 9 layers vertically; or an 18 element 2-sided Aisle Way lens with 9 layers vertically.

7. Sensor shall cover up to 2000 square feet with the Standard Lens, up to 90 linear feet with the Long Range Lens, up to 120 linear feet with the 2-Sided Aisle Way Lens, and up to 50 linear feet with the 1-Sided Aisle Way lens for walking motion when mounted at a ceiling height of 10 feet

8. The CX-100 shall have an additional single pole, double throw isolated relay with normally open, normally closed, and common outputs rated for 1 Amp at 24 VDC. The isolated relay is for use with HVAC control, data logging, and other control options.

9. The CX-100 shall have two outputs; one output is based on occupancy only and one is based on occupancy with a hold OFF and an internal photocell setting when a minimum light level is present (adjustable from 3 to 200 footcandles). CX-105 shall have only an occupancy based output.

10. For accuracy and consistency, sensor shall have a DIP switch controlled, digital time delay adjustable from 15 seconds to 30 minutes.

11. Sensor shall have user-adjustable sensitivity settings.

12. Sensor shall be furnished with a DIP switch override-ON function for use in the event of failure.

13. Adjustments and mounting hardware shall be concealed under a removable cover to prevent tampering of adjustments and hardware.

14. Sensor can be wired in parallel to allow coverage of large areas.

15. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

G. 360° Passive Infrared Sensors:

1. The passive infrared sensor shall be capable of detecting presence in the control area by detecting changes in the infrared energy. Small movements shall be detected such as when a person is writing while seated at a desk within an 8 feet radius of the sensor.

2. To avoid false ON activations and to provide high sensitivity to minor motion, Pulse Count Processing and Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of the signal received by the sensor to respond only to those signals caused by human motion.

3. Sensor shall utilize mixed signal ASIC (application-specific integrated circuit) technology, which combines analog and digital processing into one chip package, to provide immunity to RFI and EMI.

4. Sensor shall utilize a temperature compensated dual element sensor and a multi-element Fresnel lens.

5. Fresnel lens shall be a Poly IR 4 based material to offer superior performance in the Infrared wavelengths and filter short wavelength infrared, such as those emitted by the sun and other visible light sources. Lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.

6. To ensure sensitivity to small motion at the desktop, the sensor shall have a 34 element Extended Range lens (standard) or a 55 element High Density lens.

7. Sensor shall cover 360°, up to 1200 square feet of walking motion with the Standard Lens and up to 500 square feet of walking motion with the High Density lens when mounted at a ceiling height of 8 feet.

8. Sensor shall not protrude more than 0.36 inches from the ceiling and shall blend in aesthetically.

9. The CI-200 sensor shall have an additional single pole, double throw isolated relay with normally open, normally closed, and common outputs rated for 1 Amp at 24 VDC. The isolated relay is for use with HVAC control, data logging, and other control options.

10. The CI-200 sensor shall have two outputs; one output is based on occupancy only and the other is based on occupancy with a hold OFF and an internal photocell setting when a minimum light level is present (adjustable from 4 to 190 footcandles). CI-205 shall have just one occupancy based output.

11. For accuracy and consistency, sensor shall have a DIP switch controlled, digital time delay, adjustable from 15 seconds to 30 minutes.

12. Sensor shall have DIP switch sensitivity setting adjustable from minimum to maximum.

13. Sensor shall be furnished with DIP switch override-ON function for use in the event of a failure.

14. Adjustments and mounting hardware shall be concealed under a removable cover to prevent tampering with adjustments and hardware.

15. Sensor shall be capable of being wired in parallel to allow coverage of large areas.

16. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

H. Power and Auxiliary Packs:

1. Power pack shall be a self-contained transformer and relay module measuring 1.6" x 2.75" x 1.6".

2. For ease and speed of installation, power and auxiliary relay pack shall have 1/2" snap-in nipple for 1/2" knockouts and mounting on outside of enclosure.

3. Power and auxiliary relay packs shall have dry contacts capable of switching 20 amp ballast load, 13 amp incandescent, 1 hp @ 120 VAC, 60Hz; 20 amp ballast @ 277 VAC, 60 Hz; 15 amp ballast @ 347 VAC, 60Hz; 15 amp ballast, 1 hp @ 220-240 VAC, 60 Hz; and 20 amp ballast, 13 amp incandescent, 1 hp @ 220-240 VAC, 50 Hz.

4. Power packs shall provide a 24 VDC, 150 mA output.

5. Power packs shall be capable of parallel wiring without regard to AC phases on primary.

6. Auxiliary relay packs shall be identical in physical size of power packs and contain no transformer power supply and shall switch 120VAC, 277 VAC, 347 VAC or low voltage.

7. Power pack can be used as a stand alone, low voltage switch, or can be wired to sensor for auto control.

8. Power and auxiliary relay packs shall have low voltage teflon coated leads, rated for 300 volts, suitable for use in plenum applications.

9. Power pack shall be UL 2043 rated, use UL94 V-O plenum rated plastic, and have low voltage teflon coated leads, rated for 300 volts

10. B120E-P, B230E-P, and B277E-P power packs shall utilize Zero Crossing Circuitry to protect from the effects of inrush current and increase product longevity.

11. To ensure quality and reliability, power and auxiliary relay packs shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

I. Where specified, passive infrared and dual technology sensors shall offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.

J. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

K. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

L. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

M. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

N. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

O. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

P. All sensors shall have UL rated, 94V-0 plastic enclosures.

## 2.2 CIRCUIT CONTROL HARDWARE - CU

A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.

B. Relay Contacts shall have ratings of:

13A - 120 VAC Tungsten  
20A - 120 VAC Ballast  
20A - 277 VAC Ballast

C. Control wiring between sensors and controls units shall be Class II , 18-24 AWG, stranded U.L. Classified, plenum rated jacketed cable, and shall not be required to be in conduit. Cabling shall be supported per NEC and not run on top of acoustical tile ceiling. In areas where cabling cannot be routed concealed (i.e., no acoustical tile ceiling), cabling shall be routed in conduit.

D. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. It shall be the contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

B. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.

C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

### 3.2 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system. This service shall be provided in the contract at no additional cost to the Owner. At project closeout/commissioning, a detailed list of each space containing any occupancy sensor shall be provided. List shall note room number/designation, model number of sensor/slave pack installed, and denote unit was tested and commissioned.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the scheduled commissioning date. Upon completion of the system fine tuning the factory authorized technician shall provide the proper training to the owner's personnel in the adjustment and maintenance of the sensors.

END OF SECTION

SECTION 16070  
DISCONNECT SWITCHES

1.1 SUBMITTALS

A. Shop drawings shall be submitted and shall consist of manufacturer's published literature.

1.2 MANUFACTURERS

A. Acceptable manufacturers are:

1. Square "D" Company
2. G. E.
3. Siemens
4. Cutler Hammer

1.3 EQUIPMENT

A. Disconnect switches shall be provided for all motors and strip heaters located out of sight of motor controller, and where specifically indicated on the drawings. Disconnect switches shall disconnect all ungrounded conductors. When exposed to weather, enclosure shall be NEMA - 3R. Switches shall be installed to be fully accessible in accordance with Article 110-26 of the National Electrical Code.

B. All disconnects shall be heavy duty type and shall be equipped with factory installed equipment ground kit bonded to the can for grounding purposes.

C. For single phase motors, a single - or double-pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Enclosed safety switches shall be horsepower rated in conformance with Table III of Fed. Spec. W-D-865. Switches shall disconnect all ungrounded conductors.

D. Each disconnect serving ground mounted exterior A/C units shall be equipped with a padlock (Master 3206) all keyed alike.

E. All disconnects shall be equipped with provisions to lock the handle in the OFF position.

F. All disconnects shall be fusible type, fused in accordance with the name plate data on the unit. Disconnects serving water heaters or resistance heat strips shall be fused at 125% of the full load amps of the unit.

G. Install fuses so that ampere rating can be read without having to remove fuses.

H. All fuses shall be as noted in Section 16015.

I. Disconnects shall be identified as required under Section 16120.

J. Maintain 3'-0" clearance in front of disconnect having voltage rating of 250 volts and 4'-0" clearance in front of disconnect having voltage rating of 480 volts. Do not locate disconnect over other electrical equipment (i.e.: transformers). See 16000-1.14-I.

END OF SECTION

SECTION 16090  
LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop drawings shall be submitted as follows:

1. Submit dimensioned drawings of lighting control system and accessories including, but not necessarily limited to, relay panels, switches, DTC, photocells and other interfaces. Shop drawings shall indicate exact location of each device or a RFI to confirm location. Plans are diagrammatical. Contractor to verify all lighting control material requirements from approved shop drawings. "Cut Sheet" submittal not acceptable.

2. Manufacturer's data on the specific lighting control system and components.

3. One Line Diagram: Submit a one-line diagram of the system configuration indicating the type, size and number of conductors between each component if it differs from that illustrated in the riser diagram in these specifications. Submittals that show typical riser diagrams are not acceptable.

1.2 MANUFACTURERS

A. For the purpose of selecting quality and types of panels, equipment as manufactured by "Lighting Controls & Design" has been specified. Following manufacturers meeting these specifications are acceptable.

1. Watt Stopper
2. Leviton
3. HUBBELL Building Automation
4. Intelligent Lighting Controls
5. Cooper Controls

B. Such firms shall be regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 10 years. Any product other than those listed in this specification must be pre-approved a minimum of ten (10) working days before bid time. No exceptions.

1.3 DESCRIPTION OF WORK

A. Furnish and install a complete system for the control of lighting and other equipment as indicated on the plans, detailed in the manufacturer submittal and as further defined herein. Contractor is solely responsible to verify quantity, installation locations and wiring requirements for this project. Specific manufacturers catalog numbers, when listed in this section are for reference only. It is the responsibility of the contractor to verify with lighting control manufacturer all catalog information and specific product acceptability.

B. The system shall include but not be limited by the following list: Pre-wired, microprocessor controlled relay panels with electrically held, electronically latched relays panels controlled via a complete list of communication based accessories including digital switches, digital photocells, Digital Time Clock (DTC) and other devices. Microprocessor Controlled Digital Relay Lighting Control system with Cat.5 communications.

#### 1.4 GENERAL REQUIREMENTS

A. The work covered in this section is subject to all of the requirements in the General Conditions of the Specifications. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system. All Labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section.

B. Control wiring shall be in accordance with the NEC requirements for Class 2 remote control systems, Article 725 and manufacturer specification.

C. Comply with NEC and all local and state codes as applicable to electrical wiring work.

D. Lighting control panels shall be UL 916 Listed. LCPs controlling emergency circuits shall be ETL listed to UL 924. Emergency source circuits controlled in normal operation by a relay panel shall fully comply with NEC 700-9(b). Electrical contractor is responsible for verifying compliance.

E. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, commissioning of the lighting control system, and Owner instruction includes:

1. Confirmation of entire system operation and communication to each device.

2. Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors

3. Confirmation of system Programming, photocell settings, override settings, etc.

4. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.

#### PART 2 – PRODUCTS

##### 2.1 MATERIALS

A. Provide CD version of manufacturers operating software to include graphical interface software.

B. Provide 2 extra sets of as-built and operating manuals.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. A licensed electrician shall functionally test each system component after installation, verify proper operation and confirm that all relay panel and switch wiring conform to the wiring documentation. The Electrical Contractor (EC) is required to phone LC&D a minimum of 7 days before turnover for system checkout. At time of LC&D contact, all components to include

B. Mount relay control cabinets adjacent to respective lighting panelboard. Cabinet shall flush mount, per plans. Wiring between relay control cabinet and panelboards to be per local codes and acceptable industry standards.

C. Switches: Mount switches as per plans. Supply faceplates per plans and specifications. Division 16 is responsible for supplying and installing the required low voltage cable, Category 5, 4 twisted pair, with RJ45 connectors and snagless boots between all switches and panels. Field-test all Cat 5 patch cable with a recognized cable tester

#### D. Wiring

1. Place manufacturer supplied "terminators" at each end of the system bus per manufacturers instructions.

2. Neatly lace and rack wiring in cabinets.

3. Plug in Category 5 patch cable that has been field-tested with a recognized cable tester, at the indicated RJ45 connector provided at each lighting control device, per manufacturers instructions.

4. Use shielded cable for dry contact inputs to lighting control system.

5. Do not exceed 4000ft-wire length for the system bus.

6. All items on the bus shall be connected in sequence (daisy chained). Star and spur topologies are not acceptable.

7. The specified lighting control system shall be installed by the electrical contractor who shall make all necessary wiring connections to external devices and equipment, to include photocell.

### 3.2 SYSTEM DESCRIPTION

A. The lighting control system is a networked system that communicates via Cat.5. The system must be able to communicate with fully digital centralized relay panels, digital switches, photocells, various interfaces and shall include all operational software. The intent of the specification is to integrate all lighting control into one system. Distributed lighting control shall be provided using a networked micro relay panel. Lighting control system shall include all hardware and software. Software to be resident within the lighting control system. System shall provide local access to all programming functions at the master LCP and remote access to all programming functions via dial up modem and through any standard computer workstation running an industry standard internet browser. Lighting control system shall have

server built into the master LCP that “serves” HTML pages to any authorize workstation. Non-networked, non-digital, non-server capable systems not acceptable.

B. System software shall provide real time status of each relay, each zone and each group.

C. Lighting control system shall be able to be monitored by and take commands from a remote PC. At any time, should the remote PC go off-line all system programming uploaded to the lighting control system shall continue to operate as intended. Systems requiring an on line PC or server for normal operation are not acceptable

D. All devices shall be pre-addressed at the factory. Field addressing is not acceptable.

E. All programs, schedules, time of day, etc, shall be held in non-volatile memory for a minimum of 10 years at power failure. At restoration of power, lighting control system shall implement programs required by current time and date.

F. System shall be capable of flashing lights Off/On any relay or any zone prior to the lights being turned Off. The warning interval time between the flash and the final lights off signal shall be definable for each zone. Occupant shall be able to override any scheduled Off sweep using local wall switches within the occupied space. Occupant override time shall be locally and remotely programmable and not exceed 2-hours.

G. The system shall be capable of implementing On commands, Off commands, Raise (dimming) commands, Lower (dimming) commands for any relay, group or zone by means of digital wall switches, specification grade line voltage type wall switches, photocell, web based software or other devices connected to programmable inputs in a lighting control panel.

H. The lighting control system shall provide the ability to control each relay and each relay group per this specifications requirement. All programming and scheduling shall be able to be done locally at the master LCP and via the Internet. Remote connection to the lighting control system shall provide real time control and real time feedback.

I. System may consist of centralized relay panels, digital switches, photocells and various digital interfaces. Verify exact components specified relay panels and digital switches shall communicate as one network via Cat.5.

### 3.3 SYSTEM COMPONENTS

A. “GR 1400” Relay Panel:

1. NEMA rated enclosure with screw cover or hinged door. Other NEMA types optional.

2. 16 AWG steel barrier shall separate the high voltage and low voltage compartments of the panel and separate 120v and 277v.

3. Relay panel input power shall be capable of accepting 120v or 277v without rewiring

4. Control electronics in the low voltage section shall be capable of driving 2 to 16, 30a, 18,000 SCCR rated latching relays, control any individual or group of relays, provide individual relay overrides, provide a master override for each panel, store all programming in non-volatile memory, after power is restored return system to current state, provide programmable blink warn timers for each relay and every zone, and be able to control relays that default to Open, Normally Open Latching (NOL) or relays that default to Closed, Normally Closed Latching (NCL).

5. Lighting control system shall be digital. All system components shall connect and be controlled via a single Category 5, 4 twisted pair cable with RJ45 connectors, providing real time two-way communication with each system component. Analog systems are not acceptable.

6. Unused openings in the cabinet shall be effectively closed.

7. Cabinets shall be grounded as specified in the National Electrical Code.

8. Lugs shall be suitable and listed for installation with the conductor being connected.

9. Distribute and arrange conductors neatly in the wiring gutters.

10. Follow the manufacturer's torque values to tighten lugs.

11. Each relay shall have an identification label indicating the originating branch circuit number and panelboard name as indicated on the drawings. Each line side branch circuit conductor shall have an identification tag indicating the branch circuit number.

#### B. Standard Output relays

1. UL Listed 30 Amp, Latching, 18,000 SCCR, 277VAC Ballast and HID and 20 Amp Tungsten at 120 Vac.

2. Relays shall be individually replaceable. Relay terminal blocks shall be capable of accepting two (2) #8AWG wires on both the line and the load side.

3. Relays to be rated for 250,000 operations minimum at a full 30a lighting load, default to closed at normal power loss, Normally Closed Latching (NCL). All incandescent circuits shall be energized by use of a Normally Closed SoftStart™ (NCSS) relay rated at 100,000 operations at full 20a load. No exceptions.

4. Optional relay types available shall include: Normally Open Latching (NOL) relay rated for 250,000 operations, a 600v 2-pole NO and NC and a Single Pole, Double Throw (SPDT) relay.

#### C. Low Voltage Switches

1. All switches shall be digital and communicate via Cat.5. Contact closure style switches, shall not be acceptable. The programming for a digital switch will reside in the switch itself, via double EPROM memory. Any digital switch button function shall be able to be changed locally (at the DTC or a PC) or remotely, via modem, Internet or Ethernet.

2. Digital low voltage switch shall be a device that sits on the lighting control system bus. Digital switch shall connect to the system bus using the same cable and connection method required for relay panels. System shall provide capability to locally and remotely program each individual switch button, monitor and change function of each button locally and remotely. Each button shall be capable of being programmed for On only, Off only, On/Off (toggle), Raise (Dim up) and Lower (Dim down). Switches requiring low voltage control wires to be moved from one input terminal to another to accomplish these functions are not acceptable.

3. Keyed switches shall be programmable and connect to the lighting controls system bus.

4. Digital switches for high abuse areas shall be vandal resistant, contain no moving parts, and be touch sensitive and available with up to three buttons in a single gang. Multi gang versions shall also be available. Touch pads shall be Stainless Steel and capable of handling both high abuse and wash down locations. High abuse switches shall connect to the lighting control system digital bus. Each high abuse switch touch button shall be able to control any relay or any group in any panel or panels that is part of the lighting control system. Each touch button shall be able to be programmed for On, Off, Toggle or Maintain operation. All programming shall be done locally or remotely via dial up modem or web interface as described in other paragraphs of this section. High abuse switches shall be able to be enabled or disabled digitally. Each touch pad is to be identified as to function by an engraved label. Switches must be capable of handling electrostatic discharges of at least 30,000 volts (1cmspark) without any interruption or failure in operation.

#### D. DTC - Digital Electronic Time Clock

1. A Digital Time Clock (DTC) shall control and program the entire lighting control system and supply all time functions and accept interface inputs.

2. DTC shall be capable of up to 32 schedules. Each schedule shall consist of one set of On and Off times per day for each day of the week and for each of two holiday lists. The schedules shall apply to any individual relay or group of relays.

3. The DTC shall be capable of controlling up to 126 digital devices on a single bus and capable of interfacing digitally with other individual busses using manufacturer supplied interface cards.

4. The DTC shall accept control locally using built in button prompts and use of a 8 line 21-letter display or from a computer or modem via an on-board RS 232 port. All commands shall be in plain English. Help pages shall display on the DTC screen.

5. The DTC shall be run from non-volatile memory so that all system programming and real time clock functions are maintained for a minimum of 15 years with loss of power.

6. Pre-installed lighting control software shall provide via local or remote PC a visual representation of each device on the bus, show real time status and the ability to change the status of any individual device, relay or zone.

7. DTC shall provide system wide timed overrides. Any relay, group or zone that is overridden On, before or after hours, shall automatically be swept Off by the DTC a maximum of 2 hours later.

E. PHOTOCELL: Photocells to be mounted in location indicated on the plans. Photocells used for exterior lights shall provide multiple trips point from 1 roof mounted unit. All trips points shall be able to be changed remotely via Internet or dial up modem. Photocells requiring manual trip point adjustment are not acceptable. Photocell used for interior lighting control shall have multiple settings such as start-point, mid-point, off-point, fade-up, fade-down, etc. All settings shall be remotely accessible and adjustable. Systems providing local adjustment only are not acceptable. Photocells to be certified to comply with the current energy code covering this project at time of submittal of plans for building permit.

F. Interfaces: For future expansion capability, system to have available all of the following interfaces. Verify and install only those interfaces indicated on the plans.

1. A dry contact input interface card that provides 14 programmable dry contact closure inputs. Use shielded cable to connect input devices to interface card.

### 3.4 SERVICE AND SUPPORT

A. Division 16 Contractor shall contact relay panel manufacturer at least 7 days before project completion. Relay panel manufacturer will run diagnostics and confirm system programming.

B. Telephone factory support shall be available at no additional cost both during and after the warranty period. The specified manufacturer, at no added cost, shall provide additional remote programming as needed for the operational life of the system.

### 3.5 FACTORY COMMISSIONING

A. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and programming to ensure a trouble-free occupancy-based lighting control system. This service is provided in the contract at no additional cost to the Owner. At project closeout/commissioning, a detailed list of equipment shall be provided. List shall note room number/designation, model number of equipment installed, and denote unit was tested and commissioned.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the scheduled commissioning date. Upon completion of the system fine tuning the factory authorized technician shall provide the proper training to the owner's personnel in the adjustment and maintenance of the sensors.

END OF SECTION



SECTION 16100  
PULL BOXES AND JUNCTION BOXES AND FITTINGS

1.1 PULL BOXES AND JUNCTION BOXES AND FITTINGS

A. Boxes shall be provided in the raceway systems wherever required for the pulling of wires and the making of connections.

B. Pull boxes of not less than the minimum size required by the National Electrical Code Article 370 shall be constructed of code-gauge galvanized sheet steel. Boxes shall be furnished with screw-fastened covers. Covers on flush wall mounted boxes in well appointed areas (offices, reception, classrooms, media center, etc) shall be minimum 1/16 302 stainless steel. Boxes located on the exterior of the building shall be watertight. Covers shall be secured with tamper proof screws.

C. Boxes shall be securely and rigidly fastened to the surface of which they are mounted or shall be supported from structural member of the building either directly or by using a substantial and approved metal rod or brace.

D. All boxes shall be so installed that the wiring contained in them can be rendered accessible without removing part of the building.

E. Where several circuits pass through a common pull box, the circuits shall be tagged to indicate clearly their electrical characteristics, circuit number and designation.

F. All junction boxes larger than 4" x 4" flush mounted in wall shall have overlapping cover plate to cover rough-in openings.

END OF SECTION



SECTION 16110  
GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The work required under this section of the specifications consists of furnishing, installation and connections of the building secondary grounding systems. Exterior branch circuit wiring and feeder conductors extended beyond the building are included. The building electrical system shall be a 3 phase, 4 wire grounded wye delta system supplemented with equipment grounding system. Equipment grounding system shall be established with equipment grounding conductors; the use of metallic raceways for equipment grounding is not acceptable.

1.3 QUALITY ASSURANCE

A. Industry Referenced Standards: The following specifications and standards are incorporated into and become a part of this Specification by Reference.

1. Underwriters' Laboratories, Inc. (UL) Publications:
  - No.44 Rubber-Insulated Wire & Cables
  - No.83 Thermoplastic-Insulated Wires
  - No.467 Electrical Grounding & Bonding Equipment
  - No.493 Thermoplastic-Insulated Underground Feeder & Branch Circuit Cables
  - No.486 Wire Connectors and Soldering Lugs
2. National Electrical Manufacturers' Standards (NEMA):
  - WC-5 Thermoplastic Insulated Wire & Cable
  - WC-7 Cross-Linked-Thermosetting Polyethylene Insulated Wire
3. National Fire Protection Association Publication (NFPA):
  - No.70 National Electrical Code (NEC)

B. Acceptable Manufacturers: Products produced by the following manufacturer which conform to this specification are acceptable.

1. Hydraulically applied conductor terminations:
  - a. Square D
  - b. Burndy
  - c. IlSCO
  - d. Scotch (3M)
  - e. Thomas and Betts (T&B)
  - f. Anderson

2. Mechanically applied (crimp) conductor terminations:
  - a. Scotch (3M)
  - b. Ideal
  - c. Thomas and Betts (T&B)
  - d. Burndy

## PART 2 - PRODUCTS:

### 2.1 GENERAL MATERIALS REQUIREMENTS

- A. Provide all materials under this section of the specifications. All materials shall be new.
- B. All materials shall be UL listed and bear a UL label.
- C. Refer to the specific specification section for the description and requirements of materials mentioned herein for installation.

### 2.2 GROUNDING CONDUCTORS

- A. Grounding electrode conductor shall be bare or green insulated copper conductor sized as indicated on the drawings.
- B. Equipment grounding conductors shall be green insulated type THHN conductors sized as indicated on the drawings. Where size is not indicated on the drawings, conductor size shall be determined from the National Electrical Code table of sizes of equipment grounding conductors.
- C. Bonding jumpers shall be flexible copper bonding jumpers sized in accordance with the National Electrical Code table on sizes of equipment grounding electrode conductors.

### 2.3 DEVICES

- A. Each receptacle and switch device shall be furnished with a grounding screw connected to the metallic device frame. Bond equipment grounding conductor to each outlet box. For isolated ground receptacles, bond equipment grounding conductor to box, and isolated ground conductor to device grounding screw.

### 2.4 GROUND RODS

- A. Ground rods shall be 3/4" x 10'-0" copper clad steel. Connection to all ground rods shall be by exothermic weld.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Ground all non-current carrying parts of the electrical system, i.e., wireways, equipment enclosures and frames, junction and outlet boxes, machine frames and other conductive items in close proximity with electrical circuits, to provide a low impedance path for potential grounded faults.

B. Service entrance and separately derived electrical systems, grounding electrode system.

1. The neutral conductor of the electrical service serving the premises wiring system shall be grounded to the ground bus bar in the service equipment which shall be grounded to the cold water system, the ground rod system, and other grounding electrodes specified herein or indicated on the drawings. Grounding electrode conductors shall be installed in rigid, non-metallic conduit to point of ground connection, unless subject to physical damage in which case they shall be installed in galvanized rigid steel. Where metallic conduit is permitted, bond conduit at both ends to grounding electrode conductor with a UL bonding bushing.

2. Make connection to main water line, fire sprinkler piping, and gas piping entering the building. Make connections ahead of any valve or fittings whose removal may interrupt ground continuity. Install a bonding jumper of the same size as the grounding conductor around the water meter.

3. Bond together the following systems to form the grounding electrode system. All system connections shall be made as close as possible to the service entrance equipment and each connected at the service entrance equipment ground bus. Do not connect electrode systems together except at ground bus.

- a. Cold water piping system
- b. Ground rod system
- c. Structural steel metal building frame, see detail on drawings
- d. Main re-bar in a foundation footing
- e. Fire sprinkler piping
- f. Gas piping

4. Grounding electrode connections to structural steel, reinforcing bars, ground rods, or where indicated on the drawings shall be with chemical exothermic weld connection devices recommended for the particular connection type. Connections to piping shall be with UL listed mechanical ground clamps.

5. Where more than one service serves a building or interconnected buildings, connect each service equipment ground bus together with a #4/0 copper conductor in PVC conduit.

6. Bonding shall be in accordance with the National Electrical Code.

7. Install ground rods where indicated on the drawings with the top of the ground rods 12" below finished grade.

C. Equipment Grounding Conductor

1. Grounding conductors shall be provided in all branch circuit raceways and cables. Grounding conductors shall be the same AWG size as branch circuit conductors.

2. Grounding conductors for feeders are typically indicated on the drawings and the raceway is sized to accommodate grounding conductor shown. Where grounding conductor size is not indicated on the drawings, conductor shall be in accordance with the equipment grounding conductor table of the National Electrical Code.

3. A grounding conductor shall be installed in all flexible conduit installations. For branch circuits, grounding conductor shall be sized to match branch circuit conductors.

4. A feeder serving several panelboards shall have a continuous grounding conductor which shall be connected to each related cabinet grounding bar.

5. The equipment grounding conductor shall be attached to equipment with bolt or sheet metal screw used for no other purpose. Where grounding conductor is stranded, attachment shall be made with lug attached to grounding conductor with crimping tools.

6. Ground all motors by drilling and tapping the bottom of the motor junction box with a round head bolt used for no other purpose. Conductor attachment shall be through the use of a lug attached to conductor with a crimping tool.

7. Equipment grounding conductors shall terminate on panelboard, switchboard, or motor control center grounding bus only. Do not terminate on neutral bus. Provide a single terminal lug for each conductor. Conductor shall terminate the same section as the phase conductors originate. Do not terminate neutral conductors on the ground bus.

#### C. Other Grounding Requirements

1. Each telephone backboard and data network rack shall be provided with a No.6 grounding conductor. Ground conductor shall be routed to ground bar in nearest panel. Terminate conductor by stapling to backboard. Provide 6' slack conductor. If conductor is routed in a metal conduit, provide a grounding bushing at conduit end and bond to lug on ground bushing.

2. Lighting fixtures shall be grounded with a green insulated ground wire secured to the fixture with a UL listed bond lug, screw, or clip specifically made for such use.

### 3.2 TESTING

A. Upon completion of the ground rod installation, grounding resistance reading shall be taken before connection is made to the building cold water piping system. Ground resistance readings shall not be taken within forty-eight hours of rainfall. Results of ground resistance readings shall be forwarded, in writing, immediately to the Architect and Owner.

END OF SECTION

SECTION 16120  
EQUIPMENT IDENTIFICATION

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Submit sample of laminated plastic identification plate with lettering.

1.2 MATERIALS

- A. Laminated plastic plates with 3/16" high white letter etched on black background.
- B. Plates shall be permanently mounted utilizing pop rivets or a permanent mastic/epoxy.
- C. Painted, stenciled or indented tape identification is not acceptable.

1.3 ITEM IDENTIFICATION

A. All electrical apparatus such as wiring troughs, panelboards, individual circuit breakers, transformers and disconnect switches shall have laminated plastic identification plates. Identification shall match labeling shown on plans.

B. A "steel" circuit directory frame permanently attached at factory (not glued), and a directory card with a plastic covering shall be provided on the inside of each panel door. The directory shall be typed to identify the load fed by each circuit and the areas served. Spaces or room numbers shown on the drawings are not necessarily the final numbers to be assigned to these areas. The Contractors shall before completion of the project obtain from the Architect final space or room numbers so that it can be typed onto directory.

C. Circuit breakers and disconnects shall identify designation of the equipment served, circuit and panel from which it is served as well as voltage/phase of circuit.

D. On all panelboards the exterior identification plate shall match that on the drawings and the panel and circuit number serving the panel shall be designated within the panel.

END OF SECTION



SECTION 16130  
DATA OR VOICE CONDUIT AND OUTLET SYSTEM

1.1 CONDUIT SYSTEM

A. Provide a complete system of conduits and outlet boxes for data and voice wiring. Each data or voice outlet shall have a 1" conduit routed from the flushed recessed outlet box up to the accessible ceiling space above. Turn conduit out above ceiling with a 90° horizontal elbow and terminate with an insulated bushing. Where ceiling finish is exposed structure (i.e. no acoustical tile ceiling), extend conduit to an area with an accessible gypboard/acoustical ceiling. Provide nylon pull string in conduit.

B. All conduit and outlet boxes shall be for data and voice cable only. Joint use with sound systems, fire, telephone, etc. it is not acceptable.

C. Location of outlets shall be as shown on the drawings.

D. Height of wall outlets shall be as noted on the drawings. All wall outlet boxes in new construction shall be two gang type, 4" x 4" x 2 1/8" deep, with single gang plaster rings. Plaster rings shall be flush with finish of wall. Coordinate depth of plaster ring required with type of wall construction.

E. Install a quadplex receptacle at the telephone backboard and serve with a dedicated 20 ampere 120 volt circuit. The telephone shall consist of one - 3/4" x 4' x 8' plywood. Paint all sides and edges to match room finish. Install a #6 ground conductor from the nearest ground bar in panel, provide 8'-0" of coiled slack at board. Plywood shall be fire rated. Paint shall be fire retardant.

F. See site plan for routing of telephone service conduit. Prior to routing of conduit, coordinate an on-site meeting with local utility company to determine exact location. Provide a 200 pound minimum pull strength nylon cord in the service conduit. Cap off any conduit not utilized.

G. Each data network rack shall be grounded with a #6 copper routed in 1/2" conduit to the ground bar in the nearest panel. If conduit is metal, provide grounding bushings at each end of conduit. Provide a quadplex isolated ground receptacle at each data network rack and serve from a dedicated 20 amp, 120 volt circuit.

H. Conduit and its installation shall be as covered under Section 16020 of these specifications.

I. Outlets and their installation shall be covered under Section 16040 of these specifications.

J. All conduit shall be concealed unless otherwise noted.

K. Provide 302 jumbo stainless steel blank wall plates for all outlets not cabled.

END OF SECTION



SECTION 16140  
FIRE ALARM SYSTEM

1.1 SUBMITTALS

- A. Shop drawings shall be submitted as follows:
  - 1. Manufacturer's published literature.
  - 2. One line schematic diagram covering the complete building system.

1.2 MANUFACTURERS

- A. Acceptable manufacturers are:
  - 1. Notifier
  - 2. G.E. (E.S.T.)
  - 3. Fire Control Instruments, Inc.
  - 4. Simplex
  - 5. Harrington
  - 6. Farenhyt
  - 7. Fire-Lite
  - 8. Secutron

B. The acceptable manufacturers systems listed in 1.02 A, shall be installed by the authorized local factory dealer/representative for that product. The factory dealer representative shall hold a current low voltage contractor's license and have certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval. Dealer shall maintain a fully equipped and stocked service shop and shall respond to service calls within 12 normal working hours, list of key personnel, copies of appropriate licenses and list of recently completed jobs during the normal prior approval period.

1.3 SCOPE

A. This specification covers the installation of a complete electronically operated fire alarm system. The system within the building shall be electrically supervised and shall include, but not be limited to, the following components:

- 1. Manual non-code type alarm boxes, combination vibrating horns and flashing light, control equipment, duct smoke detectors, remote alphanumeric annunciator, conduit, and wiring.

1.4 GENERAL REQUIREMENTS

A. The alarm equipment and all wiring shall be installed and interconnected by a factory certified installer and placed in working order. The name of the manufacturer and serial or identification numbers shall appear on all major components. Electrical supervision of the system shall conform to provisions of Article 240. NFPA Standard 72. Corresponding parts of all similar type equipment units shall be interchangeable, and locks for all cabinets shall be keyed alike. All devices, equipment and combination thereof shall be of the manufacturer's current production. All component parts of the system and the control unit shall be approved for the purpose intended. The stamp, label, seal or certificate of the Underwriter's Laboratories or the Factory Mutual Laboratories shall be considered as acceptable evidence of such approval.

B. Fire Alarm Subcontractor shall submit a certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval and that he maintains a fully equipped and stocked service shop and shall respond to service within 12 normal working hours.

#### 1.5 DRAWINGS AND MANUALS

A. Three copies of complete instructions for the operation, inspection, testing and maintenance of the system, including wiring diagrams and replacement parts list shall be furnished upon final acceptance of the system. Also provide all special tools that are necessary for the maintenance of the equipment and include one set of fuses for each type and size.

#### 1.6 INSTALLATION

A. A qualified fire alarm technician shall install, adjust and test the equipment. The technician shall be qualified by training and experience in the installation and operation of the fire alarm system specified. The technician shall instruct operating personnel in the operation, adjustment and maintenance of the system. A statement signed by the person or persons instructed shall be supplied to the Architect prior to final operation.

B. Provide a written certification that the system is in complete and proper working order and in compliance with all codes.

#### 1.7 SYSTEM OPERATION

A. Operation of any manual or automatic initiating device shall cause a general alarm to sound.

B. Also circuits and audible sounding devices shall be electrically supervised. In the event of an open circuit or ground in the system, loss of operation of supervisory power, or other supervised component failure, a trouble signal shall be actuated until the system is restored to normal. A silencing switch shall be provided for silencing the trouble alarm.

C. The system shall operate from one 120 volt circuit.

D. Fire Alarm System shall be interlocked with range hood extinguishing system, such that when system is activated, general alarm is sounded and signal is sent to the annunciator. Provide control module to activate shunt trip breaker serving cooking equipment beneath hood.

#### 1.8 SYSTEM COMPONENTS

A. Fire alarm control panel: Furnish and install where shown an addressable control panel mounted in a recessed mounted code gauge steel cabinet, equipped with lock and keys. The control shall provide in one cabinet all necessary relays, resistors, compensators and power supplies for the signal circuits and duct type smoke detectors shown on the drawings and which are designated for 24 volt D.C. operation. Each signal circuit shall be capable of handling up to 10-24 volt D.C. horns. Provide battery backup with trickle charger.

1. The panel shall include an auxiliary relay with contacts for interrupting power to the door holders release devices upon sounding of a general alarm. The time limit cutout shall be adjustable and shall instantly reset after system has been restored. On the cabinet door shall be mounted millimeter, trouble lights, silencing switch and reset switch.

2. The Fire Alarm Panel shall be 100% field programmable and field editable without the use of any exterior programming devices (i.e., laptop computer or chip-burning device). The Fire Alarm System shall have alarm verification, as well as a maintenance type alert function to warn of contaminated detectors before a false alarm occurs.

3. Each device in the field must be individually addressed with a point I.D. and Alphanumeric read-out.

4. The panel shall be equipped with a UL listed digital dialer for off premises central station monitoring. Low voltage contractor shall connect dialer to Telco line and include one (1) year of monitoring in contract.

5. Provide a 3/4" conduit from Fire Alarm panel to nearest telephone backboard for remote station monitoring.

B. Fire alarm subcontractor shall determine the load based on the fire alarm device layout and provide additional power supply modules as required. Provide 120 volt circuit for power supply and serve from nearest 120/208 volt panel. Label panelboard schedules accordingly.

C. Manual stations: Provide manual alarm stations, semi-flush mounted, of the pull-lever type, key resettable. Housing shall be of cast metal or impact resistance plastic with raised letters designating function and operating instructions. Housing will be red enamel with white lettering.

D. Signal device: Provide combination low power D.C. strobe/horn with high intensity flashing strobe light for both audible and visual signaling or strobe light for visual signaling only. Where shown on drawings provide combination speaker/strobe for voice evacuation operation. Minimum sound level indoors at 10 feet shall be 90 db. Maximum current draw for horn and strobe light of 0.063 amps, nominal voltage of 24 D.C. Units shall be flush wall mounted 6'-8" above the finished floor at points noted on the drawings. Minimum candela level shall be 75 candela. Candela level for areas under 300 square feet may be 15. All strobes in a common area shall be synchronized. Where signaling devices are located in a Gymnasium or area susceptible to damage, Contractor shall provide a wireguard.

E. Smoke detectors shall be furnished, installed and connected under Division 16. Power supply for detectors shall be 24 volt D.C. and supplied from Fire Alarm control panel. Detectors shall be photo electric type. Each detector shall have flashing LED for operational walk check.

F. Smoke detectors in duct work shall be photo electric type furnished and connected under Division 16, installation in duct work shall be accomplished under Division 15. Power supply for detectors shall be 24 volts D.C. and supplied from fire alarm control panel. Provide contacts to automatically shut down fan motors. Sampling tubes shall extend across the entire width of the duct. Provide remote station at readily accessible location in mechanical room, or if air handling unit is above ceiling, mount remote station in wall below ceiling, having LED to indicate alarm condition and key switch to test and reset alarm relay. Mount remote

station 6'-0" above finished floor. Detectors for air handling equipment rated over 2000 CFM, but under 15,000 CFM shall be located in the supply duct. Detectors for air handling equipment rated over 15,000 CFM shall be located in the supply and return ducts. Detectors shall be provided whether called for on the plans or not. Look up code section and reference. Location of detectors in duct work shall be as recommended by detector manufacturer, but in no case shall detector be located ahead of filters. Location of duct detectors shown are schematic in nature only. Verify exact location with unit and duct work placement. Where duct detector is required to be on building exterior, provide weatherproof detector and 120 volt power as required.

G. Tamper switches and flow switches shall be provided and installed under Division 15 of these specifications, and connected under Division 16. Power supply shall be 24 volts D.C., supplied from the fire alarm control panel.

H. Heat detectors, where called for, shall be provided, installed and connected under Division 16. Detectors shall be combination rate of rise and fixed temperature rated for a minimum of 135° F, and shall be rated at 200° F where required (i.e., Kitchen).

I. Each fire alarm circuit shall be protected from lightning by installing surge protection devices either internally or externally. Circuits run between buildings shall be individually protected in addition to protection at control panel.

J. All conductors shall be installed in conduit. Conduit installation shall be as covered under Section 16020 of these specifications.

K. Number and size of conductors shall be as required by manufacturer of system being installed. Any cable run in conduit below grade shall be moisture proof, cable shall be equal to West Penn Aqua seal.

L. At time of final inspection, Contractor shall turn over a red-lined set of plans showing device location, device address, and device descriptor. Panel shall be fully programmed to denote location of addressable device. Provide a written report denoting that all fire alarm devices have been tested and are operable.

M. Verify with local code if 20A/1P breaker serving fire alarm control panel is required to be locked in the "on" position and label with red lettering. If required by local code, Contractor shall provide "lock out" device on 20A/1P breaker serving fire alarm control panel.

N. Where a post indicator valve for fire sprinkler system is provided, Contractor shall provide a fire alarm system connection to tamper switch. Connection to such shall be waterproof. Provide lightning/surge protection devices at conductors serving such. Refer to civil plan for exact location of post indicator valve.

END OF SECTION

SECTION 16160  
TRANSIENT VOLTAGE SURGE SUPPRESSORS  
FOR  
MAIN SERVICES AND DISTRIBUTION PANELS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Electrical and mechanical drawings for the TVSS shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.

B. The manufacturer shall furnish an equipment manual with installation, operation, and maintenance instructions for the specified unit.

C. Documentation of unit's UL 1449 suppression rating shall be included as required product data submittal information.

D. The contractor shall provide detailed compliance exception statements to all provisions of this specification ten (10) days prior to the bid date.

1.2 MANUFACTURERS

A. For the purpose of selecting quality and type of TVSS units, equipment as manufactured by Current Technology Inc. has been specified. The following manufacturers meeting these specifications are acceptable.

1. Innovative Technology, Inc.
2. Surge Suppression, Inc.
3. Liebert
4. LEA Dynatech
5. Clipper Power Systems

B. The manufacturer shall provide a Limited Five-Year Warranty, from the date of installation, against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's recommended installation, operation and maintenance instructions.

1.3 GENERAL

A. These specifications describe the electrical and mechanical requirements for a high-energy suppression filter system utilizing transient voltage surge suppression (TVSS) for application in Category C (Main Service Entrance) and Category B (Distribution Panels) areas as defined by the IEEE C62.41 standard.

B. The specified unit shall provide effective high energy transient voltage clamping and surge current diversion for all electrical modes of equipment connected downstream from the facility's main distribution panel or main over current device. The unit shall be designed for parallel connection to the facility's wiring system.

C. All Category B (distribution panels) shall include a high frequency attenuation filter for all modes of protection the TVSS is providing.

D. The unit shall include, but not be limited to, an engineered solid-state high-performance suppression system, utilizing Selenium Cells and/or arrays of fused non-linear voltage dependent Metal Oxide Varistors (MOV).

E. The suppression system shall not utilize gas tubes, spark gaps, or any other components which might short or crowbar the line, thus leading to interruption of normal power to connected loads. The suppression system shall not incorporate non-field replaceable fusing, circuit boards, plug-in or quick-connect connections as part of any surge current carrying path.

F. All internal wiring associated with the suppression filter system and subject to surge currents shall utilize low-impedance copper bus bar and/or copper conductor or equal. All internal connections associated with the suppression/filter system and which are subject to surge currents shall be made with compression type solder less lugs and shall be bolted in place.

G. The unit shall be connected to the panel or switch gear by means of a circuit breaker as specified on the drawings or as recommended by the manufacturer. An integral fused disconnect shall not be furnished with the unit unless otherwise specified. Provide breaker at panel per manufacturer's recommendation.

H. Units shall be provided in a NEMA 1 type enclosure constructed of minimum 14 gauge steel, painted inside and out with rust inhibiting paint. Surface or flush mount enclosures are specified on the drawings.

I. The unit shall be installed as close as practical to the wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Maximum 6' connections shall be made with copper conductor and shall not be any longer than is reasonably necessary, avoiding unnecessary bends. When possible, current carrying conductors between the panelboard and the suppression unit shall be twisted together.

J. The unit shall include mechanical lugs for each phase, neutral and ground, where applicable. The lugs shall accommodate up to a 1/0 AWG copper conductor.

K. The unit shall include externally mounted visual indicators that monitor the on-line status of each phase of the unit (L.E.D.s, neon lamps, etc.).

L. The unit shall include the manufacturer's nameplate and UL inspection labels on interior of cabinet.

#### 1.4 STANDARDS

A. The specified unit shall be designed, manufactured and tested in compliance with the following standards:

1. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.41-1991 and C62.45-1987).

2. National Electrical Manufacturers Association (NEMA).

3. National Fire Protection Association (NFPA 70 [NEC], 75, and 78).
4. Underwriters Laboratories (UL 1449 and 1283).

B. The maximum continuous operating voltage (MCOV) or threshold voltage of all suppression components utilized in the unit shall not be less than 125% of the facility's nominal operating voltage for 120 volt systems and not less than 115% of the facility's nominal operating voltage for 208, 277, and 480 volts.

C. Based on ANSI/IEEE C62.41-1991's standard 8/20 microsecond current waveform, and in accordance with NEMA Publication No. LS 1-1992, the tested single-pulse surge current capacity, in amps, of the unit shall be no less than the following:

	MODE OF PROTECTION		
	L-N	L-G	N-G
Main Service Panel:	150,000	150,000	150,000
Total Rating:	300,000		
Distribution Panels:	40,000	40,000	40,000
Total Rating:	80,000		

D. The unit shall be UL 1449 Listed as a Transient Voltage Surge Suppressor.

E. The unit shall be factory tested following IEEE C62.41 and C62.45 guidelines without failing or degrading the UL 1449 Surge Suppression Rating by more than 10%.

F. In accordance with NEMA Standard LS 1-1992, the suppression unit shall provide protection modes as follows:

1. Five (5) modes of protection for a single phase configuration:
  - a. Line-to-Neutral (2)
  - b. Line-to-ground (2)
  - c. Neutral-to-ground (1)
2. Seven (7) modes of protection for a three phase wye configuration:
  - a. Line-to-Neutral (3)
  - b. Line-to-Ground (3)
  - c. Neutral-to-Ground (1)

G. The environmental operating parameters for the unit shall meet or exceed the following conditions:

1. Operating temperature range shall be -40 to +60 C (-40 to +140 F).
2. Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.
3. The unit shall not generate noise levels in excess of 10dB, "A" weighted.

4. No appreciable magnetic fields shall be generated. Unit shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.

H. For purposes of quality assurance, the unit shall be "burned-in" at the factory, applying nominal voltages for which a particular unit is designed.

I. A list of customer-replaceable spare parts where applicable shall be included in the unit's documentation set.

END OF SECTION

## SECTION 16175 FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. The requirements of the general conditions, supplementary conditions, and division 1, general requirements, apply to Work in this Section.

#### 1.2 DESCRIPTION

A. This Section describes the requirements for furnishing and installing firestopping for fire-rated construction. This includes:

1. All openings in fire-rated floors and wall assemblies, both blank (empty) and those accommodating penetrating items such as cables, conduits, etc.

#### 1.3 REFERENCES

- A. ASTM E 814: "Standard Method of Fire Tests of Through-Penetration Firestops"
- B. UL 1479,: (same as A above)
- C. ASTM E 119: "Standard Method of Fire Tests of Building Construction and Materials"
- D. UL263: (same as C above)
- E. Published Through-Penetration Systems by recognized independent testing agencies.
  - 1. UL Fire Resistance Directory.
  - 2. Warnock Hersey Certification Listings, current year.
  - 3. Section 7810 "Firestopping".

#### 1.4 QUALITY ASSURANCE

A. Firestopping materials shall conform to Flame (F) and Temperature (T) ratings as required by local building code and as tested by nationally accepted test agencies per ASTM 814, UL 1479 or UL 2079. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating, when required by code authority, shall be based on the measurement of the temperature rise on the penetrating item(s).

- B. Fire stopping products shall be asbestos free, free of any PCBs and free of any lead.
- C. Do not use any product containing solvents, or that require hazardous waste disposal.

## 1.5 SUBMITTALS

- A. Submit manufacturer's product literature for each type of Firestop material to be installed. Literature shall indicate product characteristics, typical uses, performance, limitation criteria and test data.
- B. Submit manufacturer's Warranty and Certificate of Compliance.
- C. Material Safety Data Sheets: Submit MSDS for each firestop product.
- D. Shop Drawings: Show typical installation details for methods of installation. Indicate which firestop materials will be used where and thickness for different hourly ratings. Firestop systems tested by a recognized third party agency.

## 1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in the manufacturers' original, unopened containers or packages with manufacturers' name, product identification, lot number, UL or Warnock Hersey labels, and mixing and installation instructions, as applicable.
- B. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturer.
- C. All firestop materials shall be installed prior to expiration of shelf life.

## 1.7 PROJECT CONDITIONS

- A. Verify existing conditions and substrates before starting work.
- B. Do not use materials that are based on organic solvents.
- C. During installation, provide masking and drop cloths to prevent firestopping products from contaminating any adjacent surfaces.
- D. Conform to ventilation requirements and other precautionary requirements by manufacturer's installation instructions or Material Safety Data Sheet.
- E. Weather Conditions: Do not proceed with installation of firestop products when temperatures are in excess of or below the manufacturer's recommendations.
- F. Schedule installation of firestop products after completion of penetration item installation but prior to covering or concealing of openings.
- G. Coordinate this work with work of other trades.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following manufacturers as shown below and further defined by the materials listed in Part 2.02 of this section.

1. The RectorSeal Corp. Products as listed are a standard of generic types.
2. 3M Company
3. Hilti

## 2.2 MATERIALS

### A. Firestop Mortars:

1. Metacaulk Fire Rated Mortar by The RectorSeal Corporation
2. HILTI CP637 Firestop Mortar
3. 3M Firestop Mortar

### B. Firestop Sealants and Caulks:

1. Metacaulk 950 by The RectorSeal Corporation
2. Metacaulk 835 by The RectorSeal Corporation
3. Metacaulk 805 by The RectorSeal Corporation
4. Metacaulk 1000 by The RectorSeal Corporation
5. CP 25WB+Caulk by 3M
6. HILTI 606 Flexible Firestop Sealant
7. HILTI 601-S Elastomeric Firestop Sealant
8. HILTI FS-One Intumescent Firestop Sealant

### C. Firestop Putty:

1. Metacaulk Fire Rated Putty by The RectorSeal Corporation
2. Metacaulk Fire Rated Putty pads by The RectorSeal Corporation
3. MPS-2 Moldable Putty Stix by 3M
4. MPP-4S Moldable Putty Pads by 3M
5. HILTI CP618 Firestop Putty
6. HILTI CP 617 Firestop Putty Pad

### D. Firestop Sleeves:

1. Metacaulk Pipe Collars by The RectorSeal Corporation
2. Plastic Pipe Devices by 3M
3. HILTI CP 643 Firestop Collar
4. HILTI CP 680 Cast-In Firestop Device
5. HILTI CP 653 Speed Sleeve

### E. Intumescent Wrap Strips:

1. Metacaulk Wrap Strip by The RectorSeal Corporation
2. FS-195 Wrap Strip by 3M
3. HILTI CP 648 Wrap Strip

### F. Accessories:

1. Forming/Damming Materials: Mineral Fiberboard or other type recommended by manufacturer.
2. Primer, sealant and solvent cleaner: As recommended by firestop manufacturer.

3. Mineral wool-type, location, and density required by tested system.

G. Where subject to movement, firestop products used shall remain flexible to allow for such normal movement of building structure and penetrating item(s) without affecting the integrity of the firestop system.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine the areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to proper and timely completion of the work.

B. Verify the penetrating item(s) are permanently installed and construction of fire rated assemblies are completed prior to firestop installation.

C. Prior to installation of firestop systems, clean surfaces of penetrating item(s) that will be in contact with firestop materials. Do not use any cleaning material that will either attack penetrating item(s) or firestop product to be installed.

### 3.2 CONDITIONS REQUIRING FIRESTOPPING

#### A. General:

1. Provide fire stopping for conditions specified whether or not firestopping is indicated, and, if indicated, whether such material is designated as insulation, safing or otherwise.

2. Insulation types specified in other Sections shall not be installed in lieu of firestopping material specified herein.

#### B. Penetrations:

1. Penetrations include conduit, cable, wire, or other elements which pass through one or both outer surfaces of a fire rated floor, wall, or partition.

2. Except for floors on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof, provide firestopping to fill such spaces in accordance with ASTM E 814 (UL 1479).

3. These requirements for penetrations shall apply whether or not sleeves have been provided. Firestop the annular space between sleeve and surrounding surfaces.

4. Provide firestopping to fill miscellaneous voids and openings in fire rated construction in a manner essentially the same as specified herein before.

5. All junction boxes located in a rated wall shall be protected on sides and back of box with UL listed firestop putty pads as required to maintain integrity of rated wall.

### 3.3 INSTALLATION

A. Regulatory requirements: Install firestop products in accordance with fire rated test assemblies as published by either UL or Warnock Hersey or accordance with manufacturer's engineering judgment drawings, if no tested system exist.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration firestop systems.

1. Firestop all holes or voids made in fire resistive assemblies, made by penetrations, to ensure against the passage of flames, smoke, and toxic gases.

2. Protect materials from damage on surface subjected to traffic and install cover plate as required on any installed firestop system that will or may be subject to traffic.

3. Tool surfaces of firestop products to provide a smooth and clean appearance.

### 3.4 FIELD QUALITY CONTROL

A. Follow safety procedures recommended in Material Safety Data Sheets.

B. Examine penetration firestopped areas to ensure proper installation before concealing or enclosing areas.

C. Keep areas of work accessible until inspection by Architect and/or Building Inspector.

### 3.5 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving areas in undamaged and clean conditions.

B. Neatly cut and trim materials.

END OF SECTION



SECTION 16190  
ENGINE GENERATOR SET

1.1 GENERAL

A. Requirements contained in this Specification shall apply to and govern the work under this Section.

1.2 WORK INCLUDED

A. Provide labor and material necessary to install a standby natural gas engine-generator set of the latest commercial type and design as specified herein.

1.3 SUBMITTALS

A. The Contractor shall furnish information showing manufacturers' model number, dimensions, and weights for the engine, generator, and major auxiliary equipment.

1.4 MANUFACTURERS

A. The following manufacturers meeting these specifications are acceptable:

1. Onan
2. Caterpillar
3. Detroit Diesel
4. Kohler
5. Generac
6. Baldor

1.5 SUBSTITUTIONS

A. Proposed deviations from the specifications shall be treated as follows:

1. Request for substitutions shall be made a minimum of ten (10) days prior to bid date. Manufacturers catalog data shall accompany each request and authorized acceptance shall be by addenda only.

2. Under no circumstances will assemblers of units be acceptable. To qualify as a manufacturer, the engine or alternator must be the item manufactured and the completed engine generator set supplied by that manufacturer's authorized dealer only.

3. The Contractor shall submit copies of pertinent drawings and schematic diagrams for approval and shall include the following:

a. Engine generator set including plans and elevations or riser views clearly indicating entrance points for each of the interconnections required.

b. Engine generator/exciter control cubicle.

c. Fuel consumption rate curves at various loads, ventilation and combustion CFM requirements.

d. Exhaust mufflers and vibration isolators.

- e. Battery Charger, battery, and battery racks.
  - f. Automatic load transfer switch.
  - g. Actual electrical diagrams including schematic diagrams and interconnection wiring diagrams for all equipment to be provided.
  - h. Legends for all devices on all diagrams.
  - i. Sequence of operation explanations for all portions of all schematic wiring diagrams.
4. The specified standby KW shall be for continuous electrical service during interruption of the normal utility source and shall be certified to this effect by the manufacturer for the actual unit supplied.

5. These ratings must be substantiated by manufacturer's standard published curves. Special ratings or maximum ratings are not acceptable.

## 1.6 MATERIALS

A. Engine: The engine shall be 1800 RPM, water-cooled in line or Vee type four-stroke cycle, natural gas fuel. The engine shall be equipped with fuel, lube oil, and intake air filters, lube oil cooler, fuel transfer pump, fuel priming pump, engine driven water pump, and unit mounted instruments, water temperature gauge, lubrication oil pressure gauge, and battery charging ammeter.

1. Governor - A gear driven hydraulic governor shall maintain frequency regulation not to exceed 3% (1.8 hertz) from no load to full rated load.

2. Mounting - The units shall be mounted on a structural steel sub-base and shall be provided with suitable spring-type isolators.

3. Safety Devices - Safety shut-off for high water temperature, low oil pressure, over-speed, and engine over-crank shall be provided.

4. Guards - Guards shall be provided over all exposed moving parts as required by OSHA.

### B. Generator:

1. The generator shall be rated for continuous stand-by service at 36 KW, 45 KVA at 0.8 power factor, 277/480 volts, three phase, four wire, 60 hertz, 1800 RPM.

2. The generator shall be a three phase, 60 hertz, single bearing, rotating field, synchronous type built to NEMA standards. A voltage regulator shall be provided to match the characteristics of the generator and engine. Voltage regulation shall be + - 2% from no load to full rated load. Readily accessible voltage drop, voltage level and voltage gain controls shall be provided. Voltage level adjustments shall be a minimum of + - 5%. Generator and exciter shall be inherently capable of parallel operation with other power sources of equivalent electrical characteristics, and stator shall include a twelve lead, re-connectable buss bar system for easy load connection.

3. Entire generator assembly shall be UL2200 listed.

C. Cooling System:

1. Radiator - A radiator with blower type fan shall be sized to maintain safe operation 110 degrees F ambient temperature. Air flow restriction from the radiator shall not exceed 0.5" HO.
2. The engine cooling system shall be pre-treated by the system supplier for the inhibition of internal corrosion, and freezing.

D. Weather Proof Housing and Exhaust Muffler;

1. Housing shall consist of a weather proof enclosure to completely enclose the engine generator and accessories. Housing shall protect the engine generator from the environment, yet be conducive to easy maintenance. Housing shall have removable swing out doors on each side and lockable rear door for access to meters and controls. Side doors shall have a means to pad lock. Construction of housing shall be of a minimum 14 gauge sheet steel and painted manufacturers standard color.
2. Exhaust muffler shall be mounted on top of housing. The exhaust muffler shall be a critical grade muffler. Muffler shall be factory installed so that its weight is not supported by the engine. A flexible exhaust fitting shall be supplied and installed between the muffler and exhaust manifold. All accessories shall be factory installed. This includes flanges, muffler, tail pipe and rain cap.

E. Automatic Starting System:

1. Starting Motor - A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.
2. Automatic Control - fully automatic generator set start-stop controls in the generator control panel shall be provided. Controls shall provide shutdown for low oil pressure, high water temperature, over speed, over crank. Controls shall include a 30 second single cranking cycle limit with lockout.
3. Jacket Water Heater - A unit mounted thermal circulation type water heater incorporating a thermostatic switch shall be furnished to maintain engine jacket water to 70 degrees F. the heater shall be 120 volt, single phase, 60 hertz. Provide pressure switch actuated by oil pressure to shut down heater when oil pressure reaches running pressure.
4. Battery Charging Alternator - A belt driven battery charging alternator rated 24 volts, 35 amp DC shall be provided with transistorized voltage regulator.
5. Batteries - A lead - acid storage battery set of the heavy duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system. The battery set shall be rated no less than 220 amp-hours. Necessary cables and clamps shall be provided.
6. Battery Racks - Battery racks shall be provided for each battery and shall conform to NEC 480 - 7 (a) (1). They shall be constructed of metal and so treated as to be resistant to deteriorating action by battery electrolyte. Further, construction shall be such that nonconducting insulation material directly supports the cells.

7. Battery Charger - A current limiting battery charger shall be furnished to automatically recharge batteries. Chargers shall float at 2.17 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC volt- meter, and fused AC input. AC input voltage shall be 120 volts, single phase. Amperage output shall be no less than 6 amperes.

F. Generator Control Panel:

1. Type - A generator mounted NEMA 3R type vibration isolated 14 gauge steel control panel shall be provided. Panel shall contain, but not be limited to, the following equipment:

- a. Frequency meter, 3 ½ inch, dial type.
- b. Voltmeter, 3 ½ inch, 2% accuracy.
- c. Ammeter, 3 ½ inch, 2 % accuracy.
- d. Ammeter - Voltmeter phase selector switch.
- e. Automatic starting controls as specified.
- f. Voltage level adjustment rheostat.
- g. Dry contacts for remote alarm wired to terminal strips.
- h. Individual fault indicator lights for low oil pressure, high water temperature, over speed, and over crank.
- i. Three position function switch marked, RUN-STOP and REMOTE.
- j. Running time meter, oil pressure, battery charging ammeter, and water temperature gauges.

G. Main Line Circuit Breaker:

1. Type A main line, molded case circuit breaker mounted upon and sized to the output of the generator shall be installed as a load circuit interrupting and protection device. It shall operate both manually for normal switching functions and automatically during overload and short circuit conditions.

2. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters Laboratories National Electric Manufacturer's Association, and National Electrical Code.

H. Automatic Load Transfer Switch(es):

1. The amperage rating of the automatic load transfer switch shall be ATS No. 1 - 125 Amps.

2. Each automatic transfer switch shall be mechanically held on both the emergency and the normal side, and rated for continuous duty in an unventilated enclosure. The switches shall be double throw with the main contacts rigidly and mechanically interlocked to insure only two possible positions: Normal or Emergency. A manual operator must be provided to enable manual operation.

3. Rating and Performance: The automatic load transfer control shall be rated for continuous duty when enclosed in a non-ventilated NEMA 1 enclosure. It shall be rated for all classes of load including inductive and non-inductive at 600 volts and tungsten lamp load at 250 volts. The transfer switch portion of the control shall be designed, built, and tested to close on an inrush current up to and including twenty (20) times the continuous rating of the switch without welding or excessive burning of the contacts. The transfer switch shall be capable of switching load up to and including fifteen (15) times the continuous rating of the switch and capable of enduring six thousand (6000) cycles of operation, at rated current, at a rate of six (6) cycles per minute, without failure. One cycle shall consist of one complete opening and closure of both sets of contacts on an inrush current of ten (10) times the continuous rating of the switch.

4. Each transfer switch shall be listed under U.L. 1008, and approved by Canadian Standards Association. Switches utilizing reversing contactor mechanisms as a means to transfer load are disallowed and will not be considered.

5. Accessories to transfer switches; All automatic load transfer switches shall include the following accessories:

a. Engine starting contacts to provide for generator starting from each unit independent of the other.

b. Full phase protection. Three phase relays shall be field adjustable, close differential type with 92-95% pickup and 82-85% drop out. Relays are to be connected across live lines.

c. Test switch, to simulate a power outage.

d. Adjustable time delay on engine starting to over-ride momentary outages and nuisance voltage dips.

e. Adjustable time delay on transfer of load to emergency source. Adjustable time delay to open transfer switch contact to allow motor loads to decay.

f. Adjustable time delay on retransfer to load to normal with 5 minute cool-down timer wherein the generator set runs unloaded after transfer to line.

g. Plant exerciser to start and run the generator set with or without load each 168 hours for a 30 minute interval. Selector switch will be provided for with load or without load testing.

h. One auxiliary contact closed on emergency and one auxiliary contact open on emergency.

i. Pilot lights to indicate the normal and emergency position of the transfer switch.

- j. Isolated (ungrounded neutral bar).
- k. Disconnect plug.
- l. Time delay neutral, programmed transition, or in phase monitor.

I. Annunciator Panel: A flush recessed panel shall be provided for remote mounting in the Administrative Area or as shown on the drawings to give audible and visual warning of fault or alarm conditions in the generator set. Wiring and conduit shall be as required by the system manufacturer. The panel shall conform with the requirements of the National Electrical Code, Section 700-12, and the National Fire Protection Associates publication, NFPA No. 110-3-5.5.1, Level One. Fuel tank leak detection status shall be indicated on the annunciator.

J. Transient voltage surge protection shall be provided protecting all low voltage circuits serving the transfer switch and the annunciator. EDCO or equal.

K. Provide one (1) remote emergency power off button. Provide Nema 3R enclosure for outdoor locations. Contractor to connect such to generator.

## 1.7 MANUFACTURING

A. The engine, including engine block, oil pan, and cylinder heads, generator and all major items of auxiliary equipment shall be manufactured in the U. S. by manufacturers currently engaged in the production of such equipment.

B. The unit shall be shipped to the job site by the manufacturer's authorized dealer having a parts and service facility within a 75 mile radius of the job site. In addition, and in order not to penalize the owner for unnecessary or prolonged periods of time for service or repairs to the emergency system, the bidding generator set supplier must have no less than eighty percent (80%) of all engine replacement parts in his stock at all times. Certified proof of this requirement shall be available from the dealer.

## 1.8 TESTING

A. Prior to acceptance of the installation, equipment shall be tested to show it is free of any defects and will start automatically and be subjected to full load test through the use of existing loads and, dry type load banks supplied for this purpose at the job site by the generator set supplier.

B. Load bank testing shall be done in the presence of the Owner's engineer or his appointed representative only after the unit is permanently installed in accordance with the plans and specifications. If testing is completed without benefit of Engineer's presence, testing shall be done again in his presence. Testing shall be for a period of four (4) hours under full load.

C. Contractor shall supply all fuel necessary for load bank testing and shall before final acceptance of generator unit top off tank leaving it full.

## 1.9 CERTIFICATE TEST REPORTS, MANUALS AND INSTRUCTIONS

A. Prior to the final inspection, deliver 4 copies of the following items to the Engineer:

1. A certificate by the manufacturer of the engine-generator set that the auxiliary electrical power system has been properly installed, adjusted and tested.

2. Certified copies of all of the factory and construction site test data sheets and reports for the engine-generator set and major auxiliaries.

3. Complete operating and maintenance manuals for the engine-generator set and auxiliaries including wiring diagrams, technical data sheets and information for ordering replaceable parts:

a. Include complete interconnection diagrams which indicate all components of the system.

b. Include complete diagrams of the internal wiring for each of the items of equipment.

c. The diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

B. Laminate or mount under plexiglas a set of operating instructions for the system and install it under a neat frame, adjacent to transfer switch.

C. Provide signage, in accordance with section 16120, at main electrical service entrance equipment to indicate type and location of on-site emergency generator per N.E.C. 700.8(a).

D. Furnish the services of a competent, factory-trained engineer or technician for instructing operating and maintenance personnel on the proper operation and maintenance of the system at the time of testing.

#### 1.10 SYSTEM SERVICE CONTRACT

A. The supplier of the standby power system shall provide a copy of and make available to the owner his standard service contract which, at the owner's option, may be accepted or refused. This contract will accompany any documents, drawings, catalog cuts, specification sheets, wiring, or outline drawings, etc. Submitted for approval to the designing engineer. The contract shall be for the complete power system.

#### 1.11 WARRANTY

A. The complete standby electrical system furnished under this Section shall be guaranteed against defective parts and workmanship under terms of the manufacturer's and dealer's standard warranty. But, in no event shall it be for a period of less than five (5) years or 3000 hours from date of final testing and acceptance of the system and shall include labor, parts and travel time for necessary repairs at the job site. Warranty information shall be submitted along with construction site test data sheets. This information shall list starting and ending dates and who is to be contacted for warranty service.

END OF SECTION



SECTION 16200  
BUILDING COMMUNICATION AND PAGING SYSTEM

1.1 SUBMITTALS

A. Shop drawings shall be submitted as follows:

1. Manufacturer's published literature.
2. One line schematic diagram covering the complete building system.

B. Sound Contractor shall submit a certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval and that he maintains a fully equipped and stocked service shop and shall respond to service calls within 12 normal working hours.

1.2 MANUFACTURERS

A. For the purpose of selecting quality and type of major system components described herein, equipment manufactured by Bogen has been specified. The following manufacturers meeting these specifications in all respects are acceptable.

1. Rauland
2. Dukane

B. The acceptable manufacturers systems listed in 1.02 A, shall be installed by the authorized local factory dealer/representative for that product. The factory dealer representative shall hold a current low voltage contractor's license.

1.3 SCOPE

A. The work to be provided under this section consists of furnishing and installing all equipment, cable and labor necessary for a complete and operating system as shown on the drawings and specified herein.

1.4 GENERAL REQUIREMENTS

A. All equipment shall bear the label of Underwriter's Laboratories and be listed for use under their re-examination service.

B. All work shall be accomplished by an accredited factory trained communication technician. He shall also train personnel designated by the Owner in the proper operation and maintenance of equipment. All work in conjunction with this installation shall be in accordance with the engineering standards as established by EIA. All wiring shall be as recommended by manufacturer furnishing equipment except that each pair of cable shall be individually shielded. The manufacturer of this equipment shall provide a complete set of operating instructions, circuit diagrams and other information necessary for proper installation, operation and maintenance of the system. Three copies of the operating instructions shall be furnished to the Owner upon completion of the installation. All communications and program control systems shall be installed as a single system using common conduits and outlets. The complete system as herein specified shall be guaranteed to be free of defects in material and workmanship for a period of one (1) year from the date of acceptance.

C. Building Communication System Subcontractor shall submit a certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval and that he maintains a fully equipped and stocked service shop and shall respond to service within 12 normal working hours.

## 1.5 OPERATIONS

A. Each speaker shall be tied into the public address amplifier. All speakers shall be capable of two way voice communication.

B. Provide all call to all speakers.

## 1.6 EQUIPMENT

A. Public Address Amplifier: Bogen C100 series.

B. Ceiling recessed speaker assembly: Bogen SB10T725PG8U/W assemblies.

C. Exterior wall speakers shall be flush wall mounted, waterproof, tamper proof units capable of handling 12 watts of audio power, the complete unit shall consist of backbox, MISCO JC8WP speaker, matching 8 watt transformer and Lowell SQLK tamper proof grille with bronze finish.

D. Volume control: The attenuator shall consist of a SPDT 24 VDC relay, auto transformer (potentiometer, L-Pad). The unit shall by pass the attenuator when a priority program is switched in. Color of control knob shall be gray and all plate shall be oversize jumbo type made of stainless steel.

E. Bidirectional Horn Speaker: Bogen BDT30A.

F. Desktop Paging Microphone: Bogen MBS100A series.

## 1.7 EQUIPMENT AND CABLE INSTALLATION

A. Installation of sound reinforcement system shall be performed only by experienced electronic system installer.

B. Cable within equipment racks shall be routed in groups according to functions: control circuits, microphone circuits, line level circuits, loudspeaker circuits, and 120 VAC circuits. Cable shall be neatly arranged, but tight bundling which makes modifications difficult shall be avoided.

C. Pressure sensitive labels shall be affixed to cables at all termination points. Label method shall be indicated on record drawings.

D. Care shall be exercised in wiring so as to avoid damage to the cables and to the equipment. All wire joints and connections shall be made with resincore solder and small soldering iron or approved mechanical connectors. Soldering shall be neat and care must be taken to avoid "cold" solder joints. Splices in circuits shall be avoided. Connections to screw-type terminals shall be made with mechanically connected, un-insulated, spade-type lugs selected for the particular wire size in use and crimped.

E. All cable pairs shall be individually shielded, and all cable run underground or under slab shall be rated for wet location. All cabling not in conduit shall be plenum rated.

F. The Electrical Contractor shall ground the equipment racks via a #6 AWG insulated cable to earth ground.

G. Each speaker circuit shall be protected from lightning by installing surge protection units at punch down block located at console. Surge protectors shall be capable of handling maximum wattage on circuit.

H. All wiring above ceiling may be run exposed, when run exposed or for vertical or in wall runs they shall be run in conduit. Conduit and its installation shall be as covered under Section 16020 of these specifications.

I. Outlets and their installation shall be as covered under Section 16040 of these specifications.

J. Cover plates and their installation shall be as covered under Section 16050.

END OF SECTION



SECTION 16210  
DATA/VOICE NETWORK AND CABLING SYSTEM

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop drawings shall be submitted as follows:

1. Manufacturer's published literature for each separate type of equipment being provided. Indicate model number on cutsheet.

2. One line schematic of complete system showing a floor plan to scale. Show locations and the type of outlets, as well as all rack locations, and cabling type.

3. Documentation of testing on all wiring and terminations as per ANSI/TIA standards.

1.02 MANUFACTURERS

A. Acceptable manufacturers for each type of equipment specified shall be as noted throughout this specification section.

B. The acceptable manufacturers noted shall be installed by the authorized local factory dealer/representative for that product.

C. The contractor shall hold a current low voltage contractor's license and RCDD certificate. Any other interested parties shall submit a company resume showing years in business, certification stating that he is an authorized representative for the manufacturer of the equipment he is submitting for approval and that he maintains a fully equipped and stocked service shop and shall respond to service calls within 12 normal working hours, list of key personnel, copies of appropriate licenses and list of recently completed jobs. Submittal must be received no later than ten business days prior to bid date in order to be considered.

1.03 GENERAL

A. Workmanship: All work shall be performed in a workmanlike manner. Architect, Engineer, and/or Owner may observe the work procedures and workmanship of the Contractor but such observation will not relieve the contractor from responsibility for performance.

B. Warranty: The Contractor shall furnish a written warranty that describes the equipment supplied under these specifications will be free from defects of materials and workmanship for a period of fifteen years from the date of final acceptance unless otherwise specified and that all defects occurring within that period shall be corrected in a timely manner at no cost to the Owner.

C. Contractor's Qualifications:

1. Contractor shall be required, before awarding of contract, to demonstrate to the complete satisfaction of the Engineer that he has the necessary facilities, ability and financial resources to execute the work in a satisfactory manner and within the time specified; that he has had experience in construction work as same or similar nature; that he has past history and references which will assure the Owner of his qualifications for executing the work.

2. Contractor shall submit a copy of a valid low-voltage license (Low-Voltage General, Low-Voltage Telecommunications or Low-Voltage Unrestricted as issued by the State Construction Industry Licensing Board of Low-Voltage Contractors).

3. Contractor shall submit a copy of a BICSI (Building Industry Consulting Service International) certified RCDD (Registered Communications Distributions Designer) certificate.

D. Comprehensive List of References: Attach a detailed list of references along with contact person, dates of work, mailing address, telephone numbers.

E. Contractor must provide proof of installation in a minimum of five sites using a Enhanced Category 6 structured cabling with 100 or more active (working) nodes installed.

#### 1.04 SCOPE OF WORK

A. Scope of Project Standards and Description:

1. The cabling and wiring placed for voice and data communications on this undertaking shall be "Unshielded Twisted Pair" type and conform to the requirements contained in the latest editions of the National Electric Code (NEC) and the latest editions of the following American National Standards Institute (ANSI) specifications:

a. ANSI/TIA 568-Commercial Building Telecommunications Cabling Standard

b. TIA 569-Commercial Building Standard for Telecommunications Pathways and Spaces

c. ANSI/TIA/EIA 606-Administration Standard for Commercial Telecommunications Infrastructure

d. ANSI/J-STD 607-Commercial Building Grounding (earthing) and Bonding Requirements for Telecommunications

e. Addendums to TIA/EIA 568

B. Specifications for the Fiber Optic Backbone, the Network Hub Unit, Jacks Outlets, Horizontal Wiring, Patch Panel, and Racks are provided in this specification section.

#### 1.05 GUARANTEES

A. All communication outlets wired and serviceable must be tested and certified in compliance with ANSI/TIA 568-C.2-1 Enhanced Category 6 specifications. Testing must be "end-to-end". Test results shall be forwarded to Engineer a minimum of one week prior to final inspection.

#### 1.06 TESTING AND CERTIFICATION

A. Testing fiber optic and copper distribution systems are crucial in assuring the overall integrity and satisfactory performance of the network. Test results quantify system quality, identify system faults, and establish the baseline accountability performance of the system. Proper testing also maximizes the longevity of the system, minimizes downtime and maintenance, and facilitates system upgrades or reconfiguration.

B. The Contractor shall provide proof of communications wiring systems certification and testing certification.

C. All data and voice wiring and terminations shall be tested and must pass ANSI/TIA standards for Enhanced Category 6 Cabling. All faults shall be corrected.

D. All test results must be printed and show the following primary results:

1. Wire map
2. Length
3. Insertion Loss
4. Near-end crosstalk (NEXT)
5. Power sum near end crosstalk (PSNEXT)
6. Equal-level far-end crosstalk (ELFEXT)
7. Power sum equal-level far-end crosstalk (PSELFEXT)
8. Return Loss
9. Propagation delay

#### 1.07 LOCAL AREA NETWORK (LAN) JACK AND OUTLET SPECIFICATIONS

A. Locations shown on drawings will be equipped with a consistent arrangement of LAN communications outlets.

B. Outlet faceplate for this arrangement shall be configured in the following fashion:

1. The jacks used shall fit properly in the outlet openings of the outlet faceplate. The jacks used shall conform to Enhanced Category 6 parameters of ANSI/TIA 568-C.2-1

a. In a properly installed Category 6 UTP cabling system, the jacks used shall be capable of supporting LAN data rates of 1000 Mbps.

b. The wiring arrangement of the jack shall conform to the ANSI/TIA 568.

c. The jack shall possess the following characteristics:

(1) The eight (8) position / eight (8) conductor jack shall be capable of supporting the previously defined data rates as well as voice (including ISDN).

(2) Utilization of 110 type or equivalent insulation displacement hardware for horizontal wire attachment and acceptance of 22 or 23 AWG conductors.

(3) The jack wires shall consist of 50 micro-inch lubricated gold plating over 100 micro-inch nickel underplating.

d. Any vacant faceplate position shall be reserved for future growth and should have a dust cover/blank inserted.

C. Acceptable Manufacturer's: Molex, Ortronics, Commscope, AMP, and Belden, Leviton, Panduit, and Siemon.

D. Each jack shall have faceplate labeled. Also neatly label backside of faceplate with a permanent marker to note jack number.

E. Labeling of multiple drops in a common space shall be sequentially numbered. Numbers shall not be assigned randomly. Coordinate prior to terminating at racks, no exceptions.

#### 1.08 LOCAL AREA NETWORK (LAN) HORIZONTAL WIRING SPECIFICATIONS

A. This section covers the cable from the communications outlet to the patch panel in the IC or wiring closet. These cables shall be Enhanced Category 6 Unshielded Twisted Pair cable. Each cable shall be placed in a "point-to-point" fashion from the work area outlet to the wiring closet for each communications outlet needed. There shall be no intermediate splices or cross connects in these cables.

B. The characteristics of the horizontal cable are as follows:

1. Enhanced Category 6 cable consisting of four pair of 23 AWG bare solid copper conductors insulated with a plenum rated material. The insulated conductors are tightly twisted into pairs and jacketed with plenum rated material. No type of shield is required in the sheath.

2. Each sheath shall contain four unshielded copper pairs. Each pair shall have a different twist per foot ratio ranging from 12 to 24 twists per foot. No more than 1/2" inch may be untwisted and the sheath may not be stripped back more than 1/2" inch at the jack during installation.

C. The cable component shall meet or exceed the following requirements:

1. ASNI/TIA 568-C.2 "Commercial Building Telecommunications Standard, Part 2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard"

2. ASNI/TIA 1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted Pair Cabling "

3. Certified Category 6 Cable under Third Party Cable Certification Program.

4. ICEA S-102-700

5. ANSI/ICEA S-102-732

6. UL Standard 444

7. National Electric Code - Article 800

D. The cables shall meet or exceed the performance characteristics listed in the following Table.

Electrical Performance Table

Frequency	Loss	NEXT	PS NEXT	ELFEXT	PS ELFEXT	Return Loss	Prop Delay	Skew	ACR	PS ACR
.772	1.8	80.0	78.0	–	–	–	–	–	78.2	76.2
1.0	2.0	78.3	76.3	70.0	68.0	20.0	575	25	76.3	74.3
4.0	3.8	69.3	67.3	58.0	56.0	24.2	570	25	65.5	63.5
8.0	5.3	64.8	62.8	51.9	49.9	26.3	552	25	59.5	57.5
10.0	5.9	63.3	61.3	50.0	48.0	27.0	547	25	57.4	55.4
16.0	7.5	60.2	58.2	45.9	43.9	27.0	545	25	52.7	50.7
20.0	8.4	58.8	56.8	44.0	42.0	27.0	543	25	50.4	48.4
25.0	9.4	57.3	55.3	42.0	40.0	26.5	542	25	47.9	45.9
31.25	10.6	55.9	53.9	40.1	38.1	25.9	541	25	45.3	43.3
62.5	15.3	51.4	49.4	34.1	32.1	24.2	540	25	36.1	34.1
100.0	19.7	48.3	46.3	30.0	28.0	23.1	539	25	28.6	26.6
155.0	25.0	45.4	43.4	26.2	24.2	22.0	538	25	20.4	18.4
200.0	28.8	43.8	41.8	24.0	22.0	21.4	537	25	15.0	13.0
250.0	32.6	42.3	40.3	22.0	20.0	20.9	537	25	9.7	7.7
300.0	36.2	41.1	39.1	20.5	18.5	20.4	536	25	4.9	2.9
350.0	39.5	40.1	38.1	19.1	17.1	20.1	–	–	0.6	–
400.0	42.7	39.3	37.3	18.0	16.0	19.7	–	–	–	–
500.0	48.6	37.8	35.8	16.0	14.0	19.2	–	–	–	–
550.0	51.5	37.2	35.2	–	–	19.0	–	–	–	–
600.0	54.2	36.6	34.6	–	–	18.8	–	–	–	–
650.0	56.8	36.1	34.1	–	–	18.6	–	–	–	–

E. Plenum rated cable shall be used. The plenum cable shall be composed of four pair of 23 gauge bare solid copper conductors insulated with a plenum rated insulation that is the same material configuration on all four pairs, 3+1 or 2+2 designs are not allowed. The insulated conductors are tightly twisted into pairs and jacketed with low smoke plenum rated PVC. It shall conform to a NEC Type CMP for plenum and NEC Type CMR for riser applications.

F. Cable characteristic shall be equal to or exceed Mohawk-Cable, AdvanceNet™. Category 6 cabling.

#### 1.09 LOCAL AREA NETWORK (LAN) PATCH PANEL SPECIFICATIONS

A. This section covers the termination hardware located in the MC and IC (wiring closet). The termination hardware shall provide the capability to be able to patch connections between ports on the LAN hardware (electronics) and the horizontal cables to the work area outlets.

B. The Patch panels shall be Category 6 Modular Jack Panels. Provide 24 port or 48 port patch panels as required for number of drops.

C. The termination hardware will be co-located on 19" inch racks with the LAN electronics. The configuration of the patch panels shall be in an agreement that minimizes patch cord lengths. Provisions for cable management (organization of horizontal and vertical cable and patch cords) on the rack should be included.

D. Horizontal cables to the work area outlets will be directly connected to 110 insulation displacement hardware or equivalent associated with each jack on the patch panel. The jacks on the patch panel shall be wired in accordance with ANSI/TIA 568- C.2 standard.

E. Enhanced Category 6, factory-built, manufacture tested patch cords shall be provided for each drop. Provide 10' patch cord at station end. Provide 3' or 5' patch cord at rack end. (Length as required for electronics to properly lace cords). Patch cords shall be color coded for dedicated labs, media center, etc. Provide velcro patch cord wraps for cable management.

F. Fiber Termination Requirements: Fiber optics connections should be terminated using a rack mountable Interconnect enclosure or equivalent to insure that the connections are protected. The enclosure should be locked and no fiber cable should be visible in the rack.

G. Acceptable Manufacturer's: Molex, Pass & Seymour, AT&T, AMP, Hubbell, Leviton, Panduit, and Siemon.

#### 1.10 LOCAL AREA NETWORK (LAN) RACK SPECIFICATIONS

A. The rack shall be EIA 19" open equipment rack, 84" high, aluminum construction, drilled and tapped on both sides to EIA Standard. Rack shall have top and bottom angles for support, 15 inch wide foot with holes for bolting to floor, and factory installed grounding lugs. Black powder coated. Rack shall have two (2) position ring runs and rear cable management tray as required per number of patch panels. Provide cable management rings on sides of rack.

## 1.11 SYSTEM DOCUMENTATION

A. As part of the wiring system installation, the Contractor shall provide detailed documentation of the distribution system to facilitate system administration, system maintenance and future system changes. This requirement includes as-built drawings with all cables and terminations identified, a bill of materials of all installed equipment and wiring, rack and backboard equipment layouts showing placement of support equipment, and model and serial numbers of all installed equipment. A clear and consistent nomenclature scheme is to be defined and used on the documentation and cable labeling which facilitates locating and identifying each cable.

B. System verification and acceptance documentation signed and dated by the installer (Contractor) and the design professional shall also be provided. This documentation shall include test measurements and system calibrations performed for the entire system. Sample system operations shall also be performed with actual hardware or using contractor provided test equipment and documented to verify that the system is operational and ready for acceptance. This shall also establish the baseline performance of the system.

## 1.12 TRAINING

A. Training of owner's personnel (a minimum of two) shall be provided. Training will cover the location nomenclature, documentation structure and contents, documentation maintenance procedures, a "walk-through" for location and labeling orientation, system reconfiguration using the MDF, and IDF facilities (Termination hardware, punch blocks, etc.), operation of network equipment installed as part of the contact, test documentation, and trouble shooting of the signal and power cable portion of the installation.

B. Provide a record set plan noting drop locations and jack designations. As-built shall be a full size plan and shall be computer generated in AutoCAD 2007 format. Provide a CD to Owner with (as-built) on disc at project closeout. At each rack provide a copy of (as-built) mounted on wall. Mount plan under plexiglass.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION



SECTION 16220  
CONSTRUCTION REVIEWS INSPECTION AND TESTING

1.1 GENERAL

- A. Comply with Division 1 - General Requirements.

1.2 CONSTRUCTION REVIEWS

A. The Architect or his representative shall observe and review the installation of all electrical systems shown on the drawings and as specified herein.

B. Before covering or concealing any conduit below grade or slab, in wall or above ceiling, the contractor shall notify the Architect so that he can review the installation.

1.3 CONTRACTOR'S FINAL INSPECTION

A. At the time of the Contractor's final inspection, all systems shall be checked and tested for proper installation and operation by the Contractor in the presence of the Architect or his representative.

B. The Contractor shall furnish the personnel, tools and equipment required to inspect and test all systems.

C. Following is a list of items that the contractor must demonstrate to the Architect or his representative as complying with the plans and specifications. Please note that this list does not necessarily represent all items to be covered in the final inspection, but should give the Contractor an idea of what is to be reviewed.

1. Service ground, show connection to ground rod and cold water main.
2. Demonstrate that main service equipment is properly bonded.
3. Demonstrate that all panels have breakers as specified, ground bar, copper bus, typed directory for circuit identification and that they are free of trash.
4. Demonstrate that all conduits are supported as required by the National Electrical Code.
5. Demonstrate that all outlet boxes above or on the ceiling are supported as required by the National Electrical Code.
6. Demonstrate that outlet boxes in wall or ceilings of combustible materials are flush with surface of wall or ceiling, and that outlet boxes in walls or ceilings of non-combustible materials are so installed that the front edge of the box or plaster ring is not set back more than 1/4".
7. Demonstrate that outlet boxes in wall are secure.
8. Demonstrate that all devices are properly secured to boxes, that device plates are properly aligned and are not being used to secure device.
9. Demonstrate that all 125 volt receptacles are properly connected.

10. Demonstrate that all fixtures have specified lamps, ballast and lens, and that they are supported as required by the National Electrical Code or as called for on the drawings or in the specifications.

11. Demonstrate that all disconnects requiring fuses are fused with the proper size and type, and that all disconnects are properly identified.

12. Demonstrate that Fire Alarm System is in proper working order, initiating an alarm signal from each manual and automatic device (including smoke detectors).

13. Demonstrate that Sound System is in proper working order, and meeting all requirements outlined in specifications.

14. Demonstrate that Engine Generator Set is in proper working order and meeting all requirements outlined in specification.

END OF SECTION

SECTION 16230  
ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Coordination and arrangement with serving electric utility company for service connection (including payment of all costs associated with the service).

B. Contractor shall pay all utility bills for the service until Substantial Completion. After Substantial Completion, the utility bills shall be transferred to the Owner's name and the Owner will be responsible for those bills after that point.

B. Pad mounted service entrance as shown on drawings.

C. Electrical demand meter provisions.

1.2 SYSTEM REQUIREMENTS

A. Voltage: 208/120 volt, 3 phase, 4 wire.

B. Amperage and wire size as shown on drawings.

1.3 SUBMITTALS

A. Submit product data consisting of manufacturer's published literature and as specified in Section 16100 for the meter and transformer.

B. Submit "Electrical Service Verification" letter on contractor's company letterhead as outlined in Section 16000 stating: The specified service voltage and arrangement is available from the serving utility company.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pad Mounted Transformers: Provided by serving utility company.

B. Electrical Demand Meter: Coordinate with serving utility company for meter base.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate and make all arrangements with serving electric utility company for specified electrical service prior to any installation.

B. Primary service to transformer shall be provided by serving utility company. Pad mounted transformer shall be provided by serving utility company. Secondary service raceway and conductors are by the contractor. The serving utility company will connect service conductors to transformer secondary.

END OF SECTION

